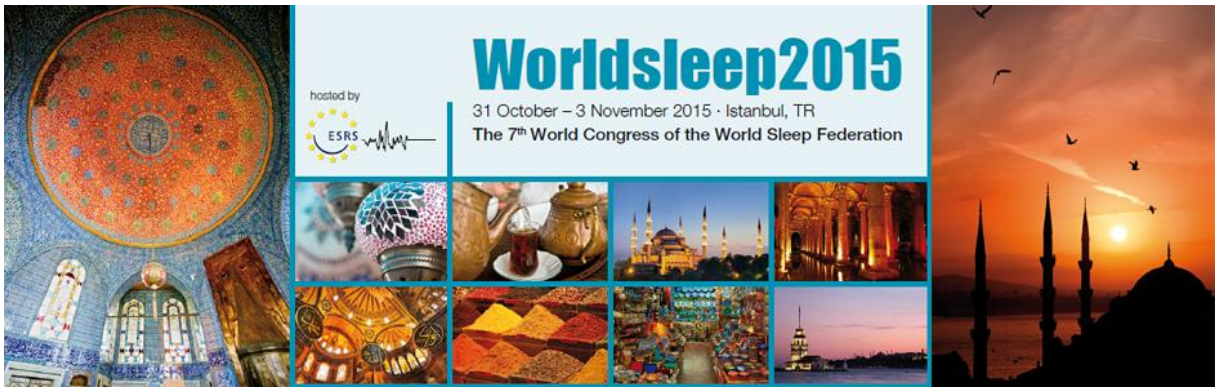


ABSTRACT BOOK

by session, date and time

This abstract book contains all submitted and accepted abstracts of present speakers / poster authors at the Worldsleep 2015

01.11.2015 - 09:00-10:30
Opening Plenary: Sleep & Health Symposium

679 - **Sleep, aging and dementia**
Presented by: Sonia Ancoli-Israel

S. Ancoli-Israel
Psychiatry, University of California, San Diego, La Jolla, CA, United States

Objectives: Sleep disturbances are frequently observed in dementia and include insomnia, obstructive sleep apnea (OSA), REM sleep behaviour disorder, excessive daytime sleepiness and circadian rhythm alterations. Disrupted sleep in demented persons can contribute to behavioural disturbances, cognitive dysfunctions, mood alterations and caregiver distress. Moreover, in individuals with obstructive sleep apneas, the intermittent hypoxemia adds to the daytime consequences of disrupted sleep. The objective of this talk is to help in the understanding of the progression of sleep disturbances from healthy elderly to those with Alzheimer's disease (AD).
Methods and materials: Data will be presented from a series of studies examining sleep in patients with dementia. Patients were recruited from nursing homes and from the community, with either moderate-to-severe dementia or mild dementia. All were studied with either home sleep recordings or actigraphy. Some patients with obstructive sleep apnea and mild dementia were randomized to a randomized clinical trial of continuous positive airway pressure (CPAP) to examine the effect of treating apnea on cogntion.
Results: Institutionalized demented patients on average sleep only 66% of the night and awaken about every 20 minutes. In general, they are rarely asleep for a full hour or awake for a full hour throughout the day and night. The majority of AD patients also have obstructive sleep apnea (OSA). A randomized controlled trial of CPAP vs. placebo CPAP in patients with AD and OSA confirmed that patients with AD do show high amounts of SDB, that AD patients can tolerate CPAP with the average number of hours worn not differing from sleep clinic patients. In addition, CPAP improved OSA, daytime sleepiness, night time sleep, some aspects of cognitive function. When patients who continued using CPAP after the end of the study were compared to those who discontinued CPAP use, there was less cognitive deterioration, less depression, less daytime sleepiness, and better subjective sleep quality.
Conclusions: Sleep is extremely disturbed in dementia with OSA being very common. These results raise the possibility that long-term CPAP treatment may result in a slowing in the progression of cognitive dysfunction. In conclusion, OSA may aggravate cognitive dysfunction in dementia and thus may be a reversible cause of cognitive loss in patients with AD.

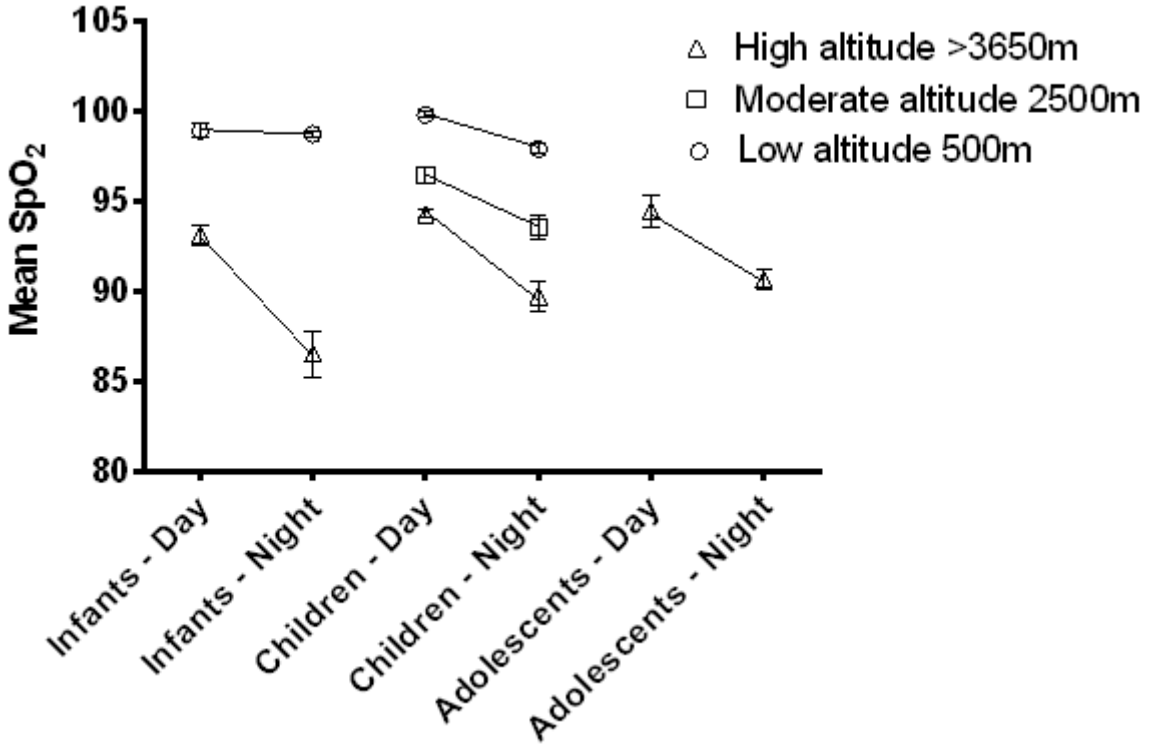
01.11.2015 - 11:00-12:00
Sleep Disorder Breathing in Children

81 - **Nocturnal hypoxia in high altitude native children - evidence of incomplete adaptation in children with mixed ancestry**
Presented by: Catherine Hill

C.M. Hill[1,2], A. Baya[3], J. Gavlak[2,4], A. Carroll[5], K. Heathcote[6], D. Dimitriou[7], V. L'Esperance[8], R.J. Webster[9], J.W. Holloway[10], J. Virues-Ortega[11], F.J. Kirkham[1,2,4], A.M. Hogan[4,12], R.S. Bucks[13]
[1]Division of Clinical Experimental Sciences, University of Southampton, [2]Southampton Children's Hospital, Southampton, United Kingdom, [3]School of Psychology, Universidad Privada de Santa Cruz de la Sierra, Santa Cruz, Bolivarian Republic of Venezuela, [4]Institute of Child Health, University College London, London, United Kingdom, [5]Sleep Disorders Unit, Canberra Hospital, Canberra, ACT, Australia, [6]Department of Otolaryngology, Poole General Hospital, Poole, [7]Institute of Education, University College London, [8]Department of Primary Care and Population Health, King's College London, London, United Kingdom, [9]9 Laboratory for Cancer Medicine, Harry Perkins Institute of Medical Research and University of Western Australia Centre for Medical Research, University of Western Australia, Crawley, WA, Australia, [10]Division of Human Development and Health, Faculty of Medicine, University of Southampton, Southampton, United Kingdom, [11]School of Psychology, The University of Auckland, Auckland, New Zealand, [12]Department of Anaesthetics, Whittington Hospital, London, United Kingdom, [13]School of Psychology, The University of Western Australia, Crawley, WA, Australia

Objectives: We studied developmental aspects of sleep related breathing in high altitude, native

children. Physiological adaptation to high altitude hypoxia may be impaired in Andeans with significant European ancestry. The respiratory 'burden' of sleep may challenge impaired adaptation leading to relative, nocturnal hypoxia. Nocturnal hypoxia in early development may have life-long implications.
Methods and materials: Diurnal and nocturnal oxyhaemoglobin saturation (SpO_2) was measured in 75 healthy Bolivian children aged 6 months to 17 years, native to low altitude (500m), moderate high altitude (2500m) and high altitude (3700m), 62 of whom had 5 hours of nocturnal artefact-free data. Genetic ancestry was determined from DNA samples.
Results: Children had mixed ancestry (average composition 41.6% European, 56.9% Native American, 1.5% African), with no significant altitude differences. As predicted, diurnal SpO_2 decreased across altitudes, with a significant age by altitude interaction, such that infants had the lowest diurnal values at high altitude. Novel findings include a significant effect of both age and altitude on sleep-related fall in mean nocturnal SpO_2 and SpO_2 stability. At high altitude there was a greater drop in nocturnal SpO_2 across all ages and an increase in SpO_2 variability, compared to low altitude. These differences diminished with age.
Conclusions: Physiological adaptation to HA living in native Andeans is unlikely to compensate for the significant differences we observed between diurnal and nocturnal SpO_2, most marked in infancy. This vulnerability to sleep-related hypoxia in early childhood has life-span implications. Future studies should characterise the nocturnal respiratory physiology underpinning our observations.
Figure 1: Developmental trajectory of diurnal and nocturnal SpO_2 values
Wake and sleep mean pulse oximetry at altitudes by age-group (infants, 6 - 12 months old; children, 4 - 10 years old; adolescents, 13 to 17 years old). Error bars are standard errors



[Figure 1]

Acknowledgements: To Univalle (Cochabamba, La Paz), USPA (Santa Cruz), Universidad Privada Abierta Latinoamericana, (Santa Cruz) Universidad de La Salle, (La Paz) Universities and their student volunteers who supported these studies. Grateful thanks to the Australian Medical Bioinformatics Resource, a National Health and Medical Research Council of Australia Medical Bioinformatics Genomics Proteomics Program, and Masimo Inc. for the loan of pulse oximeters.

566 - **Sleep characteristics and severity of central sleep apnea in children 6 to 24 months in a pediatric sleep laboratory**
Presented by: Carlos Sendon

C. Sendon[1,2], *E. Okafor*[2], *J.F. Chocano*[2,3]
[1]Pediatrics, Eastern Virginia Medical School, [2]Pediatrics, Children's Hospital of The King's Daughter's, [3]Pediatrics Pulmonology, Eastern Virginia Medical School, Norfolk, VA, United States

Objectives: Central apnea (CA) is defined in children as the cessation of breathing during sleep without any breathing effort for at least 20 seconds, or absence of 2 breaths associated with 3% oxygen desaturation or an arousal. Apnea following a sigh is not considered pathologic unless it is associated with an arousal or oxygen desaturation. Mild CA occurs in healthy infants, when severe it can be associated with central nervous system pathology. The severity of CA is characterized by the central apnea index (CAI), values greater than 0.9 are considered abnormal. The adverse consequences of severe CA are well known, but those of milder degree are still in study. We aim to evaluate the sleep characteristics and severity of CA in a particular age group evaluated in our sleep center.
Methods: Retrospective review of 377 Polysomnography (PSG) studies performed from 2009 to 2014 in children from 6 to 24 months. Central apnea was classified by severity using the CAI [none (< 0.9), mild (0.9-5), moderate (>5-10) and severe (>10)]. Ethnicity, gender, sleep efficiency, arousal index, sleep stages, CAI and AHI (Apnea Hypopnea Index) were analyzed.
Results: 183 (49%) were African-American, 169 (45%) were Caucasian. 259 (69%) were male. Sleep Efficiency: 82.29 +/-12.9. Arousal index: 15.2+/- 8.5, the arousal index was statistically significantly higher in Caucasians (two-sample t test, P = .03). Stage 1: 2.3% +/- 1.3, Stage 2: 33.8%+/-13.2, Stage 3: 38.8% +/- 14.5, REM: 26.9% +/-8.25. The mean AHI was 11.6, the AHI was statistically significantly higher in Caucasians (Mann-Whitney U test, P = .002). 26/377(6.9%) had a CAI < 0.9, 132/377(35%) between 0.9-5, 67/377(17.7%) between >5-10, and in 152/377(40.4%) the CAI was >10. The CAI was statistically significantly higher in Caucasians (Mann-Whitney U test, P < .001).
Conclusions: CA was present in 93% of the studied population, 58% of patients presented moderate to severe central apnea. The sleep architecture, but the arousal index, was preserved in this population. CA was associated with obstructive events and the severity of CA and OSA (obstructive sleep apnea) was higher in Caucasians.

677 - **Residual OSA and snoring in children following adenotonsillectomy**
Presented by: James Di Pasquale

U. Kurup, J. Di Pasquale, L. de Amorim, P. Habibi
Paediatrics, Imperial College London, London, United Kingdom

Objectives: The most common treatment intervention for childhood Obstructive Sleep Apnoea (OSA) involves surgical removal of tonsils and/or adenoids. Despite this, residual obstructive Sleep-Disordered Breathing (SDB) is known to persist in many children. Children with untreated OSA and snoring are disadvantaged when compared to those who are successfully treated for these conditions. Disadvantages range from neurocognitive and behavioural impairment to cardiovascular and metabolic dysfunction.
Using polysomnography, this study assessed the frequency and severity of residual SDB in children attending the paediatric sleep laboratory at St Mary's Hospital, London.
Methods: This retrospective review includes 50 consecutively-referred children who returned to our laboratory for a reassessment sleep study at least 3 months after surgical intervention for OSA. Children were diagnosed on the basis of polysomonographically-defined OSA (mild, moderate, or severe) and snoring (soft, moderate, or loud).
Results: Children were aged between 1 and 13 years (mean 4 years) and 64% (*n*=32) were male. All children were initially diagnosed with OSA and snoring. Adenotonsillectomy was performed in 82% (*n*=41) of cases. The remaining children received either tonsillectomy (16%; *n*=8) or adenoidectomy (2%; *n*=1).
Following surgery, two-thirds of all children (66%; *n*=33) had residual OSA ranging from mild to severe disease; only 34% (*n*=17) had complete resolution of their OSA. Severe OSA persisted in almost one-third of children (28%; *n*=11) who were initially diagnosed with severe OSA (78%; *n*=39).
Residual snoring was detected in 98% (*n*=49) of all children. Snoring volume improved by at least one category (e.g., from moderate to soft) in 56% (*n*=28) of cases, and worsened in 6% (*n*=3) of cases. A reduction in snoring volume was most commonly observed in children who were initially moderate snorers; 81% (*n*=21) of moderate snorers had soft volume snoring following surgery. Snoring volume did not change following surgery in 38% (*n*=19) of cases.
Conclusions: Residual OSA and snoring are very common among British children referred for reassessment sleep studies following surgical intervention. Children with symptoms of SDB after

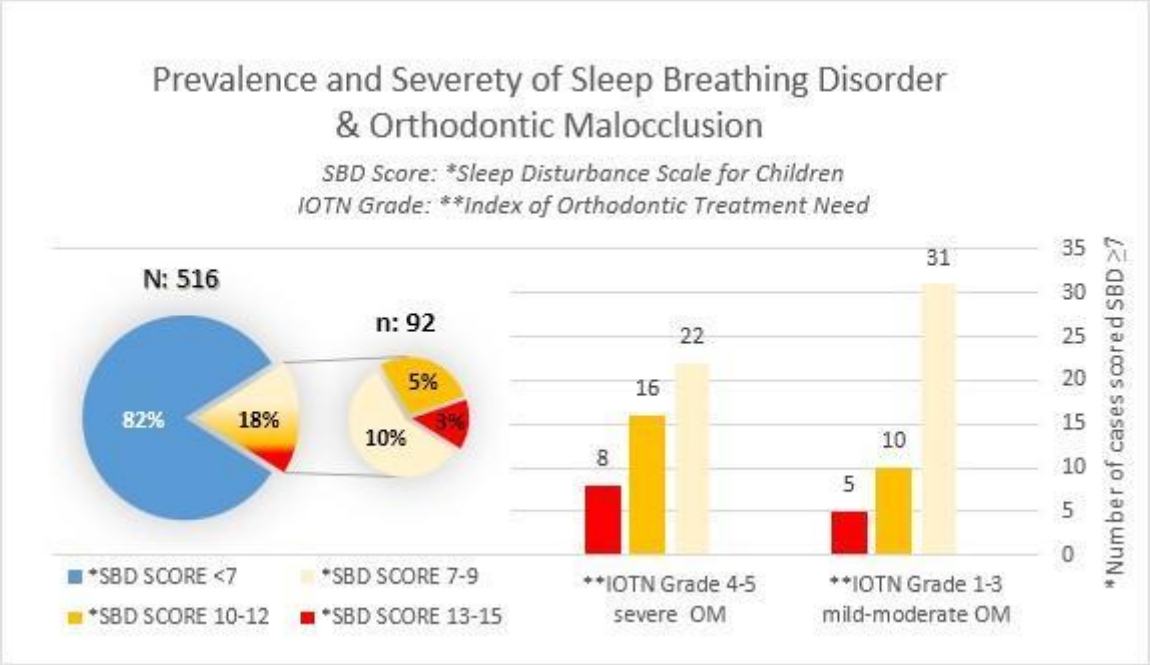
surgery should be followed-up with further investigation(s) to quantify residual pathology. Reassessment sleep studies are a useful way to distinguish those children with residual OSA from those with snoring alone.

439 - **Prevalence of orthodontic treatment need and risk of sleep breathing disorder in a children and adolescent population of public oral health clinics in Sydney, Australia. PrIOR-CS: a clinical survey study**

Presented by: Banu Aras

B. Aras[1], S. Ajwani[2], A.T. Ng[1,3], D.J. Papadopoulos[1,3], S. Bhole[2], M.A. Darendeliler[1]
[1]Orthodontics, [2]Oral Health Services, Sydney Dental Hospital, University of Sydney, [3]Centre for Sleep Disorders and Respiratory Failure, St George Hospital, University of New South Wales, Sydney, NSW, Australia

Introduction: Sleep Breathing Disorders (SBD) may accompany with some Orthodontic Malocclusions (OM). From both SBD and OM perspective, early diagnosis would intercept developing problems before becoming severe. Given the role of Public Oral Health Clinics (POHC) is largely screening and then referral with appropriate prioritisation of treatment for socio economically disadvantaged children and adolescents it is worth investigating the potential coexistence of OM and SBD to further refine the triage process. Index of Orthodontic Treatment Need (IOTN)[1] is a validated tool widely used in identification of the prevalence and severity of the OM. IOTN Grades 4 and 5 cover severe malocclusion and eligibility for public orthodontic services. The Sleep Disturbance Scale for Children (SDSC)[2] is a validated questionnaire, scores parent-reported sleep behaviour and disturbance. SBD-subcategory is related to paediatric sleep apnoea.
Aim: This study aims to identify the prevalence of children and adoescents with potential risk of sleep disordered breathing and existing orthodontic malocclusion in POHC.
Subjects and methods: 516 adolescent and children aged 7-13 (mean 10.1) were screened in three POHC in Sydney and South Western Sydney, NSW, Australia by single examiner as a part of PrIOR-CS-a clinical survey study. Questionnaires were completed by parent following consent was given. Cut-off point for the SBD-subcategory was determined as 7 for the sum of the scores given to questions 13,14 and 15.
Results: Of the 516 cases 92 were identified with SDB score of ≥7 (17.8%). %50 of these cases had severe orthodontic malocclusion (IOTN Grade 4 or 5).



[Prevalance&Severity_of_SBD&OM]

Conclusion: Almost one out of five children (17.8%) visiting POHC, which is the main source of referrals to orthodontic specialist services, may have SBD with an even chance of getting benefit from orthodontic treatment. Introducing SDSC in POHC with proper clinical referral protocols should be

considered.

References:

1. Brook, PH; Shaw, WC. The development of an index of orthodontic treatment priority. *European Journal of Orthodontics*, 1989;20:309-320.
2. Bruni O, Ottaviano S, Guidetti MR, *et al.* The Sleep Disturbance Scale for Children: construction and validation of an instrument to evaluate sleep disturbance in childhood and adolescence. *J Sleep Res*1996;5:251-61.

671 - **A novel method to measure respiratory effort in adolescents, based on calibrated respiratory plethysmography (cRIP)**

Presented by: David Jonsson

D. Jonsson[1], J.S. Agustsson[2], H. Helgadottir[2], A. Josefsson[1], R. Bjarnason[1,3], T. Helgason[3]

[1]Faculty of Medicine, University of Iceland, [2]Nox Medical, [3]Children´s Medical Center, Landspitali University Hospital, Reykjavik, Iceland

Objectives: To determine the prevalence of sleep disordered breathing (SDB) in obese Icelandic children aged 12-18 years and to find a clinical subgroup with higher risk of SDB. Research has shown that the conventional apnea-hypopnea index (AHI) or the obstructive apnea-hypopnea index (OAHI) may not be the optimal diagnosis criteria for SDB in adolescents. Furthermore, there is an unresolved debate on which criteria to use for adolescents. In this study we look at power loss (PL) as a clinically relevant indicator of SDB in obese adolescents and the conventional indices.

Methods and materials: Cross-sectional, prospective study. Data was obtained from 27 children, randomly selected from a population of obese children referred to the children's hospital. The study group had a mean age of 14.25 ± 1.69, a mean BMI of 34.45 ± 4.16 and a mean BMI-Z score (standard deviation score) of 3.43 ± 0.67. The participants answered the Children's Sleep Habits Questionnaire (CSHQ) and undertook a sleep recording with portable respiratory sleep monitor (T3, Nox Medical). Medical history of all children was viewed, including history of tonsillectomy and abnormal blood tests (insulin, liver enzymes and cholesterol). The respiratory events were scored using AHI and OAHI. The novel respiratory power loss (PL) is measured by calibrated respiratory plethysmography (cRIP). PL is quantified by comparing the power in the thorax and abdomen movements, to the power of the total respiratory movement.

Results: The prevalence of SDB was found to range from 11% to 100%, depending on the diagnosis criteria used and selected AHI and OAHI cutoffs. Using adult criteria the mean AHI and OAHI were 2.46 ± 2.08 and 2.19 ± 1.76. Using pediatric criteria the mean AHI and OAHI were 3.29 ± 2.25 and 3.12 ± 2.08. The correlation between the respiratory indices and clinical factors is shown in table 1.

Table 1. The correlation between the respiratory indices (PL, OAHI and AHI) and BMI-Z, waist circumference, waist circumference, blood tests, tonsillectomy and CSHQ score.

	BMI-Z		Waist circumference		Blood test		Tonsillectomy		CSHQ	
	R	P	R	P	R	P	R	P	R	P
PL	0.43	0.03	0.40	0.05	0.46	0.02	-0.33	0.10	-0.03	0.90
OAHI	-0.99	0.62	0.02	0.93	0.02	0.93	0.17	0.39	-0.09	0.66
AHI	-0.07	0.75	0.08	0.69	-0.01	0.96	0.19	0.34	-0.08	0.68

[Table 1]

Conclusions: The large range of possible diagnosis outcomes using conventional AHI and OAHI makes the diagnosis of SDB unreliable in adolescents. Since AHI and OAHI focus on counting apneas and hypopneas and ignore the quality of breath, a measure of the respiratory effort may be more suitable for children and adolescents, where apneas and hypopneas may not be the main cause of symptoms. These preliminary results show a correlation between power loss, as a measure of respiratory effort, and clinically relevant variables. Further validation of power loss as a measure of respiratory effort is needed.

01.11.2015 - 11:00-12:00
Sleep and Aging - Basic to Clinical Science

94 - **Ageing alters the EEG microstructure and motor cortical drive across sleep in the rat models of impaired brain cholinergic control**
Presented by: Jasna Saponjic

J. Saponjic[1], J. Ciric[1], K. Lazic[1], J. Petrovic[1], A. Kalauzi[2]
[1]Department of Neurobiology, University of Belgrade, Institute for Biological Research - Sinisa Stankovic, [2]Department for Life Sciences, University of Belgrade, Institute for Multidisciplinary Research, Belgrade, Serbia

Objectives: Our previous study has shown that the onset of healthy ageing alteration of the sleep/wake states architecture and cortical drives during sleep in rats was at 4.5 months age. The aim of this study was to follow the impact of ageing in the rat models of Alzheimer's and Parkinson's diseases cholinergic neuropathology. We used the bilateral nucleus basalis (NB) and pedunculopontine tegmental nucleus (PPT) lesioned rats as the *in vivo* models.
Methods and materials: We performed the experiments in three experimental groups of adult Wistar rats (n=39), chronically instrumented for sleep recording: the physiological control, and the bilateral NB and PPT lesions. Following two weeks of postoperative recovery we recorded spontaneous sleep at 3, 3.5, 4.5, and 5.5 months age. We analyzed the sleep architecture, and the sleep states related EEG microstructures and motor cortical drives.
Results: Ageing did not affect sleep architecture in the NB and PPT lesioned rats ($X^2 \geq 0.25$; $p \geq 0.1$). Ageing did not affect the Wake EEG microstructure from 4.5-5.5 months ($X^2 \geq 1.49$; $p \geq 0.16$), and there was no consistent effect on the NREM EEG microstructure during both lesions. Conversely, the EEG sigma amplitude during REM consistently increased from 3.5-5.5 months in the PPT lesioned rats vs. the controls or NB lesioned rats ($X^2 \geq 8.87$; $p \leq 0.01$). Aging augmented the motor cortical delta drive across all sleep states ($X^2 \geq 9.61$; $p \leq 0.01$) alongside the augmented NREM and REM theta, sigma and beta drives ($X^2 \geq 14.77$; $p \leq 0.001$) during both lesions.
Conclusions: Ageing sustainably augmented the EEG sigma amplitude during REM of the PPT lesioned rats, but it augmented the NREM and REM delta, theta, sigma, and beta motor cortical drives in both rat models of impaired brain cholinergic control. We evidenced the distinct EEG microstructure and motor cortical drive across sleep during healthy vs. pathological ageing.

91 - **The effect of aging on NREM sleep EEG slow waves in mice**
Presented by: Maria Panagiotou

M. Panagiotou[1], V.V. Vyazovskiy[2], J.H. Meijer[1], T. Deboer[1]
[1]Molecular Cell Biology, Leiden University Medical Centre, Leiden, The Netherlands, [2]Physiology, Anatomy and Genetics, University of Oxford, Oxford, United Kingdom

In the course of aging an overall decline in circadian drive, associated with circadian amplitude decrements, is observed. In addition, sleep-wake impairments emerge, predominantly sleep fragmentation. In this study, we want to investigate the effect of age on sleep and electroencephalogram (EEG) parameters, and NREM sleep slow wave morphology in young (6 months, n=9) and aged (18-24months, n=24) male C57BL/6 mice. EEG and the electromyogram were recorded for 48 h in a 12:12 L:D cycle beginning at lights on. On the second day a 6-h sleep deprivation (SD) was performed starting at light onset. Aged mice had increased total NREM sleep during darkness and more long NREM sleep episodes (32-256s) (t-tests, $p < 0.0001$ after significant ANOVAs). In addition, older animals exhibited significantly higher levels of absolute EEG slow-wave activity (SWA, 0.5-4.0 Hz) in NREM sleep as compared to younger animals (t-tests, $p < 0.0001$ after significant ANOVA). In both age groups more large amplitude slow waves, less multipeak waves and steeper slopes of the slow waves were found at the beginning of the light period as compared to the end of the light period (t-tests, $p < 0.0001$ after significant ANOVAs). However, the incidence of multipeak waves was lower in aged mice and the changes in slopes during baseline and after SD were less pronounced as compared to the young mice (t-tests, $p < 0.0001$ after significant ANOVAs). The increased sleep, the longer NREM sleep episodes, the higher SWA together with the lower number of multipeak slow-waves suggest an increased sleep pressure in the older mice. The differences observed in the shape and incidence of individual slow waves may arise from changes in connectivity

and altered cortical network properties, such as local and global neuronal synchronization.

187 - **Differential alerting and melatonin response to moderately bright light during 40 hours of extended wakefulness in young and older healthy volunteers**
Presented by: Antoine U. Viola

A.U. Viola[1,2], G. Virginie[1], M. Maire[1], C. Reichert[1], C. Schmidt[1,3], C. Cajochen[1]
[1]Centre for Chronobiology, Basel, Switzerland, [2]Sleep Disorders Centre, Strasbourg, France, [3]Cyclotron Research Center, Liege, Belgium

Objectives: Light has distinct non-visual effects on human physiology and behaviour, such as suppressing melatonin and sleepiness, particularly when administered in the late evening. However, whether extended light exposure has a sustained alerting and melatonin suppressing effect during extended wakefulness in young and older volunteers has not been investigated so far. In this study we examined the role of extended light exposure as a countermeasure for the detrimental effects of sleep deprivation on sleepiness and the circadian melatonin profile.
Methods: Twenty four participants (15 young (25.3±0,7) and 9 older (63.2±1,3) have completed the in-lab part of the study, which consisted of a balanced cross-over design with different but a constant light exposure regimes during 40h of extended wakefulness. Participants underwent 3 sessions with a 40h dim light exposure, a 40h white light exposure or a 40-h blue enriched white light exposure. Questionnaires were administered hourly to assess subjective sleepiness on the Karolinska Sleepiness Scale (KSS) along with saliva collections for melatonin assays.
Results: Moderately bright light during sustained wakefulness induced a significant alerting response in the older but not young participants ("age" x "light condition" p=0.02), independent on whether the moderately bright light was blue enriched or not. In contrast, melatonin suppression was only significant in the young participants and only in the late evening from 10 pm to 2 am during both non- and blue enriched light at 250 lux (light x time of day p=0.0011, for the young separately.
Conclusion: Our preliminary data indicate that constant exposure to moderately bright light during extended wakefulness has alerting properties, which are age-dependent such that older profit more than young volunteers. Contrariwise, moderately bright light affected circadian phase markers in young but not in older participants, maybe due to the fact that melatonin level in the older was already at a lower level under dim light, such that the light was not strong enough to further suppress melatonin. This data have implications on the use of moderately bright light in night work and shift work settings, where constant light levels are very common, and on age-related changes in the alerting response to light under elevated sleep pressure.

421 - **Age affects sleep microstructure more than sleep macrostructure**
Presented by: Johanna Schwarz

J. Schwarz[1,2], E. Lindberg[3], G. Gruber[4], J. Theorell-Haglöw[3], H. Fischer[1], T. Åkerstedt[2]
[1]Department of Psychology, Stockholm University, [2]Stress Research Institute, Stockhom University, Stockholm, [3]Department of Medical Sciences Respiratory Medicine and Allergology, Uppsala University, Uppsala, Sweden, [4]The Siesta Group, Vienna, Austria

Objectives: It is well-known that physiological sleep changes across age. However, large-scale studies have focused on sleep macro-structure only, while sleep microstructure has been mostly addressed in small and non-representative samples. The current study investigates the effect of age on sleep macro- and microstructure in a large sample of women.
Methods: Ambulatory home polysomnography recordings were obtained on one occasion in 400 non-pregnant women that were randomly selected from a representative sample (oversampling of snorers). The present analyses included 213 women (age (yrs): mean =49.0, SD=11.4, Min=22, Max=72). Sleep scoring, spectral analysis of NREM sleep and microstructure analysis (C3-A2) were conducted using automatic analysis and verified manually by a sleep scoring expert. Linear regression analyses with age (continuous) as predictor were conducted (adjusted for AHI, self-reported snoring, subjective health, subjective sleep complaints, depression and anxiety symptoms). Cohen's f^2 was calculated as local effect size measure, with $f^2 \geq 0.02$ depicting small, $f^2 \geq 0.15$ medium and $f^2 \geq 0.35$ large effect sizes respectively.
Results: Increasing age was associated with significant decreases in Total Sleep Time ($f^2 = 0.09$), N3 sleep (min) ($f^2 = 0.04$) and REM sleep (min) ($f^2 = 0.09$). Delta power during NREM sleep ($f^2 = 0.04$) and N3 sleep ($f^2 = 0.11$) as well as sigma power during NREM sleep ($f^2 = 0.03$) decreased. Older age

was also associated to increased sleep fragmentation in terms of increased wake during the sleep period and less time spent in consolidated N2, N3 and REM sleep (intervals of at least 5min length, which has previously been associated to more restorative sleep). REM density and slow spindle density (11-13Hz) were not significantly altered, but fast spindle (13-16Hz) (f^2 = 0.21) and K-complex (f^2 = 0.14) density significantly declined with increasing age. For the covariates, medium effect sizes were observed for N1 (min) and arousalindex.
Conclusions: According to effect sizes calculations, the age-related alterations in sleep microstructure are larger than the alterations in sleep macrostructure. In particular, the quality of N3 (in terms of delta power) and N2 sleep (in terms of fast spindle and Kcomplex density) seems to decline. The decrease in sleep spindles and K-complexes during N2 sleep may indicate a decrement of sleep protective mechanisms with increasing age.

316 - **Sleep efficiency is associated with dual-task walking among community dwelling older adults**
Presented by: Maayan Agmon

M. Agmon, T. Shochat, R. Kizony
University of Haifa, Haifa, Israel

Objectives: Over a third of people over 70 and the majority of older adults over 85 have a clinical diagnosis of gait abnormalities. Gait abnormalities can lead to loss of independence, increased risk of falls, increased mortality and mobility. Dual-task (DT) interference during walking is widely recognized as a functional mobility concern among older adults. Adding a cognitive task to walking may lead to decreased walking distance and increased stride to stride variability, which associates with increased risk for falls and cognitive decline. Although sleep problems are common among older adults, few studies addressed associations between sleep disturbance and gait abnormalities. We aimed to examine associations between objective sleep/wake measures and gait with DT walking in community dwelling older adults, hypothesizing that reduced sleep efficiency during the nighttime sleep period is associated with increased gait abnormalities during a daytime DT challenge.
Method and materials: Thirty-two (65.6% women) independently functioning community dwelling older adults (mean age 71.0±5.9, Montreal Cognitive Assessment mean score 24.4 ± 2.3) participated. Sleep efficiency (percent of sleep of the time-in-bed interval) was objectively assessed by seven-day wrist actigraphy monitoring. Measures of gait were walking distance (meters) and stride to stride walking speed variability as a single task (ST), and with two additional cognitive tasks as DT: (1) verbal fluency (number of words generated) and (2) subtraction by 3 from a random number, both during 1-min periods. Bivariate correlations were performed to assess relationships between sleep efficiency and ST/DT measures.
Results: Higher sleep efficiency was associated with increased walking distance under the ST condition (r=0.45, p=0.01), and as a DT with subtraction (r=0.39, p=0.03) and with verbal fluency (r=0.399, p=0.02). Higher sleep efficiency was also associated with lower stride to stride speed variability as a DT with subtraction (r=-0.45, p=0.01) and with verbal fluency (r=-0.506, p=0.004).
Conclusions: Reduced sleep efficiency during the nighttime sleep episode was associated with lower ability to efficiently divide attention between two tasks, as expressed by significant reduction in walking distance and increased gait variability. These findings point to the importance of the diagnosis and treatment of these two conditions concomitantly.

01.11.2015 - 11:00-12:00
Cardiovascular Autonomic Modulation during Sleep in Different Populatons

517 - **Sleep and blood pressure in preschool children: results from the generation XXI birth cohort**
Presented by: Marta Goncalves

M. Goncalves[1,2,3], A.R. Costa[1,2], A.C. Santos[1,2], H. Barros[1,2]
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Objective: To estimate the association between sleep characteristics and high blood pressure (BP) in preschool children.

Methods: This study included 4419 singleton children of the Portuguese population-based birth cohort Generation XXI, evaluated at 4 years of age by face-to-face interview. Data regarding sleep characteristics, such as night awakenings (every day), night time (< 10.0; 10.0-10.50; >10.5) and total sleep time (< 10.5; 10.5-11.0; >11.0), sleep onset delay (>20 minutes to fall asleep) and naps (none, several days a week, every day), were collected through a structured questionnaire. BP was measured using an aneroid sphygmomanometer with a proper size cuff, and was classified as high if the systolic and/or diastolic BP was ≥95th percentile, defined according to the American Academy of Pediatrics. To evaluate the association between sleep and high BP, odds ratio (OR) and respective 95% confidence intervals (95% CI), were computed using multivariate logistic regression. Models were adjusted for children's age, body mass index, and maternal educational level.
Results: The prevalence of high BP was 13.8%, similarly in boys and girls (13.7% *vs.* 13.9%, p=0.786). Overall, 14.8% of the children had night awakenings every night, 27.4% took more than 20 minutes to fall asleep and 42.8% did not nap in the afternoon. Approximately one-third of the children slept less than 10.0 hours per night and, regarding total sleep time, 32.8% sleep less than 10.5 hours. After adjustments, night awakenings (OR=1.37, 95%CI: 1.09-1.73) and sleep onset delay (OR=1.36, 95%CI:1.12-1.64) were positively associated with high BP. No association between night time and total sleep time, naps and high BP were observed.
Conclusions: Night awakenings and sleep onset delay were independently associated with high BP, which highlights the importance of promoting sleep quality early in childhood.
Acknowledgement: The authors gratefully acknowledge the families enrolled in Generation XXI for their kindness, members of the research team for their enthusiasm and perseverance and the participating hospitals and their staff for their help and support.
Source of funding: G21 was funded by *Programa Operacional de Saúde - Saúde XXI, Quadro Comunitário de Apoio III* and *Administração Regional de Saúde Norte* (Regional Department of Ministry of Health). It has support from the Portuguese Foundation for Science (PTDC/SAU-ESA/105033/2008) and Technology and from the Calouste Gulbenkian Foundation.

494 - **Heart rate variability and sleep in preschool children**
Presented by: Rosemary S.C. Horne

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Background: Studies in both adults and children have demonstrated that short sleep duration is associated with both adverse cardiovascular and daytime functioning outcomes. It is thought that the autonomic nervous system could be the link between sleep problems and these adverse outcomes. Heart rate variability (HRV) has been widely used as a measure of assessing autonomic cardiovascular control. Studies in both adults and school-aged children have shown that subjects with sleep disordered breathing (SDB), which is associated with both adverse cardiovascular and daytime functioning outcomes, have lower HRV. To date there have been no studies in pre-school children, when the incidence of SDB peaks, on the relationship between HRV and sleep quantity.
Methods: 142 snoring children (aged 3-5y) and 38 non-snoring controls underwent overnight polysomnography (PSG). ECG was sampled at 512 Hz and HRV analysis was performed in LabChart (7.2, ADinstruments, Australia) in the frequency domain in two-minute artifact-free bins of the same sleep stage. HRV comprised LF (0.04-0.15 Hz), HF (0.15-0.4 Hz), total power (≤ 0.4 Hz) and the LF/HF was calculated as a measure of sympathovagal balance. Variables in each child were averaged for Wake before sleep onset, N2, N3 and REM sleep. Regression analysis was used to correlate HRV parameters and total sleep time (TST), sleep latency (SL) and sleep efficiency (SE).
Results: The groups did not differ in age or sex or heart rate averaged over the entire sleep period. Usual sleep duration, as recorded by parental sleep diary for 1 week prior to the PSG study was not different between groups during the week or at weekends with children averaging 10 hours sleep per night. There were no significant relationships between HRV and TST, SL or SE in the control group. In the group of children with SDB there was a significant correlation between TST and LF/HF in N2 (R=.251, p< 0.01) and N3 (R=.665, p< 0.001) and between SE and LF/HF in N2 (R=0.299, p< 0.001), N3 (R=0.211, p< 0.01) and REM sleep(R=0.261, p< 0.01). There were no relationships with SL or the daytime functioning domain within the OSA-18 questionnaire.
Conclusions: This study provides evidence that both sleep quantity and sleep quality can influence autonomic control in pre-school children and treatment of sleep disorders should be implemented as early as possible to prevent adverse outcomes.

513 - **Altered nighttime cardiac autonomic nervous system tone in otherwise healthy overweight adolescents**
Presented by: Rodrigo Chamorro

R. Chamorro[1,2], C. Algarín[1], O. Rojas[1], M. Garrido[1], R. Ferri[3], S. Durán[1], B. Lozoff[4], P. Peirano[1]
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Objective: To compare the cardiac autonomic nervous system (ANS) tone during nighttime sleep-waking stages in healthy normal weight (NW) and overweight (OW) adolescents.
Methods and materials: Sixty healthy adolescents (33 NW and 27 OW) were categorized as NW (n=33) or OW (n=27) according to body-mass index WHO percentiles. Through PSG recordings sleep-waking stages (non-REM sleep stages S1, S2 and SWS, REM sleepand wakefulness (W) were scored. The ECG signal was processed for R-R intervals detection using the software Hypnolab 1.2 (SWS Soft, Italy) and the following spectral components were obtained: high-(HF), low-(LF) and very low- (VLF) frequency powers, and the sympathovagal balance (indexed by the LF/HF ratio). Data were compared between groups for each sleep-waking stage during the whole night and also for successive thirds
(T1, T2 and T3) by means of a mixed-effects linear regression model.
Results: Conventional sleep macrostructure parameters and the proportion of non-REM sleep stages were similar in both groups but REM sleep percentage, lower in the OW group ($p < 0.04$). Compared with NW subjects, OW subjects showed shorter RR interval in W ($p < 0.008$) and S2 ($p < 0.02$) duringT1 and S1 duringT2 ($p < 0.04$), without difference in T3. This group also had higher VLF power in W during T1
($p < 0.02$), S2 during T2 (tendency, $p < 0.07$) and S1 during T3 ($p < 0.01$). Both groups presented similar LF power but it was higher for the OW group in W during T2 ($p < 0.007$). Finally, OW subjects were also characterized by lower HF power and higher LF/HF ratio in W during T2 ($p < 0.007$).
Conclusions: Our results indicate altered cardiac ANS tone in OW adolescents. Given that differences between groups were apparent only during the first two thirds of night, we suggest that sleep mechanisms would be less efficient to establish the corresponding cardiac ANS modulation in otherwise healthy OW adolescents.
(Support: Fondecyt 1110513 and NIH R01 HD33487 grants)

345 - **Correlation between severity of obstructive sleep apnea and prevalence of silent cerebrovascular lesions**
Presented by: Olga Tikhomirova

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The Nikiforov Russian Center of Emergency and Radiation Medicine, St Petersburg, Russian Federation

Objectives: We investigated the correlation between obstructive sleep apnea (OSA) and prevalence of silent cerebral white matter lesions (WML).
Methods and materials: 100 consecutive men with different risk factors underwent 1.5 -T magnetic resonance imaging (MRI) scans, B-mode carotid ultrasonography, complex laboratory diagnostics included lipid profile, glucose, hs-C reactive protein (hs-CRP). Silent cerebral WML was detected in 66 patients. These patients had undergone an all-night polysomnography (PSG) to assess apnea.
Results: 66 men with WML were subdivided in two groups. The group 1 without apnea (AHI < 5/h) included 32 subjects with mean age 66 years (range 43-82), with a mean body mass index (BMI) of 27.5 kg/m2 (range 21.0-38.3) and a mean AHI of 2/h (range 0-5). The group 2 included 34 patients with apnea (AHI > 5/h) with mean age 68 years (range 50-88), with a mean BMI of 27.2 kg/m2 (range 18.6-34.5) and a mean AHI of 19.4/h (range 5.5-48.0). The amount of silent lacunar infarctions was 8.3 +/- 0.75 and 11.4 +/- 0.87 in 1 and 2 groups respectively ($p< 0.05$). There were established the correlation between AHI and prevalence of silent lacunar infarctions ($r=0.37$ $p< 0.01$).
Conclusions: Results indicate that patients with OSA have a higher prevalence of silent cerebrovascular lesion than those without OSA.

269 - **Absence of cardiovascular autonomic modulation during sleep in patients with acute**

ischemic stroke: an analysis of the SAS-CARE study cohort
Presented by: Paola Proserpio

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Background: Cardiac autonomic changes are described in acute ischemic stroke (AIS) and correlate with a poor outcome. Insula seems to play a prominent role in autonomic cortical control. Cardiovascular autonomic control (CAC) varies across sleep stages, with a sympathetic predominance during REM and a vagal predominance during NREM sleep. However, no data are available on CAC in AIS patients during sleep. Aim of the study was to assess CAC during wake and different sleep stages in patients with AIS.
Methods: From the population of the SAS-CARE prospective study [1], 47 patients with a diagnosis of AIS, without relevant sleep apneas (Apnea Hypopnea Index < 15) and cardiac arrhythmias were selected. Polysomnography (PSG) was conducted within seven days from AIS. ECG and respiration were extracted from PSG and divided in 4 sleep stages: wake (S0), non-REM 2 (S2), non-REM 3 (S3) and REM. Linear spectral (Sp) and non linear symbolic analysis (SA) were used for the analysis of CAC. Briefly, Sp identifies two oscillatory components, low frequency (LF), marker of sympathetic modulation, and high frequency (HF), marker of vagal control. SA recognizes three main indices, 0V%, index of sympathetic modulation, 2LV% and 2UV%, markers of vagal modulation. Corrected Conditional Entropy (CCE) was used to assess autonomic cardiovascular complexity. Site and size of lesions were analyzed.
Results: Sp and SA showed no differences among wake, non-REM and REM sleep. A reduction of total power and Heart Rate (HR), a decrease of 2UV%, marker of vagal modulation, and a reduction of CCE correlated with a worse neurological outcome (NIH stroke scale score at discharge). The subgroup of patients with insular involvement showed a lower sympathetic modulation compared to the patients without insular involvement during both wakefulness and sleep, without differences across these states.
Conclusions: This study shows that patients with AIS do not display the physiological autonomic modulation during sleep. Moreover, a negative correlation between CAC impairment and clinical outcome is confirmed. Insular involvement seems to be associated with a predominance of vagal modulation.
1) Cereda CW, et al. Sleep-disordered breathing in acute ischemic stroke and transient ischemic attack: effects on short- and long-term outcome and efficacy of treatment with continuous positive airways pressure--rationale and design of the SAS CARE study. Int J Stroke. 2012.

01.11.2015 - 11:00-12:00
Breakthrough in the Identification of Sleep-Wake Networks

273 - **Optogenetic stimulation performed with simultaneous *in vivo* microdialysis reveals that cholinergic neurons in the basal forebrain promote wakefulness by actions on neighboring non-cholinergic neurons**
Presented by: Janneke C. Zant

J.C. Zant[1], T. Kim[1,2], L. Prokai[3], S. Szarja[3], J. McNally[1], J.T. McKenna[1], C. Shukla[1], C. Yang[1], A.V. Kalinchuk[1], R.W. McCarley[1], R.E. Brown[1], R. Basheer[1]
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Objective: The presence of three interacting, cortically projecting neurotransmitter systems in the wake-promoting area of the basal forebrain (BF) poses a challenge in dissecting out their respective roles in the control of sleep-wake behavior. Optogenetic stimulation of BF cholinergic (Ch) neurons promotes wakefulness. However, potential local interactions of Ch neurons with BF non-Ch neurons

have not been addressed. To determine the effect of Ch optical stimulation on the local levels of acetylcholine (ACh) and its effects on neighboring neurons, we designed an 'optodialysis probe' that enables optical stimulation with simultaneous *in vivo* microdialysis to measure local ACh release. We also used the optodialysis probe for pharmacological blockade of ACh effects on neighboring non-Ch neurons.
Methods: The optodialysis probe was constructed using a modified CMA7 guide cannula to which a fiber optic cannula was glued using a biocompatible glue. ChAT-ChR2-EYFP-BAC mice were implanted with the optodialysis probe, aimed at the BF area, and with EEG/EMG electrodes. The experiment consisted of a No-stimulation day and a stimulation day, where a 8-10Hz, 10-s stimulation paradigm was repeated every min for 2 h, using 10-ms laser pulses (473 nm). Hourly microdialysis samples were analyzed by liquid chromatography-tandem-mass-spectrometry. To antagonize muscarinic and/or nicotinic receptor-mediated input to BF non-Ch neurons, atropine (50µM) or atropine and mecamylamine (1mM) were administered by reverse microdialysis during Ch stimulation.
Results: Optical stimulation significantly increased wakefulness by 51±24% (p=0.043), and the ACh levels by 83.5±14% (p=0.007) when compared to the time-matched period on the No-stimulation day. Reverse microdialysis of the ACh receptor antagonists, atropine and mecamylamine, blocked the increase in wakefulness produced by stimulation of Ch neurons. The mean latency of sleep to wake transitions observed during optical stimulation (13.5 s) increased to 20.85 s with atropine perfusion. Atropine+mecamylamine cocktail further increased the latency to 23.95 s, values comparable to those on the drug-free baseline No-stimulation day.
Conclusion: The wake-promoting effect of Ch stimulation is not primarily due to Ch actions in the cortex but rather to local release of ACh in the BF and subsequent activation of cortically-projecting, non-Ch neurons.
Support: VA, NIH (R21 NS079866, R01 MH039683, R01 MH099180) & Welch Foundation.

145 - **Cholinergic basal forebrain structures are not essential for the mediation of the arousing action of glutamate**
Presented by: Zoltán Lelkes

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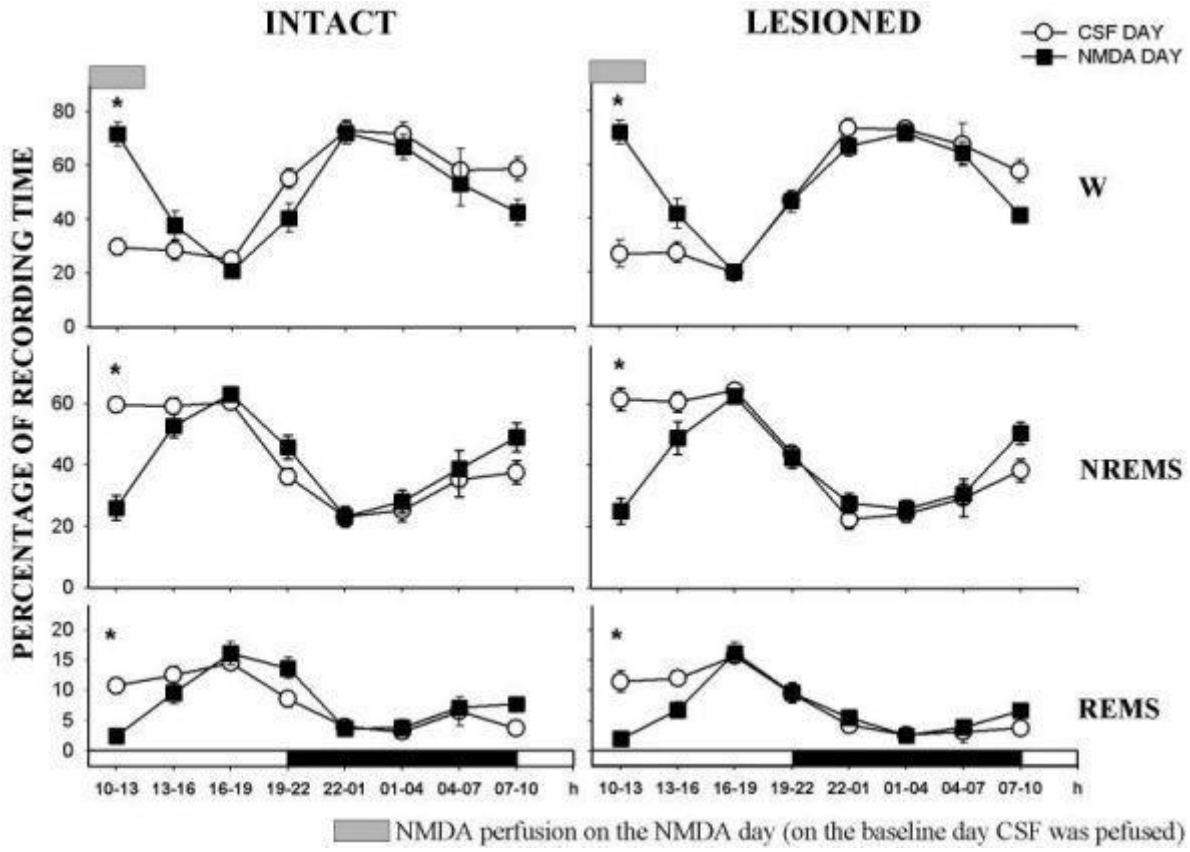

[Graf1]

Objectives: Cholinergic basal forebrain (BF) structures contribute to cortical activation and receive rich innervations from the ascending activating system. They are involved in the mediation of the arousing action of noradrenaline and histamine. Glutamatergic stimulation in the BF results in cortical acetylcholine release and suppression of sleep. However, it is not known to what extent the cholinergic vs. noncholinergic BF projection neurons contribute to the arousing action of glutamate (GLUT). To elucidate the roles of cholinergic BF structures, we administered *N*-methyl-D-aspartate (NMDA), a GLUT agonist into the BF in intact rats and after destruction of BF cholinergic cells by 192 IgG-saporin (SAP).
Methods and materials: In 8 Han-Wistar rats with implanted EEG/EMG electrodes and guide cannulae for microdialysis probes 0.23 µg SAP was administered into the BF, the 8 control animals received artificial cerebrospinal fluid (CSF). Two weeks later a microdialysis probe targeted into the BF was perfused for 3 h with CSF on the baseline day and with 0.3 mM NMDA on the subsequent day. Sleep-wake activity was recorded for 24 h on both days.
Results: NMDA exhibited a robust arousing effect both in the intact and the SAP lesioned rats. Non-REM sleep and REM sleep were decreased significantly during the 3-h NMDA perfusion (Graf 1).
Conclusion: Cholinergic BF structures are not essential for the mediation of the arousing action of GLUT.

167 - **Metabotropic glutamate receptors of subtype 5 and sleep homeostasis**
Presented by: Alexandra Sousek

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Objectives: Glutamate signalling is tightly controlled across the sleep-wake cycle. Studies in humans revealed enhanced availability of metabotropic glutamate receptor of subtype 5 (mGluR5) after sleep deprivation (SD), positively correlating with SD-induced subjective sleepiness and electroencephalographic (EEG) delta power (1-4 Hz) in recovery sleep. Furthermore, expression of *Homer1a*, binding partner of mGluR5, is elevated upon SD in mice. Thus, we aim to investigate the

effects of mGluR5 deficiency in mice on EEG parameters, vigilance states and cognitive capacities after acute sleep deprivation.
Methods and results: We performed sleep recordings in wild-type (WT), heterozygous (HT) and *mGluR5* knock-out (KO) mice for 48h baseline, 18h recovery after a 6h-SD (n=8/genotype) and further 24h recovery (n=5/genotype). We found that KO mice respond significantly different to SD than WTs and HTs, such that NREM and REM sleep in the dark periods of recovery days 1 and 2 were almost completely suppressed, while wakefulness was increased compared to baseline. WT and HT animals re-gained 80 min of sleep at the end of recovery day 1 and reached the level of baseline at the end of recovery day 2, while KO mice even lost 30 min of sleep compared to baseline in recovery day 1 and further 30 min in recovery day 2. Time-course analyses of EEG delta power revealed compromised build-up of homeostatic sleep need in KO animals.
Conclusions: These observations lead to the conclusion that the lack of functional mGluR5 causes severe disturbances in mechanisms of sleep homeostasis. How these differences in amount of vigilance states and delta power accumulation after SD affect cognitive functions, such as working memory in the Y-maze, is under current investigation.
Study supported by the Swiss National Science Foundation (grant#320030-135414 to HPL) and the CRPP “Sleep and Health” of the University of Zürich.

274 - **A screen for potassium channels contributing to local sleep**
Presented by: Christine Muheim

C. Muheim[1], T. Sartorius[2], R. Dallmann[1], N. Gu[3], J.F. Storm[3], R. Dürr[1], R. Huber[4], P. Ruth[2], S.A. Brown[1]
[1]University of Zurich, Zurich, Switzerland, [2]University of Tuebingen, Tuebingen, Germany, [3]University of Oslo, Oslo, Norway, [4]University Hospital Zurich, Zurich, Switzerland

Recent work has impressively documented that sleep is not only a temporally but also a spatially distinct state (Hung et al., 2013). Therefore, local modulations in small brain regions such as thalamocortical neuronal assemblies might already be sufficient to locally alter the spectral waves characteristic of sleep. We have exploited such “local sleep” to conduct an AAV-mediated RNA interference screen for cortical potassium channels important to sleep. Among the 31 channels examined, large-conductance potassium channels figured prominently among potentially important genes. One of these, *Kcnma1 ,* was characterized in more detail using a classic full-brain knockout model. *Kcnma1* is a large conductance calcium dependent potassium channel (BK) with a broad expression throughout the mammalian brain. Local BK channel depletion reduces “slow wave” power in all vigilance states, thereby altering kinetics of the homeostatic sleep process. These phenotypes could be rationalized both electrophysiologically through reduced burst firing capacity and transcriptomically because of altered inhibitory synaptic composition. The reduction of slow wave power is independent of time of day and furthermore can only be restored partially under increased sleep pressure, suggesting a bona fide effect upon the sleep homeostat. By contrast, we and others (Meredith et al., 2008, Montgomery et al., 2012) have shown separately that BK activity in the SCN is necessary for circadian electrical output from SCN neurons. Because the BK channel shows this dual function, our results suggest that ion channels and in particularly BK channels can integrate circadian and homeostatic effects upon sleep directly through regulation of neuronal firing and inhibition. More generally, they demonstrate that individual ion channels can play roles specific to individual brain “signatures” of sleep.

637 - **The supramammillary nucleus and the claustrum activate cortical structures during paradoxical (REM) sleep**
Presented by: Pierre-Hervé Luppi

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Cortical activity is classically believed to be fast and intense during rapid eye movement sleep (“REM sleep” also called paradoxical sleep “PS”) and waking in contrast to non-REM sleep. Positron emission tomography in humans further indicates that the limbic cortices are more active during REM sleep than waking. However, the state of the cortex at the cellular and molecular level during PS and the neuronal pathways involved in its activation remain to be defined. Here we show that only a few limbic cortical areas are activated during PS by projections from the supramammillary nucleus, a small hypothalamic

structure and the claustrum. Combining cDNA microarray, qPCR, "in situ" hybridization and immunohistochemistry in control rats (n=20), rats deprived of PS during 72h (n=20) and rats allowed to recover from deprivation during 3 or 6h (n=20), we find that, during PS hypersomnia, the dentate gyrus, the claustrum, the cortical amygdaloid nucleus, the anterior cingulate, medial entorhinal and retrosplenial cortices are the only cortical structures containing neurons with an increased expression of BDNF, FOS and ARC, known markers of activation and/or synaptic plasticity. Such limited activation contrasts with the near global cortical activation occurring during waking as reflected by our FOS staining obtained after the induction of 3h of waking (n=4). Combining FOS staining, and retrograde labeling using cholera toxin B subunit in rats allowed to recover from deprivation during 6h, we further show that the activation of the anterior cingulate (n=4) and the retrosplenial cortices (n=4) during PS is induced by a projection from the claustrum. Using the same approach, we also show that the activation of the dentate gyrus during PS hypersomnia is due to a glutamatergic projection from the lateral part of the supramammillary nucleus. Finally, we demonstrated that lesion of the supramammillary nucleus (n=4) causes a dramatic decrease in the number of FOS+ neurons in the dentate gyrus in rats allowed to recover from deprivation during 6h compared to control animals. These data contrast with classical views suggesting a widespread cortical activation during PS. We propose that the activation during PS of the supramammillary-limbic cortical network revealed for the first time in the present study may trigger dreams and contribute to the consolidation of emotional memory known to occur during this state.

01.11.2015 - 13:30-15:30
Symposium: Cost and gain of neuronal networks: sleep-wake regulation from mice to human

689 - **Global sleep and single neurons**
Presented by: Vladyslav Vyazovskiy

V.V. Vyazovskiy
University of Oxford / Sleep and Circadian Neuroscience Institute (SCNi), Oxford, United Kingdom

The temporal dynamics of sleep is manifested in the alternation of non-rapid eye movement (NREM) and REM sleep and slow homeostatic changes of EEG slow-wave activity (0.5-4Hz). In turn, the temporal organisation of waking is manifested in the distribution of waking episodes across 24h, the duration of continuous waking bouts and regular shifts between behavioural states within waking. Recent evidence suggests that these relatively slow and global processes are tightly linked with the dynamics of cortical activity on a much faster temporal scale, including the activity of individual neurons. However, it remains unknown, whether individual neurons in the neocortex are influenced in a top-down fashion by global state changes, or, alternatively, global state transitions are initiated at the level of local neuronal ensembles. As well known, EEG slow waves during sleep are associated with the occurrence of neuronal network silent (OFF) periods, which alternate with periods of intense spiking (ON-periods). We found that both long-term and immediate preceding state history affect the dynamics of global EEG slow waves and local OFF-periods. Furthermore, we found that in the first minutes upon spontaneous awakening, cortical neurons tend to enter OFF periods more frequently. Interestingly, cortical OFF periods are also typical after sleep deprivation, even in awake animals, and our data suggest that even during highly active behavioural states, local cortical “sleep” can occur, specifically during stereotypical or habitual behaviours. Finally, we found recently that the quality of awake state, as reflect in the type of behaviour and corresponding patterns of local and global cortical activity predicts the duration of sustained waking bouts as well as intensity of subsequent sleep. Thus, investigating cortical network activity at a single neuron level provides important mechanistic insights into understanding the temporal organisation of waking and sleep on a global scale.

706 - **Sleep and synaptic plasticity: spotlight on dendrites**
Presented by: Julie Seibt

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[1]Charité - Universitätsmedizin Berlin, Berlin, Germany, [2]Institute of Physiology, University of Bern, Bern, Switzerland, [3]College of Medical Sciences, Sleep and Performance Research Centre, Washington State University Spokane, Spokane, WA, United States

Sleep has now been linked to brain plasticity at many levels, with converging evidence from the molecular, cellular and behavioural fields. Studies in humans and animals show that experience

induces local and use-dependent cellular and molecular changes in the sleeping brain. Sleep also participates in network remodelling through selective elimination and stabilization of spines during developmental and adult brain plasticity. Our own findings further suggest that synaptic protein production in the cortex is enhanced during sleep and is required for the consolidation of both synaptic potentiation and depression induced by waking experience. Since evidence points at a role for sleep in consolidation of selected networks and synapses, one might expect that measuring activity directly from dendrites can provide new and important insights into the role of sleep in dendritic functions in general, and synaptic plasticity in particular.
To address this issue, we used optical imaging of Ca^{2+} activity from dendrites in the somato-sensory cortex of freely behaving rats. Continuous recordings of combined Ca^{2+} and EEG signals revealed that activity of population of dendrites increase significantly during individual slow-wave-sleep episodes, in an almost linear fashion. The magnitude of increase is strongly correlated with increase in spindle-beta (9-30 Hz) power. Additional correlation analyses confirm a selective and robust link between local spindle-beta oscillations and activity of large population of dendrites in the cortex. Our results support current hypotheses of a direct link between spindles and dendritic activity and further reveal an important, yet unexplored, functional coupling between spindle and beta oscillations (15-30Hz). Interestingly, frequencies in the spindle-beta range detected during early development in humans and animals represent spindles´ immature form (“spindle-like” activity, ~8-25Hz) and are known to be important for developmental plasticity. It is therefore tempting to propose a functional adaptation of these oscillations across lifespan.

01.11.2015 - 13:30-15:30
Symposium: Update on type 1 narcolepsy

709 - **Pathogenesis of type 1 narcolepsy: an update**
Presented by: Birgitte R. Kornum

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[1]Department of Clinical Biochemistry, [2]Danish Center for Sleep Medicine, Rigshospitalet, Glostrup, Glostrup, Denmark

Type 1 Narcolepsy is caused by a loss of hypocretin (orexin) signaling in the brain. Genetic data suggests the disorder is caused by an autoimmune attack on hypocretin producing neurons in hypothalamus. This hypothesis has however not yet been confirmed by consistent findings of autoreactive antibodies or T-cells in patient samples. One explanation for these negative results may be that the autoimmune process is no longer active when patients present to the clinic. With increasing awareness in recent years, more and more patients have been diagnosed closer and closer to disease onset. We have tested whether an active immune process in the brain could be detected in these patients, as reflected by increased cytokine levels in the cerebrospinal fluid (CSF). However, cytokine levels did not differ significantly between controls and patients, even in 5 patients with disease onset less than a month prior to CSF sampling. In these 5 patients very close to onset there was a clear tendency for an increase in Th1 related cytokines and this was not seen for Th17 and Th2 associated cytokines. Despite the lack of consistent findings of increased levels of immune markers in narcolepsy, it is still possible that there is an autoreactive immune mechanism in narcolepsy type 1. It could be that the delay between the autoimmune attack and onset of narcolepsy symptoms is so long that general inflammatory markers have returned to basal levels. As memory T lymphocytes can be very long lived, it is possible that such cell could still be detected in blood samples from narcolepsy Type 1 patients even years after disease onset. We and others have assayed T-cells from patients for autoreactivity, and the present talk will focus on recent developments in this area.

01.11.2015 - 13:30-15:30
Symposium: Why do we sleep so late?

28 - **Sleep in traditional societies: human sleep under evolutionarily relevant conditions**
Presented by: Jerry Siegel

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How did humans sleep before the modern era? Because the tools to measure sleep were developed long after the invention of the electric light, television, the Internet and related devices that are suspected of delaying and reducing sleep, there is no reliable data on how sleep has changed from levels more characteristic of our species´ evolutionary history. To address this question, we have investigated sleep in three traditional human societies. Despite their varying genetics, histories, and environments, we find that all three groups show similar sleep organization, suggesting that they express core human sleep patterns, probably characteristic of pre-modern era Homo sapiens. Group sleep durations averaged between 5.7 and 7.1 h, amounts at the low end of durations reported for healthy subjects in industrial societies, with a difference of nearly one hour between summer and winter sleep durations. Daily variation in sleep duration was strongly linked to the time of sleep onset, rather than the time of sleep offset. Although they lack electric lights, none of these groups began sleep near sunset, with sleep onset occurring, on average, 3.3 h after sunset. Furthermore, awakening was not tightly linked to sunrise. The sleep period consistently occurred during the nighttime period of lowest environmental temperature, was not interrupted by extended periods of waking and terminated near the daily nadir of temperature. Light exposure was maximal in the morning and greatly decreased at noon, indicating that all three groups seek shade at midday. Napping occurred on less than 7% of days in winter and 22% of days in summer. Mimicking aspects of the natural environment experienced by these groups might be effective in treating certain modern sleep disorders.

01.11.2015 - 13:30-15:30
Symposium: Pathophysiology of sleep-dependent memory consolidation and cognition in children

699 - **Sleep spindles in children: sleep-related learning state or trait?**
Presented by: Kerstin Hoedlmoser

K. Hoedlmoser[1], P. Peigneux[2], A. Sadeh[3], M. Schabus[1]
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There is a growing body of evidence postulating relationships between sleep and cognitive abilities focusing declarative, emotional and procedural memory in children. Furthermore some studies report relationships of general cognitive abilities by means of intelligence and sleep. In past sleep and memory research a main focus had been lying on 'macroscopic' estimates of sleep, that is, the amount of REM or SWS. Today however, specific sleep features and mechanisms are regarded as increasingly important for different types of offline memory (re-)processing. Especially, sleep mechanisms like sleep spindles are being under active discussion. To investigate the functional interactions between sleep spindle activity, declarative memory consolidation and general cognitive abilities in school-aged children we tested 63 (mean age 9.56±0.76 years; 28 girls, 35 boys) healthy, pre-pubertal children with ambulatory all-night polysomnography (two nights). We examined the effect of prior learning (word pair association task; experimental night) vs. non-learning (baseline night) on sleep spindle activity and assessed general cognitive abilities using the Wechsler Intelligence Scale for Children-IV (WISC-IV). Analysis of spindle activity during N2 and N3 sleep evidenced predominant peaks in the slow (11-13Hz) but not in the fast (13-15Hz) sleep spindle frequency range (baseline and experimental night) and therefore analyses were restricted to slow sleep spindles. Changes in spindle activity from the baseline to the experimental night were not associated with the overnight change in the number of recalled words reflecting declarative memory consolidation. However, children with higher sleep spindle activity as measured at frontal, central, parietal and occipital sites during both baseline and experimental nights exhibited higher general cognitive abilities (WISC-IV) and declarative learning efficiency (i.e. number of recalled words before and after sleep). We therefore conclude that slow sleep spindles (11-13Hz) are most prominent in children aged 8 - 11 years and are associated with inter-individual differences in general cognitive abilities and learning efficiency but not declarative memory consolidation, indicating rather a sleep-related learning trait than state.

700 - **Kids learn fast. Sleep reorganizes memory-related plasticity processes in children**
Presented by: Charline Urbain, Philippe Peigneux

C. Urbain[1], X. De Tiège[2], M. Op De Beeck[2], M. Bourguignon[2], V. Wens[2], D. Verheulpen[2], P. Van

Bogaert[2], P. Peigneux[2]
[1]The Hospital for Sick Children, Toronto, ON, Canada, [2]Université Libre de Bruxelles, Brussels, Belgium

Objectives: Behavioural results show that sleep is crucial for consolidation of declarative memories in children, as in adults, but the underlying cerebral mechanisms remain virtually unexplored.
Methods and materials: Using magnetoencephalography (MEG), we investigated the impact of sleep (90-minute nap) on the neurophysiological processes underlying the creation and consolidation of novel associations between unknown objects and their functions in children. Twenty-one healthy children were scanned using MEG during three picture-definition sessions, i.e. pre-learning [session 1; S1], immediate retrieval [S2] and delayed retrieval [S3]). S2 and S3 were separated by either a 90-minutes nap (*Sleep*) or a similar period of wakeful rest (*Wake* group). Children were randomly assigned between conditions. After MEG data preprocessing, immediate (S2) vs. delayed (S3) retrieval Event Related magnetic Fields (ERFs) were compared between groups.
Results: Learning-dependent changes in brain activity were observed within hippocampal and parahippocampal regions, followed by sleep-dependent changes in the prefrontal cortex, whereas no equivalent change was observed after a similar period of wakeful rest.
Conclusion: We show that a 90-minute daytime nap after learning is sufficient to trigger a transfer of memory-related brain activity toward prefrontal areas, where it incorporates into pre-existing semantic knowledge. This functional reorganization process is similar to that observed in adults, but occurs at a much faster rate. Although naps are beneficial for memory consolidation in adults, no study has shown evidence for such a fast reorganization of memory-related brain processes after a nap. Rather, similar hippocampo-neocortical transfer was observed only after several days to weeks in adults. These results emphasize the importance of providing sleep opportunities for children between learning periods.

701 - **Nap slow wave activity and emotional reactivity in typically developing children and early ADHD**
Presented by: Rebecca S. Spencer

R.S. Spencer, L. Kurdziel, A. Cremone
University of Massachusetts, Amherst, MA, United States

Anecdotally, children are emotionally dysregulated without a nap, suggesting that sleep promotes emotional regulation. To examine this, in the morning, healthy children (M=51.6 months) were presented with neutral faces, each paired with a positive or negative statement. Recognition of the learned faces was probed following a mid-day nap and equivalent time wake (counterbalanced), and again 24-hrs after encoding. Accuracy did not differ immediately following a nap compared to wake. However, 24-hrs after encoding, following overnight sleep, recognition accuracy was greater if the child had napped after learning the previous day. Nap SWA was associated with memory decay over the nap yet was also associated with enhanced overnight SWS, which in turn, enhanced overnight improvement in emotional recognition memory.
In a second experiment, we found that nap SWA is also associated with reduced emotional biases in attention. Following a nap and equivalent interval awake, children (M=54.67 months) performed a Dot Probe task in which children were presented with face pairs: a neutral face paired with a positive or negative face. Faster response time when the cue is in the place of the emotional compared to neutral faces is indicative of an emotional attentional bias. When nap-deprived, children exhibited attention biases towards emotional stimuli (negative and positive). However, no attention biases emerged when children napped. Faster responding was associated with SWA, suggesting that SWA supports efficient processing of emotional stimuli.
Given this evidence that sleep modulates attention and emotion in children, we next examined whether differences in sleep in ADHD are associated with reduced inhibitory behavior. Young children (M=79.5 months) with symptoms of ADHD and controls (M=80.2 months) completed a Go/No-Go task both before (baseline) and after overnight sleep. During the task, children were presented a series of images of animals and were instructed to respond for all animals (Go), except the chimpanzee (No-Go). The change in accuracy from baseline to morning was significantly greater for the control group relative to the ADHD group for Go trials. Enhanced inhibitory function observed overnight (morning-baseline) in controls was related to greater SWS (and decreased nREM2).
In sum, this work supports a role of SWS in emotional regulation in typically developing children and

deficits in SWS may underlie behavioral deficits such as those in ADHD.

01.11.2015 - 17:00-18:00
Round Table: What's new in cardiovascular control during sleep: from basic research to clinical implications

595 - **Sleep and cardiovascular control before birth**
Presented by: Laura Bennet

L. Bennet
Department of Physiology, The University of Auckland, Auckland, New Zealand

When we think about sleep and its effects on our adult health, we seldom think that our problems might have started in fetal life. Yet, it is during fetal life that the foundation or our sleep architecture is laid down and impaired fetal sleep may programme for later adult disease. Fetal sleep like states evolve from a desynchronous state to cycling between rapid-eye movement (REM) and non-REM patterns. These are interspersed with increasing periods of transitional sleep, and it is debated as to whether the fetus is ever awake. Fetal cardiovascular control matures as a function of key factors such as growth and autonomic nervous system development, but it is also modulated by sleep cycling and the changes in fetal behaviour associated with different sleep states and their energy demands. While long though non-circadian, we now know that fetal activity including sleep is regulated by circadian clocks, at least late in gestation. Little is known about the control of these rhythms. It is suggested that fetal clocks may be an extension of the maternal peripheral clock system, and it is known that maternal signals (e.g. melatonin, food and metabolic factors) play a critical role in entraining fetal circadian rhythms. Modern day life, with our over-exposure to light, stress, shift work and western diets, challenges our circadian rhythms and this is associated with poor sleep and risk for illness. Pregnancy is already associated with poor sleep quality, and these life-style factors compound the issue. New research suggests that impaired maternal circadian rhythms and inadequate sleep are associated with impaired fetal development and increased risk for adult diseases such as hypertension, diabetes and conditions such as obesity. How this relates to fetal and post-natal sleep development is unknown. Current research findings suggest there is an urgent need to establish ways to ensure adequate maternal sleep and thus normal fetal sleep development.The focus of this talk will be to explore the development of fetal sleep and the evidence that impaired fetal sleep may have adverse consequences for later adult life.

501 - **Cardiovascular consequences of sleep disordered breathing during in infants and children**
Presented by: Rosemary S.C. Horne

R.S. Horne
The Ritchie Centre and Department of Paediatrics, Monash University, Melbourne, VIC, Australia

During childhood sleep is at a life time maximum. Sleep is essential for normal development and is particularly important in childhood when infants spend over 70% of each 24 hours asleep and children around 50%. During infancy infants are also most vulnerable to respiratory disruptions due to immature cardiorespiratory control. Preterm infants frequently exhibit apnoeas termed apnoea or prematurity and an immature breathing pattern termed periodic breathing. Apnoea of prematurity is usually resolved by tern equivalent age, however periodic breathing can continue over the first 6 months after term equivalent age. Periodic breathing has been considered benign as the apnoeas are short, however we have shown that it is associated with significant reductions in cerebral oxygenation. Whether these repetitive falls in cerebral oxygenation contribute to the adverse neurological outcomes frequently observed in ex-preterm children is yet to be ascertained. In older children sleep disordered breathing is very common and it is estimated that these affect around 35% of all children. As in adults sleep disordered breathing has significant effects on the cardiovascular system with primary school aged children exhibiting elevated blood pressure or 10-15 mmHg together with increased sympathetic activity as measured by heart rate variability. The effects on the cardiovascular system are milder in younger children with elevated blood pressure only being observed in those with moderate to severe disease in REM sleep. These finding raise the question - should we be identifying and treating sleep disordered breathing earlier in children. These physiological studies provide important evidence which will influence treatment of these conditions in children to improve long term outcomes.

01.11.2015 - 17:00-18:00
Combined Oral Session: Insomnia: Predictors / Treatment and Sleep in Syndromic Children

47 - **The modulation of arousal and sleep continuity by transcranial Direct Current Stimulation (tDCS) in healthy controls and patients with insomnia**
Presented by: Christoph Nissen

L. Frase[1,2], H. Piosczyk[1,2], S. Zittel[1,2], F. Jahn[1,2], P. Selhausen[1,2], L. Krone[1,2], B. Feige[2], A. Sterr[3], K. Spiegelhalder[2], D. Riemann[2], M.A. Nitsche[4,5], C. Nissen[1,2]
[1]Department of Psychiatry and Psychotherapy, [2]Department of Clinical Psychology and Psychophysiology, University Medical Center Freiburg, Freiburg, Germany, [3]School of Psychology, University of Surrey, Guildford, United Kingdom, [4]Department of Clinical Neurophysiology, University Medical Center Göttingen, Göttingen, [5]Leibniz Research Centre for Working Environment and Human Factors, Dortmund, Germany

Objectives: The mammalian brain undergoes characteristic activity changes during the transition from active wakefulness to decreased arousal and sleep. Following a model of top-down modulation of sleep, this study examined whether excitability changes in the frontal cortex feed-back to sleep/wake regulation. Specifically, we hypothesized that bi-frontal activation by anodal tDCS will increase arousal as indexed by a decrease of total sleep time (TST) and that cathodal tDCS will induce opposite effects in healthy controls. In a second step, we investigated the effects of the same interventions in patients with primary insomnia as a human model of cortical hyperarousal.
Methods and materials: After adaptation to the sleep laboratory, 19 healthy controls (13 females, mean 53.7 +/- 6.9 years) and 19 patients with primary insomnia (13 females, mean 43.8 +/- 15.1 years) underwent three experimental nights in intervals of 4-7 days with a tDCS protocol (anodal, cathodal or sham in a counterbalanced order) immediately prior to polysomnography (11 pm to 7 am). tDCS was applied by two frontal stimulation electrodes (FP1/FP2) and two parietal reference electrodes (P3/P4) at a constant current of 1 mA in a repetitive stimulation protocol with anodal activation (13 min) and cathodal deactivation (9 min) stimulation (interstimulus interval 20 min).
Results: Bi-frontal anodal stimulation in healthy controls resulted in a significant decrease in total sleep time of about 25 minutes with a corresponding increase in wake time and decrease in sleep efficiency in comparison to both sham and cathodal stimulation. No significant effects on sleep architecture were observed. No intervention effects were observed in patients with insomnia.
Conclusions: This is the first report that bi-frontal anodal tDCS can decrease total sleep time in healthy controls. This might have interesting clinical implications for conditions of reduced arousal such as hypersomnia or fatigue. Patients with chronic insomnia appear to react differently to tDCS, which could be caused by a global increase of cortical arousal. Future studies are needed to further optimize and test tDCS protocols for clinical conditions of disturbed arousal and sleep.

518 - **Sleep oscillations at baseline predict responses to cognitive behavioral therapy for chronic insomnia**
Presented by: Ali Salimi

B. Hatch[1,2,3], M. Mograss[2,3,4], A. Salimi[2,3,4], S. Boucetta[2,3,4], J. O'Byrne[2,3,4], O. Weiner[1,2,3], M. Brandewinder[5], C. Berthomier[5], J.-P. Gouin[1,2], T.T. Dang-Vu[2,3,4]
[1]Psychology, [2]Perform Center, Concordia University, [3]Centre de Recherche de l'Institut Universitaire de Geriatrie de Montreal, [4]Exercise Science, Concordia University, Montreal, QC, Canada, [5]Physip SA, Paris, France

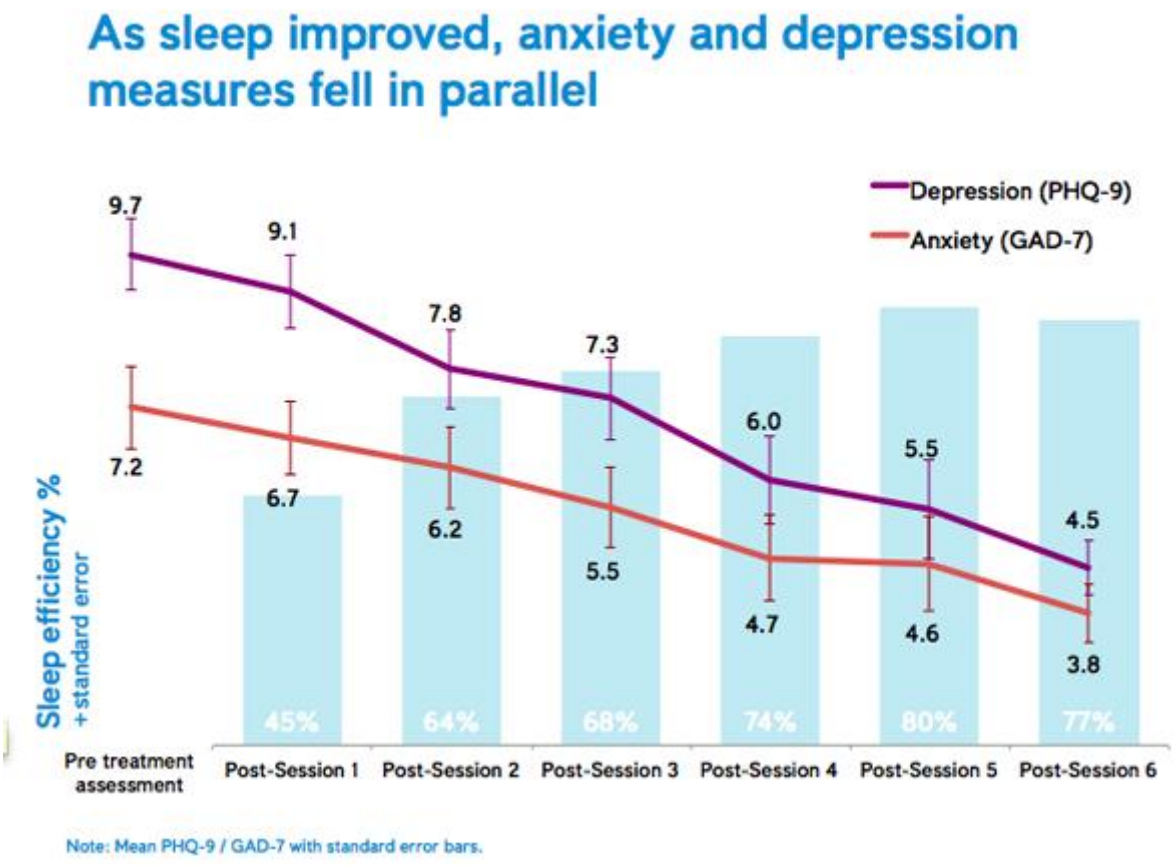
Introduction: Approximately15% of the population complains of chronic insomnia associated with impairments in daytime functioning. Cognitive-behavioral therapy for insomnia (CBT-I) clinically reduces insomnia severity; however less than half of them achieve clinical remission. Polysomnographic (PSG) sleep spindles andslow-wave activity (SWA) have been shown to modulate sleep stability and sleep quality. Our objective was to evaluate whether sleep oscillations contribute to pathophysiology and predict treatment response to CBT-I in chronic insomnia.
Methods: Nineteen chronic insomniacs (14F, M=39y+/-13SD) had 6 weeks of group CBT-I following overnight PSGs (baseline, pretreatment). Sleep spindles and EEG power density in the sigma and delta (SWA) frequency range (adapted bands) were analyzed from central-occipital (C4-O2) derivation for each Non-REM sleep cycle and across the night (Non-REMN2-N3 stages) in a 'pre-/post-CBT-I'

(sleep diary, Pittsburgh Sleep Quality index-PSQI, PSG) x 'EEG' (spindles, SWA) repeated ANOVA (controlling for age, gender and education).
Results: There was a significant interaction between sigma power during Non-REM sleep cycle 1 and latency to N3 as measured by PSG following CBT-I ($p < 0.001$), such that higher sigma power at baseline was associated with larger decrease in latency to N3 after CBT-I. Wake after sleep onset (WASO) and sleep efficiency, as measured by sleep diaries pre-/post-CBT-I, were seen to interact with several measures of spindles (e.g. density, amplitude and sigma power) in N2-N3stages ($p's < 0.05$), such that higher spindle activity at baseline was associated with larger decreases in WASO and increases in sleep efficiency following CBT-I. Larger improvement in sleep quality after CBT-I as measured by PSQI was associated with higher sigma power and spindle density at baseline ($p's < 0.01$). However, no significant interactions were observed between SWA at baseline and changes in sleep measures following CBT-I.
Conclusions: These data suggest that individual differences in spindle activity modulate neurophysiological vulnerability to insomnia and a differential response to CBT-I.
Support: CIHR, NSERC, and FRQS

681 - **Can digital CBT for insomnia address poor mental health? A cohort study within a UK mental health service**
Presented by: Annemarie Luik

S. Bostock[1,2], N. Baldwin[3], L. Chisnall[3], P. Hames[2], C. Espie[1,2], A. Luik[1]
[1]Nuffield Department of Clinical Neurosciences, University of Oxford / Sleep and Circadian Neuroscience Institute (SCNi), Oxford, [2]Big Health Ltd, London, [3]eTherapy, Self Help Services, Manchester, United Kingdom

Objectives: Insomnia has been implicated in the aetiology and maintenance of common mental health disorders. We report preliminary results from the audit of a novel e-therapy service in the UK, where digital CBT-I is being offered as an alternative to traditional CBT for depression.
Methods: The setting was a community-based provider of psychological therapies, part of a national network of IAPT services (Improving Access to Psychological Therapies), funded by the NHS. Patients can access IAPTs services via self-referral or GP-referral. Adults with home internet access who presented with mild to moderate anxiety or depression and poor sleep were eligible for free access to Sleepio, a validated six session CBT-I self-help program (Espie et al. 2012). Insomnia symptoms (ISI), anxiety (GAD-7) and depressive symptoms (PHQ-9) were assessed at baseline and post treatment. A care co-ordinator also completed weekly 10-15 minute phonecalls to measure PHQ9 and GAD7 during the program.
Results: Up to April 2015, n=102 patients (63% female, mean age 45 years; range 18-79) were referred to digital CBT-I and n=98 started the first session. Of those who entered treatment, 64% completed all 6 sessions and 79% completed 4 sessions or more. Within completers, mean PHQ9 depression scores decreased from 9.7 to 4.5, and anxiety from 7.2 to 3.8. After 6 sessions there were highly significant reductions in the numbers of patients meeting caseness for insomnia (ISI), depression (PHQ9) and anxiety (GAD7), from n=43 to n=4, n=31 to n=5 and n=23 to n=5 respectively. Based on intention to treat analysis, 65% of patients referred to digital CBT-I 'moved to recovery' (i.e. no longer met caseness for anxiety or depression) compared with a national target of 50%.
Conclusions: This early audit data suggests that digital CBT-I with minimal clinical support is an effective self-help tool for the treatment of patients with common mental health disorders and comorbid sleep problems.



[Figure]

204 - **Obstructive sleep apnea syndrome in muscular versus neuronal disorders in children: Duchenne muscular dystrophy and spinal muscular atrophy**
Presented by: Gulcin Benbir Senel

G. Benbir Senel, B. Zeydan, G. Incesu, A. Aydin, S. Saltik, C. Yalcinkaya, D. Karadeniz
Istanbul Universitiy Cerrahpasa Faculty of Medicine, Istanbul, Turkey

Objective: We aimed to compare sleep architecture and the presence of sleep-related breathing disorders in muscular versus neuronal disorders in children with Duchenne muscular dystrophy (DMD) and spinal muscular atrophy (SMA).
Methods: Children with DMD or SMA admitted to Child Neurology Clinics in Pediatrics and Neurology Departments were prospectively investigated with a full-night video-polysomnography.
Results: Ten children diagnosed as DMD and 5 children with SMA were included in our study. Age- and gender-match control group consisted of six children. All patients with SMA were males, only 1 patient with DMD and only one child in control group were females (p=0.073). The mean age was 7.8±3.0 years in children with DMD, 5.4±3.7 years in children with SMA, and 8.0±1.2 years in healthy children (p=0.792). The body mass index values were also similar among three groups (p=0.892). Polysomnographic parameters including total sleep time, sleep latency, sleep efficiency, percentages of sleep stages were all similar. The apnea-hypopnea index (AHI), on the other hand, was higher in patients with SMA (9.2±6.2/h) than in patients with DMD (2.8±5.1/h, p=0.040) and than in controls (2.0±1.0/h, p=0.036), but was similar between patients with DMD and controls (p=0.371). The index of periodic leg movements in sleep was also higher in children with SMA (8.4±8.9/h) than in children with DMD (2.6±4.3/h, p=0.254), and control group (2.6±3.7/h, p=0.571), though not significant.
Conclusion: We demonstrated a very high comorbidity of OSAS in children with SMA and DMD, which requires further attention to improve the quality of life and respiratory status.

463 - **Success rates and acceptability of domiciliary cardiorespiratory studies to screen for**

obstructive sleep apnoea in children with Down syndrome
Presented by: Johanna Gavlak

R. Kingshott[1], J. Reynolds[1], J. Martin[2], C. Rush[3], A. Ashworth[3], H. Evans[4], H. Elphick[5], M. Farquhar[3], P. Gringras[3], C. Hill[6], J. Gavlak[7]
[1]Sleep Physiology, Sheffiled Children's Hospital, Sheffield, [2]Biomedical Research Unit, University Hospital Southampton, Southampton, [3]Children's Sleep Medicine, Evelina Children's Hospital, London, [4]Respiratory Medicine, Southampton Children's Hospital, Southampton, [5]Respiratory Medicine, Sheffiled Children's Hospital, Sheffield, [6]Paediatric Sleep Medicine, University of Southampton/Southampton Children's Hospital, [7]Southampton Children's Hospital, Southampton, United Kingdom

Introduction: The ICSD-3 permits obstructive sleep apnoea (OSA) diagnosis in adults with domiciliary studies. Paediatric diagnosis requires full laboratory polysomnography. This is unrealistic in the UK where laboratory facilities are patchy. A European study reported sensitivity of 90.9% and specificity of 94.1% for home cardiorespiratory OSA diagnosis in children compared to laboratory polysomnography. We report success rates and acceptability of domiciliary OSA screening in children with Down syndrome (DS).
Method: Children with DS aged 6 months to 6th birthday were recruited from three UK centres. OSA was assessed using the SomnoTOUCH device (S-Med) comprising: chest and abdominal RIP, pulse oximetry, nasal pressure flow, body position sensor and actimetry. Parents chose domiciliary or attended cardio-respiratory laboratory studies. Studies were deemed adequate if > 4 hours of data were recorded. Families were contacted 3 months later and asked how easy/difficult they found the domiciliary study and whether they would be happy to repeat the experience.
Results: 201 children were recruited of whom 4 did not progress to cardiorespiratory studies. Of the remaining 197 children, 188 (95%) had successful studies. Four families (2%) chose to be admitted directly to the sleep laboratory. Of those opting for domiciliary studies, 151 (77%) were successful at first attempt, 13% on repeat attempts and 16 (8%) were successfully repeated in the laboratory. Of families who had completed home studies, 163 (85%) were contacted. Two thirds reported that the experience was easy or OK and 82% were happy to repeat in the future.
Discussion: For common conditions like DS, in which regular screening for OSA is recommended, UK resources do not match need. The trade-off between full hypopnoea detection with polysomnography and likely improved sleep quality with cardiorespiratory domiciliary studies needs to be balanced. Domiciliary cardiorespiratory studies are a cost-effective option, acceptable to the majority of parents.

01.11.2015 - 18:00-19:30
Poster Session 1

223 - **Types and prevalence of insomnia and parasomnia in school children in the city center of Trabzon, Turkey**
Presented by: F.Mujgan Sonmez

F.M. Sonmez[1], N. Ozgun[2], G. Can[3], M. Topbas[3]
[1]Turgut Ozal University, Faculty of Medicine, Ankara, [2]Diyarbakir Goverment Hospital, Diyarbakir, [3]Public Health, Karadeniz Technical University, Trabzon, Turkey

Objectives: Insomnia and parasomnia are the most commonly seen sleep disorders in childhood. The prevalence of sleep disorders in childhood is %25-40. A limited number of studies have been made on this issue in Turkey. This study aimed to define the prevalence and factors involved in the etiology of insomnia and parasomnia.
Material and method: An 84-item questionnaire was administered to 5200 school children from different socioeconomic levels in 10 primary schools and 10 secondary schools. The questionnaire included items that elicited about the symptoms, findings of sleep disorders and the factors that predispose to them according to ICSD-2 diagnostic criteria, sleeping habits, demographic, social and economic conditions of children. Of the 5200 questionnaires, 4144 were evaluated after the inappropriate questionnaires were eliminated.
Results: The mean of age was 11.30+3.28 years. 780 (%18.8) of the subjects were diagnosed with insomnia and 1980 (%47.8) were diagnosed with parasomnia according to ICSD-2 diagnostic criteria. There was no gender difference between the patients diagnosed with insomnia and parasomnia. Snoring was seen more often in males and sleep talking and nightmares were seen more often in

females ($p < 0.05$). Sleep talking was the most commonly seen parasomnia type with a ratio of %28.4, followed by bruxism in %14.1, nightmares in %12.9, primary snoring in %7.2, night terror in %5.7, enuresis in %4.7, and sleepwalking in %4.2 of the patients. Total sleep duration and prevalence of parasomnia decreased and prevalence of insomnia increased significantly with increasing age ($p < 0.05$).
Conclusion: In our study, the effect of the parameters that affect the prevalence of sleep disorders is similar to the literature. We believe that prevalence studies made from different areas of Turkey will be very important in having an insight into the importance of sleep disorders in childhood and their treatment methods.
Note: This study was presented as a poster at EPNS Congress in Brussels, 2013

271 - **The association between self-reported sleep duration and Body Mass Index in Korean adolescents**
Presented by: Yu-Jin G. Lee

B.H. Lee[1], Y.J. Lee[2], S.J. Kim[3], D.-U. Jeong[2]
[1]Seoul National University College of Medicine, [2]Department of Psychiatry and Center for Sleep and Chronobiology, [3]Department of Medicine, Seoul National University College of Medicine, Seoul, Republic of Korea

Objectives: Previous study has shown that insufficient sleep is related to obesity in adolescents. This study is designed to investigate the association between sleep duration (divided into sleep duration on weekdays, weekends and catch-up sleep on weekends) and body mass index (BMI) in Korean adolescents while adjusting for confounding factors of extra academic time, academic performance, socioeconomic status and depressive mood.
Methods: A total of 3,785 adolescents (boys: 58.2%, girls: 41.8%) between the ages of 11 to 18 years (mean age 15.26±1.45) from 9 middle schools and 7 high schools completed self-report questionnaires including weekday sleep duration, weekend sleep duration, height, weight, extra academic time, academic performance, socioeconomic status and Beck Depression Inventory (BDI).
Results: The mean sleep duration (hours) of the total participants was 7.03±1.29 on weekdays, 8.86±1.63 on weekends, and 1.83±1.53 for weekend catch up sleep. The sleep duration on weekdays was significantly longer in boys (average sleep duration(hour): 7.16±1.22 (boys), 6.86±1.37 (girls); $t= 7.05$, $p< 0.001$). The sleep duration on weekends was significantly longer in girls (average sleep duration(hour): 8.78±1,66 (boys), 8.97±1.58 (girls); $t= 3.52$, $p< 0.001$). The weekend catch up sleep duration was significantly longer in girls (average sleep duration(hour): 1.62±1.54 (boys), 2.11±1.47 (girls); $t= 9.76$, $p< 0.001$). The average body mass index was 20.26±3.34 in total participants and it was significantly higher in boys (average BMI(kg/m^2): 20.73±3.62 (boys), 19.61±2.76 (girls); $t= 10.35$, $p< 0.001$). After adjusting for confounding factors including age, gender, extra academic time, academic performance, economic status and BDI score, longer sleep duration on both weekdays and weekends were associated with decreased BMI ($p=0.002$ and $p< 0.001$, respectively) for both genders. Increased weekend catch-up sleep duration was associated with decreased BMI in girls ($p=0.038$), but not in boys ($p=0.343$).
Conclusion: According to current results, longer sleep duration on weekdays and weekends in adolescents was associated with lower BMI. Longer weekend catch-up sleep duration correlates with lower BMI in girls but not in boys. In summary, more sleep duration on weekdays and weekends is associated with lower BMI, but the relationship between catch-up sleep duration and BMI shows a gender difference in Korean adolescents.

478 - **Genetic risk for psychosis is associated with nightly awakenings at 8 months in girls**
Presented by: Katri Kantojärvi

J. Liuhanen[1], O.A. Saarenpää-Heikkilä[2], K. Kantojärvi[1], J. Paavonen[1], A. Kylliäinen[3], P. Pölkki[4], A.-L. Satomaa[5], S.-L. Himanen[5], J. Jaatela[1], J. Suvisaari[1], T. Paunio[1,6]
[1]National Institute of Health and Welfare, Helsinki, [2]Pediatrics, Tampere University Hospital, [3]University of Tampere, Tampere, [4]University of Eastern Finland, Kuopio, [5]Clinical Neurophysiology, Tampere University Hospital, Tampere, [6]University of Helsinki, Helsinki, Finland

Objectives: Consolidation of sleep is an essential feature of early neurological development. We hypothesized that sleep consolidation may have connection even to more sever disturbances in brain development and mental health. The objective of the current study was to examine for association

between a polygenic risk score for schizophrenia, neurodevelopmental disorder, and early development and sleep in babies at 8 months of age.
Methods and materials: The Finnish Child Sleep birth cohort was gathered in Tampere University Hospital, Finland. Health nurses in maternity clinics recruited totally 2244 mothers to approve a prenatal questionnaire during pregnancy. DNA samples were collected from 1501 babies at time of birth and genotyped with Infinium PsychArray BeadChip, Illumina. The polygenic risk score for schizophrenia was composed of 108 genotyped variants, each representing one of the 108 genomic areas associated with schizophrenia (Schizophrenia Working Group of the Psychiatric Genomics Consortium, 2014). Questionnaire-based data included characteristics of sleep (sleep length and nightly awakenings), socioemotional development and motor development at the age of 8 months. In addition, data from polysomnography registration was available for a subset of babies. Home atmosphere, babies' illnesses and breastfeeding were also reported by the parents and used as covariates in our analyses.
Results: The polygenic risk score for schizophrenia was associated with parent-reported nightly awakenings in girls (n=464, $p < 0.05$ after correction for multiple testing), but not in boys (n=501, $p>0.2$). In boys, the risk score showed trend for association to sleep efficiency, measured by PSG (n=26, P=0.05, Spearman correlation). There were no associations between the genetic risk and other developmental measures.
Conclusion: The polygenic risk score for schizophrenia was associated with parent-reported nightly awakenings in girls. Since sleep in early childhood is considered to mark development and maturation of brain, our study suggests that genetic risk for schizophrenia manifests already early in life. The difference between boys and girls needs further examination.

239 - **Epigenetic dysregulation of genes related to synaptic long term depression among adolescents with depressive disorder and symptoms of insomnia**
Presented by: Anna S. Urrila

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Adolescence is characterized by major changes in sleep patterns. It is also a period of augmented vulnerability to psychiatric and sleep disorders. We hypothesized that sleep has an independent effect on development and plasticity of brain during adolescence and that this plasticity is compromised in adolescents suffering from depression and insomnia as compared to healthy controls. We also hypothesized that these changes would be reflected in changes in the epigenome (DNA methylation) of blood leukocytes, given the systemic physiological effects of sleep insufficiency as revealed by previous studies.
The study sample comprised altogether 17 medication-free adolescent boys (mean age16.0y) that were recruited from adolescent psychiatric outpatient units and via announcements in a hospital newspaper. They were questioned for current symptoms of insomnia and daytime sleepiness (AIS, PDSS) and depressive mood (BDI-21, HDRS). Ambulatory polysomnography was performed in the adolescents' home environment. Levels of whole-genome DNA methylation were measured by Illumina 450K array and differences in the methylation levels of cases and controls were analyses by using the statistical software R. Ingenuity Pathway analysis was applied to identification of the most significant pathways with differentially methylated positions (DMPs).
We found altogether 278 genomic CpG loci that were differentially methylated in the cases and controls at P< 0.0005. The most significantly associated canonical pathways from Ingenuity Pathway analysis were those related to synaptic long term depression and telomerase activity (P< 0.003 for both). Preliminary analysis revealed association of DMPs derived from those pathways to subjective symptoms of insomnia, daytime sleepiness, and experience of depressed mood in the complete sample (P< 0.05). Furthermore, in addition to the subjective measure of sleep, the DMP associated in patients also to objective measures of sleep (total sleep time, sleep efficiency and relative amount of slow wave sleep and REM sleep) as well as to measures of vigilance (P< 0.05).
Among adolescents, depressive disorder with manifest symptoms of insomnia associate to distinctive epigenetic pattern of DNA methylation in blood leucocytes. Finding of enrichment of DMPS on genes related to synaptic long term depression emphasize the important role of sleep in synaptic plasticity and the wide-spread physiological consequences of disturbed sleep among the adolescents.

467 - **Children at risk for sleep disordered breathing in a national Romanian study**

Presented by: Mihaela Oros

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Objectives: Since 1990s, a large number of epidemiological studies have been conducted in different countries, which added new data about recognition, treatment and clinical outcomes among adult patients with sleep related breathing disorder (SRBD) and various comorbidities.
Many of the clinical characteristics of pediatric obstructive sleep apnea (OSA) and the determinants of its epidemiology differ from those of adult OSA. Pediatric OSA is a cause for significant morbidity among children.
Although the first Romanian sleep laboratory for adult patients was opened in 1996, paucity in pediatric sleep disorder research in Romania has left room for a need to recognize and report on the condition.
Methods and materials: We conducted a study to determine the percentage of Romanian children who are at risk for a pediatric sleep-related breathing disorder. The research endeavor used the Pediatric Sleep Questionnaire (PSQ), the SRBD Scale, a 22 UM PSQ item developed by the University of Michigan. The Romanian version of SRBD Scale was translated and cross-culturally adapted through a multistep approach. As novelty for the Romanian pediatric sleep disorder research setting, the questionnaire was applied for the first time, as part of the current research.
Results: The whole sample size was of 1272 households, representative for the Romanian population; 38% of the overall sample was addressed in the rural area, while 10% in Bucharest, the capital of the country. The percentage of children, aged between 18 months and 18 years, who are at risk for pediatric sleep-related breathing disorder is 9.6% with the maximum sampling of error of +/- 6.2% at 95% level of confidence.
Our data are consistent with those from the literature, and support the need for increased awareness of the presence of sleep problems in children, as well as for an early recognition and treatment.
Conclusions: In this era of co-developing a drug with a diagnostic in order to create a stratified medicine, epidemiological data are still needed so that research is aimed at specific patient populations with specific phenotypes. These are the first Romanian data regarding pediatric SDB which open many other questions for future research with a possible impact through adult age.

270 - **Pediatric obstructive sleep apnea: otorhinolaryngology approach**
Presented by: Ivo Miguel Moura

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Objectives: Description of demographic and clinical data and identifying the type of therapeutic approach in children with moderate OSA; Identification of factors associated with therapeutic decision.
Methods: Retrospective analysis of medical records of children with moderate OSA. All children with moderate OSA diagnosed through performing PSG between January 2010 and October 2014 are included. The Brodsky scale was applied to the tonsillar hypertrophy, tonsillar hypertrophy was considered grade III and grade IV. PSG parameters were assessed: total sleep time, latency, efficiency, N1, N2, N3, REM, cyclicality and wakeups, IAH, O2 average and O2 minimum saturation. The results were analyzed to determine factors associated to the choice of treatment in children treated medically and in the subgroup of surgically treated children whose indication did not correspond to chronic disease or recurrent infections.
Results: 107 children were analyzed, of which 68 were male (63.6%) and 39 female (36.4%). The average age was 4.9 years (± 3.1) with 78.5% between 2 and 8 years old. Six children had a history of prematurity, 24 children had atopic diseases; 25 children had chronic conditions. In 70.1% of the children daytime symptoms were identified and in 90.7% nighttime symptoms were reported by parents / caregivers. The Brodsky classification revealed tonsillar hypertrophy in 41.1% of children. The parameters of PSG analyzed revealed: mean AHI of 6.7 (± 1.5); the average of the average saturation was 95.1% (± 1.8) and in 81 children (75,7%) saturations below 94% were recorded; the average efficiency was 84.5% (± 12.2), severe fragmentation was detected in 15% of the children and modified cyclicity in 41.1%; 89.7% showed increased N2, 69.2% increased N3 and 90.7% decreased REM. Twenty-eight (26.2%) children were treated medically and 79 (73.8%) children underwent surgery. In 52 the indication for surgery did not correspond to chronic disease or recurrent infections. The presence of nocturnal symptoms (p = 0,02) and the degree of tonsillar hypertrophy (p = 0.001)

were statistically significant factors in choosing the type of treatment in the sample.
Conclusions: Randomized studies are needed to evaluate the different therapeutic options. Assessment and treatment protocols of children with OSA are essential for standardizing the criteria. In our sample, the presence of nocturnal symptoms and the degree of tonsillar hypertrophy portend the type of treatment.

527 - **Night to night variability of home nocturnal pulse oximetry**
Presented by: Michelle Davies

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Objectives: Nocturnal pulse oximetry (NPO) has demonstrated a positive predictive value for identifying obstructive sleep apnoea (OSA) diagnosed by polysomnography (1). Night to night variability of NPO needs further study following encouraging comparisons in children selected for suspected OSA (2). This study aims to confirm whether single-night NPO is sufficient in detecting abnormal oxygen saturation (SpO_2) to reduce wait times and alleviate pressure on an expanding paediatric sleep service.
Methods: This was a retrospective analysis of all baseline 2-night home NPO (January 2014 - February 2015) with a minimum estimated sleep time of 6hrs; children using ventilators or supplemental oxygen were excluded. Mean and minimum SpO_2 and 4% oxygen desaturation indices (ODIs) were documented. SPSS (Version 22) was used to calculate Descriptive Statistics, perform Spearman's correlations and a Wilcoxon matched pairs test.
Results: Data were available from 40 children (17 females, median age 6.0 years (1.15-17.15 years)). SpO_2 variables correlated well between nights (Figure 1), with p values of 0.000 for each mean and minimum SpO_2 and 4% ODI (r= 0.657, 0.680, and 0.793, respectively). The Wilcoxon matched pairs test found no significant differences between the nights (p=0.662, 0.384 and 0.957, respectively) (z-values=-0.437, -0.870 and -0.054, respectively). Ninety percent (36/40) of first night NPOs remained above or below a cut-off of 4 dips/hour on the second night NPO.

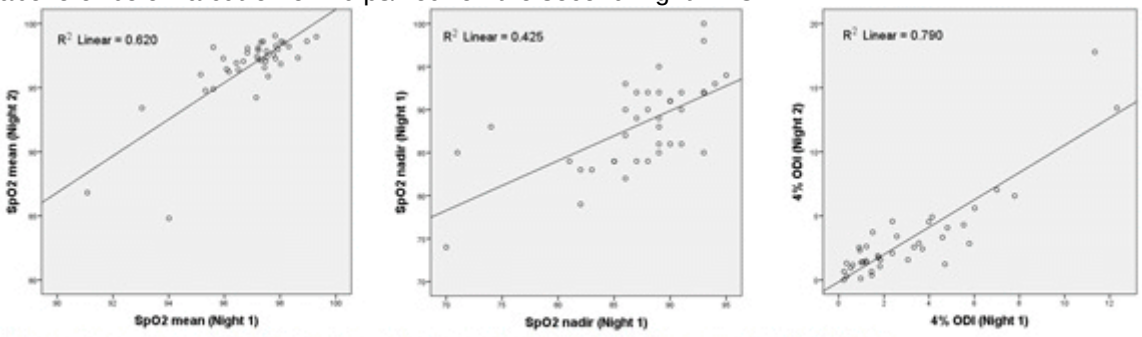

Figure 1: Scatter plots showing correlations between Nights 1 & 2 of SpO_2 mean, nadir and 4% ODI
[Figure 1]

Conclusions: There is excellent agreement within baseline two-night NPO suggesting a single-night is sufficient.
References:
1. Brouillette RT[1], Morielli A, Leimanis A, et al. Nocturnal pulse oximetry as an abbreviated testing modality for pediatric obstructive sleep apnea. Pediatrics. 2000;105(2):405-12.
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586 - **Primary nocturnal enuresis, assessment of sleep and ADH secretion patterns**
Presented by: Lamia Afifi

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Background: Data regarding sleep patterns in nocturnal enuresis (NE) using polysomnography is

conflicting. We aimed to study the sleep architecture in children with severe primary nocturnal enuresis and assess their pattern of antidiuretic hormone (ADH) secretion.
Subjects and methods: This study included 31 children aged 6-18 years with primary mono-symptomatic severe nocturnal enuresis. They were subjected to a single overnight polysomnographic assessment and compared to healthy matched controls. In addition assay of ADH levels was performed at 9-11 am and 9-11 pm in 28 patients with NE.
Results: Enuretic children had significantly prolonged sleep latency, higher stage N 1 percentage, less total sleep time, sleep efficiciency and REM sleep percentage compared to the control group. Ten (32.2%) NE children had nocturnal arrhythmia while six (19.35%) had a respiratory distress index index >5. Reversed ADH secretion pattern was present in 82% of the tested NE children. Children with reversed ADH secretion had less stages 1 and 3 and higher sleep efficiency than the NE children with normal ADH rhythm.
Conclusion: Primary NE is associated with disturbed sleep architecture. It is important to test for sleep disordered breathing and cardiac arrhythmia in children with NE. Reversed pattern of ADH secretion is very common in NE children, a finding that can tailor treatment regimen in those kids using vasopressin.

431 - **"How do you sleep?" Sleep as reflected in self figure drawings of young adolescents living in residential care facilities compared to those living at home**
Presented by: Tamar Shochat

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Objectives: Sleep problems are common among adolescents, can affect different areas of functioning, and are often comorbid with emotional or developmental issues. Adolescents living in residential care facilities (RCFs) have a history of neglect, abuse, or other familial or environmental deficiencies, all of which may contribute to a higher risk of sleep problems. The purpose of this study was to explore sleep patterns and related behaviors of young adolescents living in RCFs, and to examine whether these patterns are reflected in their self figure drawings and accompanying narrative descriptions.
Methods and materials: This cross-sectional study compared young adolescents (ages 10-12) in RCFs (N=26) and in normative homes (N=33). Participants completed standard quantitative self-report (School Sleep Habits Survey) and actigraphy measurements of sleep patterns and related behaviors, and were asked to draw themselves sleeping and to describe their drawing. Drawings were analyzed using quantitative indicators of self figure drawings and qualitative analysis of the narratives, performed by two independent raters.
Results: Group comparisons (t-tests) revealed that on weekdays, compared to adolescents living at home, adolescents living in RCFs go to bed and rise earlier ($p< 0.001$), sleep longer and take longer to fall asleep ($p< 0.01$) based on actigraphy, with similar findings for self-report. No differences were found in sleep efficiency (actigraphy), related behaviors and mood (self-report). On examination, drawings demonstrated that young adolescents in RCFs frame their sleeping figure in a closed boundary (88% vs 48.5%), and are more prone to use monochromatic colors (72% vs 45.5%) than their home residing counterparts, respectively ($p< 0.05$). Qualitative analysis identified themes of *exclusion,* that are expressed in switching between grammatical persons (from ´I´ sentences to ´he´ or ´she´ sentences) and expressions of *self-aggrandizing* in the RCFs group.
Conclusions: Combining distinct modes of measurements, findings suggest that adolescents in RCFs may have difficulties falling asleep; however, it is likely that the structured environment enables good sleep hygiene and helps to prevent additional sleep problems. The need for protection and a sense of security are expressed in the drawings and the themes emerging from the narratives. This study offers a unique tool that may complement our understanding of adolescents´ perceptions of their sleep.

237 - **Effects of sleep on early cognitive development in young children with Down syndrome**
Presented by: Frances Knight

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In typically developing (TD) children poor sleep contributes to cognitive difficulties. Children with Down syndrome (DS) have severe sleep problems, particularly with breathing, as well as cognitive and behavioural difficulties. It is currently unknown how sleep problems affect early cognitive development in individuals with DS.
This study explores, for the first time, the relationship between objective measures of sleep and well-validated indices of early cognitive development in 2- to 4 year-olds with DS and age-matched TD children. Sleep was monitored using home respiratory polysomnography and children completed the Mullen Scales of Early Learning to assess motor skills, visual reception and language development. We found increased obstructive apnoeas and hypopnoeas during sleep in children with DS. Cognitive development was delayed relative to the TD group, with expressive language being a particular area of weakness for children with DS. We report preliminary data on the relationship between sleep and cognitive development and expect that sleep problems contribute to delays in early cognitive abilities. These findings will support the notion that sleep problems should be examined and treated from an early age in children with DS, which may be crucial for achieving the greatest cognitive outcomes. Since DS is the most common sporadic developmental disorder, this will have wide-reaching clinical implications and set the stage for follow-up intervention studies.

612 - **The dynamics of cortical network activity during non-rapid eye movement sleep in early and late adulthood mice**
Presented by: Laura E. McKillop

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Sleep undergoes changes with ageing, both with respect to sleep-wake architecture and characteristics of electroencephalogram (EEG) slow-wave activity (SWA, 0.5-4Hz). The cortical neuronal mechanisms underlying these age-dependent changes are currently unknown and it is unclear at what age alterations in sleep become evident.
We recorded cortical multiunit activity (MUA) from the primary motor cortex across 12h light periods in male C57BL/6J mice during early adulthood (EA, 21.91±1.96 weeks, n=5) and late adulthood (LA, 50.29±1.44 weeks, n=7). Recordings were performed with a 16-channel microwire array, of which 10.40±1.12 and 10±0.58 channels showed robust MUA in EA and LA mice respectively (n.s., unpaired t-test). In this study we investigated the duration and number of neuronal silent (OFF) periods, which were defined as periods of total neuronal silence >20ms.
The average duration of OFF periods in non-rapid eye movement (NREM) sleep was similar between EA and LA mice ($p=0.36$, unpaired t-test) and showed a significant decline across the light period in both groups (% of mean 12-h levels, EA: 7.12±2.54%, $p=0.02$; LA: 14.27±4.02%, $p< 0.001$, paired t-test). Within the first minute of individual NREM sleep episodes the duration of OFF periods increased by 12.96±3.08% in EA mice and by 16.47±3.70% in LA mice ($p< 0.05$ in both). While the number of OFF periods did not significantly change across the initial 1 minute of NREM sleep in either group, the intraepisodic increase in time spent in OFF periods was found to be more pronounced in LA mice (21.35±4.64%, $p=0.005$), compared to EA mice (17.73±5.83%, $p=0.06$). Moreover, when expressed as a percentage of the first 16-s of a corresponding NREM episode the increase in time spent in OFF periods was significantly higher in LA mice (EA: 29.15±8.63%; LA: 57.90±7.80%; $p=0.04$).
In summary, neuronal OFF periods during NREM sleep show dynamic alterations across 12-h and within individual episodes, which parallel changes previously observed in EEG SWA. This suggests that OFF periods can provide important mechanistic insights into the age-dependent variations observed with the EEG. Intriguingly, our results show that age-dependent changes in cortical network activity during sleep can be found as early as 50 weeks old.
BBSRC Industrial CASE grant (BB/K011847/1), Eli Lilly and Company, MRC NIRG (MR/L003635/1), FP7-PEOPLE-CIG (PCIG11-GA-2012-322050), and Wellcome Trust Strategic Award (098461/Z/12/Z).

552 - **Which physical exercise before sleeping**
Presented by: Nicolas Bessot

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Objectives: The heat loss phase following physical exercise could promote sleep and decrease sleep latency. However it has been shown that exercise was an arousal effect in such case. The competitive sleepy and arousal effect of exercise could explain some of discrepancies identified in the literature. These effects could be partly due to the hormonal response induced by exercise. Indeed, the hormonal response depends on the exercise characteristic including aerobic / anaerobic contribution. So we can suggested that the type of exercise (anaerobic versus aerobic) could differently influence subsequent sleep.
Methods and materials: Nineteen active young males adults (15 males, 4 females) free from sleep problem participated to this study (age: 20.9 ± 1.7 years old; height: 176 ± 7 cm; body mass: 69 ± 10 kg: physical activity: 9.3 ± 5.6 h/week). The experiment consisted of recording 3 polysomnography on 3 separate days for each subject with 3 different pre sleep conditions (anaerobic exercise, aerobic exercise, control condition). The experimental condition started at 22h00 and consisted of 30 minutes (Total work = 2122 × body weight (kg) + 9915 Joules) of a cycling continuous (aerobic) and discontinuous (anaerobic) exercises or control conditions (seat on a chair). At 23:00, the subject was set in supine position, the lights switched off and the participant was asked to try to sleep. Subjects were awakened at 07:00 h.
Results: Sleep latency significantly increase after physical activity conditions. No effect of pre sleep condition is observe on other sleep variable (sleep efficiency, Total sleep time and latency of entire night and each stage). Further analysis will be performed on sleep data.
Conclusions: Physical exercise just before going to sleep don't impact sleep except for sleep latency. There is no separate impact according to the type of exercise (anaerobic vs aerobic). However additional analysis must be performed on data to confirm this statements. In this study the exercise intensity and duration were relatively low. The effect on subsequent sleep architecture of the intensity and duration of an exercise should be tested in the future.

69 - **Association between chronotype and suicidal ideation in medical students**
Presented by: Zohreh Yazdi

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Objective: Suicide is one of the disasters of psychological health. Due to WHO official report in 1996 every year 500.000 people end their life by attempting suicide. Purpose of this study was to determine frequency of suicidal ideas among medicine students, and to find out the correlation between their Chronotype and severity of these ideas.
Methods: This cross sectional study was done in Qazvin University of Medical Science. The questionnaire was given to all of the medical students which were in second year till 6th year of education course. A total of 200 students were completed a self-administered questionnaire regarding age, sex, marital status, smoking, and type of accommodation. Also, students´ chronotype were detected by Horne and Ostberg Morningness Eveningness questionnaire.
Results: Among 200 medical students, 102 (51%) were male and 98 (49%) were female. Mean age of participants was 22.8±4.6, with a range of 18-26 years. Our findings showed that 48 students (24%) had partial suicidal ideas and 19 students (9.5%) had absolute suicidal ideas. Majority of our participants had an intermediate chronotype (124, 62%). Frequency of evening type and morning type were 46 (23%) and 30 (15%), respectively. Smokers, younger students, and married students had significantly more suicidal ideation ($P< 0.05$). There was no association between different chronotype and suicidal ideation ($P>0.05$).
Conclusion: Approximately 35% of students experience suicidal ideation. Some factors increase probability of this idea. It is suggested to distinguish and reduce risk factors in medical students.

185 - **Gender-related alterations in cortisol and subjective well-being under moderately bright light during 40-h of sustained wakefulness**
Presented by: Antoine U. Viola

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It was shown that subjective well-being is modulated by circadian phase, sleep pressure and also gender. However, it is not yet known, whether circadian and sleep-wake homeostatic modulation of subjective well-being is different in men and women under differential light conditions. We examined gender-related effects of extended light exposure during sleep deprivation on well-being, subjective sleepiness, melatonin and cortisol levels.
Methods: 26 young participants underwent 40h of extended wakefulness once under dim-light, and once under either white-light or blue-enriched white light exposure. Subjective sleepiness and well-being was assessed hourly along with melatonin and cortisol assays. Mixed-model analyses of variance for repeated measures were applied for statistical analyses.
Results: Subjective well-being exhibited a clear circadian modulation with lower values during the biological night than during the biological day in both gender, while well-being did not worsen or improve with increasing sleep pressure. However, a significant effect for the factor 'gender' was found for well-being, which indicated that men felt generally better under sustained wakefulness than women under all light conditions. Furthermore the significant interaction 'gender'x'light condition', indicated that men felt better under both moderately bright light sources compared to dim light, whereas women only showed a significant improvement in well-being under the blue-enriched light condition. Bright light during sustained wakefulness induced a significant decrease in subjective sleepiness. However, only at the trend level women felt sleepier than men under all light conditions with no significant interaction term 'gender'x'light condition'. Melatonin levels were in general significantly higher in women than to men, with no significant gender difference in the suppressing effect of both moderately bright light conditions. In contrast to melatonin, there was no main effect of 'gender' for the cortisol profile, but a significant interaction term 'gender'x'light' which yielded higher cortisol levels in women compared to men under the white light condition.
Conclusion: Our data indicate that constant exposure to moderately bright light during extended wakefulness has gender specific effects on well-being and cortisol secretion. Thus, when implementing new light solutions in institutions requiring night shift work, the gender composition of the workforce should be considered.

281 - **How is sleep and mood affected by ocular deficits?: A case series study**
Presented by: Iona Alexander

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Objectives: To compare sleep and mood in individuals with congenital and acquired anophthalmia and sighted control subjects.
Method and materials: 8 individuals with clinically congenital anophthalmia, 11 individuals with acquired anophthalmia [eyes removed 4-20 years ago] and 11 sighted controls were recruited. Pittsburgh Sleep Quality Index (PSQI) and the Hospital Anxiety and Depression Scale (HADS) were completed to assess sleep quality and mood. The PSQI is used to rate subjective sleep quality with a cut-off point of above 5/21 indicating 'poor' sleep. The HADS determines the level of anxiety and depression with a cut-off point of 8/21 for anxiety or depression. Rest/activity cycles (N=14) were assessed) and Magnetic Resonance imaging (MRI) (N=14) was used to determine the extent of ocular loss. Urinary melatonin levels have been collected in this ongoing study as a physiological marker of entrainment.
Results: All subjects with acquired anophthalmia reported higher PSQI scores (mean 10.27) than those with congenital anophthalmia (mean PSQI = 5.13) or the control participants (mean PSQI = 5.83).
Nine participants with congenital anophthalmia showed entrainment in their actigraphy traces, although only 3 had vestigial eye tissue present. The participants with acquired anophthalmia who were recently enucleated showed entrainment, whereas the subject who was 20 years post-enucleation did not show entrainment.
The amount of time since one has been enucleated may relate to the level of entrainment as determined by actigraphy. There was no increased prevalence of anxiety and depression in either the congenital or acquired anophthalmic groups compared to controls.

Conclusion: A small number of photosensitive ganglion cells in vestigial tissue may be sufficient for entrainment. However, social routines may modulate rest-activity patterns of those without any eye structure. The amount of time one has been enucleated has an impact on rest/activity patterns but not on mood.

283 - **Association between morningness/eveningness, addiction severity and psychiatric disorders among individuals with addictions**
Presented by: Jacques Taillard

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Objectives: Studies have shown that Evening-Type (ET) subjects used more stimulating and sedative substances, and presented more psychiatric disorders than Morning-Type (MT) subject. However, there is a lack of data on the chronotype of patients with addiction. The aim of our study was to describe chronotype and associated factors in a sample of outpatients beginning treatment for addiction.
Methods and materials: 333 dependent subjects (40 ± 11.3 years, 63 % Men) were assessed with the morningness-eveningness questionnaire of Hörne & Ostberg, the Addiction Severity Index and the Mini International Neuropsychiatric Interview.
Results: 20% were MT and 32% were ET. When comparing ET to MT, multivariate analysis showed that ET was significantly associated with poly-problematic addiction (OR =6.10 [1.59-26.0], p=0.01), non-substance addictions (OR =4.71 [1.32-18.6], p=0.02), cannabis addiction (OR =7.48 [1.57-41.9], p=0.01), and mood disorders (OR =2.58 [1.14-6.20], p=0.02), but not with severity of addiction. MT was associated with antisocial personality disorder (OR =0.19 [0.04-0.75], p=0.02).
Conclusions: Results suggested that chronotype was associated with specific addiction pattern and psychiatric disorders.

532 - **Biological and psychological evaluation of performance markers**
Presented by: Cátia Reis

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Objectives: Psychomotor Vigilance Task (PVT), melatonin and cortisol salivary concentrations are often used as performance markers.
Salivary protocols to analyse synchronously different markers are very important in human research, especially due to their applications in daily routines.
PVT, melatonin and cortisol present circadian variations, and protocols to evaluate them separately are well established. However the time lag of their rhythms renders temporal correlation analysis more complex. Therefore the aim of this work was the establishment of a protocol to evaluate putative performance markers.
Methods: Ten healthy individuals performed 11 daily saliva collections and PVT testing for two days at specific schedules from 7am to 2am. One day after sleep deprivation (SD) and another with standard sleep periods (baseline). 24h activities were measured by sleep diaries and actigraphy in order to obtain sleep-wake variations. Hormonal analysis was performed recurring to ELISA immunoassays.
The 6 optimal sampling points for both biomarkers and PVT in baseline and SD were determined following a Bayesian methodology, where the Fisher Information is optimized, considering not only the data uncertainty, but also the existent variability of the model parameters.
Results: The amplitude and acrophase of melatonin rhythm were lower in SD. For cortisol both the peak value and the rhythm amplitude were lower in SD. The PVT results were synchronous with the melatonin in the baseline with performance deteriorating when melatonin increases. Such partially lost after SD. The PVT performance is associated with the cortisol rhythm except in the hours after awake. After SD the classical inverse correlation between cortisol and PVT was observed.
The minimum saliva collection time points that present the best fit curve for the PVT, melatonin, and cortisol were 07:00, 08:00, 12:00, 19:00, 21:00, 23:00.
Conclusions: The described protocol showed reliable results to multimodal evaluation and

synchronization of performance and hormonal parameters.

578 - **Concordance of sleep duration questions and sleep diaries from an internet survey**
Presented by: Christopher J. Gordon

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Objectives: Epidemiological research often relies on subjective estimations of sleep duration from simple questions. It is unclear whether this accurately reflects an individual's sleep duration when compared to sleep diaries. We determined from a large internet survey if simple questions of sleep duration agreed with 7-day sleep diaries.
Methods: An Australian-wide sleep survey asked respondents about subjective sleep duration using a single question (hours of sleep normally) and two-question (sleep onset and offset times) and to complete a 7-day sleep diary. Bland-Altman graphs assessed agreement, precision and bias between sleep duration questions and sleep diaries. Systematic differences were determined using *t*-test and Spearman's rho for systematic bias.
Results: Data from 1662 adult participants showed that single and two questions of sleep duration were significantly different from sleep diaries (both $p < 0.001$). Sleep duration questions were imprecise compared to sleep diary sleep duration (95% level of agreement: single question: 157.2 min, two questions: 175.8 minutes). There was systematic bias throughout the measures (single: rho=0.204, two question: rho=0.309, $p < 0.001$). We also found significant associations between the systematic difference of simple questions and sleep diary sleep duration and several sociodemographic health risk factors (e.g. BMI).
Conclusions: We present data from an internet survey that simple questions about habitual sleep duration show imprecision and systematic bias compared to a 7-day sleep diary. These data also suggest that subjective estimations of sleep duration are associated with health risk factors which may be related to systematic reporting bias of risk factors rather than biological sleep duration.

591 - **Effect of age and chronotype on kinetics of sleep pressure build-up**
Presented by: Jacques Taillard

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Objectives: Dynamics of homeostatic sleep pressure is modified by age or by chronotype. EEG power during wake (alpha-theta waves) has been used to monitor sleep pressure build-up. The aim of the study was to determine the effect of age and chronotype on sleep pressure during wakefulness under controlled high or low sleep pressure conditions.
Methods and materials: 21 volunteers (aged 20-75 years) were enrolled in a study including two 40-h constant routines. In the “Sleep Deprivation” condition, the volunteer was kept awake for 40 hours to obtain a high sleep pressure condition. In the “NAP” condition, the volunteer adopted a short wake/sleep cycle (150/75 min) resulting in a low sleep pressure condition. Sleep pressure was evaluated every 3h45 via a Karolinska Drowsiness Test.
After an automatic artefact rejection the spectral power in the theta-alpha (6-9Hz) band was calculated on the frontal EEG Fz.
Results: The time course of EEG theta-alpha activity was more pronounced especially during the biological night for young participants due to strengthened circadian amplitude.
The time course of EEG theta-alpha activity was more pronounced but the circadian amplitude was more attenuated for morning participants.
Conclusions: These results obtained using KDT demonstrate that age and chronotype modify the kinetics of sleep pressure build-up, thus confirming similar results using sleep EEG.
Acknowledgements: Research funded by ANR

18 - **A six-year sleep lab experience in an Egyptian university hospital**

Presented by: Maha Yousif

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Background: Sleep disorders are common and the gold standard for diagnosis is through polysomnography (PSG) with standard scoring criteria. Published clinical and polysomnographic data reporting sleep disorders among Egyptian patients are lacking.
Objective: To study clinical and polysomnographic characteristics in Egyptian patients with suspected sleep disorders.
Patients and methods: All patients` polysomnographic records and sleep questionnaires were reviewed from November 2006: November 2012 at the Minoufiya University Hospital Sleep Disorders Unit.
Results: 421 patients were recruited 229 males (54.4%); excessive daytime sleepiness and obesity were major features (ESS=16, BMI=33). Most of the patients were referred by a chest physician (81%). The most common symptoms were snoring (84.6%), witnessed apneas (78.6%), insomnia (70.9%) while the least was parasomnia (15.4%). 337 patients were diagnosed as having obstructive sleep apnea OSA (80%) of them, 70 (21%) had mild OSA, 75 (22%) had moderate OSA and 192 (57%) had severe OSA, The most common diseases accompanying OSA were: systemic hypertension (77%), diabetes (63%), COPD (57%), and coronary heart disease (49%).
Conclusions: Sleep medicine in Egypt is still lagging behind the developed world, awareness of sleep disorders among Egyptian physicians should be increased. Diabetes, HTN, IHD and COPD are the commonest predisposing factors for OSA among Egyptians especially snorers, obese and overweight patients.

170 - **Exploring the relationship between sleep and emotion in daily life: a pilot study**
Presented by: Andrea Ballesio

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Objectives: Recent findings suggest that poor sleep quality is associated with mood instability, mood disorders and enhanced negative emotions. Sleep and emotion seem to be related by a bidirectional link. However, research exploring the relationship between sleep quality and emotion in daily life is almost lacking. The aim of the present study was to explore this bidirectional relationship between sleep and emotion in an ecological momentary assessment design.
Methods and materials: The sample consisted of 24 normal sleepers, 9 males, 15 females (age range: 19-32 years; mean ± sd: 22.6 ± 3.3 years). Sleep was measured at the participants' home for five consecutive nights both through self-report sleep diaries and objectively through a portable electronic device (ZEO, Inc.) recently validated. For each participant the best and the worst night were selected based on the sleep efficiency index. Adaptation night and week-end nights were excluded from the analyses. Participants were asked to rate their emotional experience every night before going to bed and every morning after the final awakening. According to the bidirectional hypothesis, we expected that negative emotions in the evening would predict impairment in sleep parameters in the following night. In turn, lower sleep quality was hypothesized to predict enhanced negative emotions on the following morning.
Results: Negative emotions reported at night predicted the sleep quality the following night but significantly only for the best night. Specifically, negative emotions at night were significantly associated with Total Sleep Time (r=-488; p=0.016) and with Deep Sleep (r=-.450; p=0.027). These correlations were not reported the following morning.
Discussion: Preliminary findings suggest that pre-sleep negative emotions affect sleep quality while sleep impairment does not seem to affect emotions at awakening. Positive emotions were not significantly related with sleep parameters.

231 - **Evening typology and morning tiredness associates with low leisure time physical activity and high sitting**
Presented by: Heini Wennman

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Objectives: Circadian typology is a latent trait, usually assessed with scoring on a series of questions thought to represent the construct. But, in the classification most people end up as neither a definite morning nor evening type but still have a stronger preference towards either end of the continuum. It is suggested that the health risks associated with evening typology relate to unhealthy behaviors. However, the link between chronotype and health status is far from clear and bigscale studies are lacking. Our aim was to operationalize chronotype using latent class analysis (LCA) to compare and understand characteristics of chronotype in a population-based sample of adults in Finland.
Methods and materials: A total of 4904 men and women aged 25 to 74 years, representative of the Finnish general popuation, were included. All data were self-reported via questionnaires, including questions on chronotype (a psychometrically justified subset from the original Horne-Östberg Morningness-Eveningness Questionnaire), sleep, leisure time physical activity and sitting. Chronotype was operationalized by LCA, relying on the information criteria, stability and interpretation for the best model. Index variables were formed regarding physical activity and sitting. The associations of latent chronotypes with physical activity and sitting were analyzed by multinomial logistic regression after adjusting for sleep duration, age, gender, education, smoking, diet, body mass index, prevalent cardiovascular disease, and depression.
Results: We found five latent groups including “rested more-evening type” (28%), “rested more-morning type” (25%), “morning type” (24%), “tired more-evening type” (16%), and “evening type” (8%) groups. Operationalization of chronotype by LCA suggests that morning alertness was an important feature to differentiating chronotypes. Further, the “evening type” and the “tired more-evening type” had higher odds for none to very low and for low physical activity, as compared to “morning type”. In addition, “evening type” was associated with more time spent sitting, as compared to “morning type” (Table 1).

	Leisure time physical activity (n=4311)				***Sitting (n=4378)***		
Latent chronotype	**None or very low physical activity**	**Low physical activity**	**Medium physical activity**	**High physical activity**	**Low sitting**	**Medium sitting**	**High sitting**
Evening type	3.01 (2.00-4.53)	1.47 (1.01-2.13)	1.12 (0.78-1.61)	ref.	ref.	0.90 (0.65-1.24)	1.69 (1.19-2.41)
Tired, More-evening type	2.70 (1.91-3.81)	1.79 (1.34-2.39)	1.31 (0.99-1.74)	ref.	ref.	0.89 (0.70-1.14)	1.14 (0.86-1.52)
Rested, More-evening type	1.75 (1.30-2.36)	1.47 (1.16-1.86)	1.17 (0.93-1.47)	ref.	ref.	0.95 (0.78-1.16)	1.10 (0.86-1.39)
Rested, More-morning type	1.71 (1.26-2.32)	1.42 (1.11-1.81)	1.02 (0.81-1.30)	ref.	ref.	0.78 (0.64-0.96)	0.77 (0.60-0.99)
Morning type	ref.	ref.	ref.	ref.	ref.	ref.	ref.
Results as odds ratios and 95% confidence intervals. Models included also sleep duration, age, gender, education, body mass index, smoking, diet, prevalent cardiovascular disease, and depression.							

[Table 1. Results for multinomial logistic models]

Conclusions: Our findings indicate that it is important to assess sleep schedules and morning tiredness, which then could be targeted as a potential mediating factor for health-related behaviors, in particular physical activity, and subsequently health status.

236 - **Effects of napping on impulse control**
Presented by: Ugo Faraguna

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Objectives: Among the many beneficial effects of nocturnal sleep, an improvement in impulse control has been repeatedly shown. Conversely, sleep deprivation significantly compromises subjects´ performance in task involving impulse control. Here we aimed at evaluating whether mid-afternoon napping may have a beneficial effect on impulse control performance.
Methods and materials: Seven young adults (mean age=26±8.22 yrs) who had normal sleep-wake habits without habitual daytime napping participated in the study. They underwent two testing sessions with a validated Go/NoGo task (Garavan et al. 1999). The first session consisted of two blocks: one preceding while the other one following napping, performed at least 30 minutes after awakening (Nap Session - average NREM nap duration 48±15 min). Each block was preceded by a Psychomotor Vigilance Task trial, used to control for vigilance and for potential effects of sleep inertia. During this session, subjects went to bed around 3 p.m. and were allowed to sleep for a maximum of one hour. They were awakened in case the EEG would show signs of transition to REM, which was prevented in every subject. A week later the same subjects underwent the control session, repeating the two PVT and Go/NoGo blocks, but spending the same time between blocks in quiet waking, rather than sleeping (Control No-Nap Session). During both sessions all subjects were monitored by a 64-Ch EEG system. Activity monitoring by actigraphy covered at least three days preceding each session.
Results: During the post-nap block subjects showed a significant improvement in the proportion of correct responses when no go stimuli were presented (“correct withholds”, post-nap mean=0.521±0.424 versus pre-nap mean=0.398±0.184, p= 0.019, t=3.163). In the control session, subjects did not show any significant improvement (p=0.395).
Conclusion: The present results revealed the positive effects of mid-afternoon napping on impulse control as measured by a standard Go/NoGo task.

370 - **Effects of Dusk-dawn simulation light on daytime cognitive performance, mood, alertness and night sleep in young people**
Presented by: Yingying Zhu

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Study objective: To investigate the effects of dynamic dawn-dusk simulation light on daytime cognitive performance, subjective alertness, mood and night sleep in young people with mild sleep restriction during workdays.
Methods and materials: 16 Subjects are recruited to participate in a 72-h laboratory protocol during which one of three different lighting conditions (separated by 1 week) is administered each morning or night after/before (depending on the lighting condition) the 6-h sleep restriction night. Two sessions of 30-min cognitive tasks will be run immediately after light exposure.
Light setting: dawn-dusk simulation light (DDS) comprises dawn and dusk simulation light that the former is manipulated by polychromatic light gradually increases from 0 to 300 lux during 30 min before wake-up time and remains on for 20 min after wake-up time, while the dusk light send out pre-dusk signal (200lux) for 45 min to give subjects time in bed, then decline exponentially to 0.001 lux. The blue light (BL: 470nm) and dim light exposure (DL: < 8lux) will be the other two experimental groups, one of which will be exposed immediately after awakening.
Cognitive tasks: Emotional Stroop task (implicit), Facial-expression recognition task (explicit), word-preference test, working memory task, attention test, psychomotor vigilance test(PVT).
Results: the whole study will be completed in September, recently a pilot study is being administered (from May to July). Although the details of results cannot be presented right now, the expected results are as follows: a main effect of lighting conditions tend to be significant—DDS will significantly increase subjects' alertness and positive mood compared to DL; With respect to cognitive tasks, subjects will perform better in DDS and BL, but not for DL. Sleep quality and efficiency will be improved in DDS (less nocturnal activity, more immobile phases) from overall time course compared to BL and DL.
Conclusions: DDS could improve subjective alertness, mood and cognitive performance during daytime working hours for young people. What's more important, DDS could help decrease sleep

inertia resulting from sleep restriction during workdays and increase sleep quality at night.

472 - **Nocturnal sleep and circadian sleep wake pattern in adult subjects with Down syndrome (DS)**
Presented by: Sandra Giménez Badia

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Objetives: Sleep disruption worsens cognitive performance both in children and in adults. Children with DS present a high prevalence of sleep disorders, especially obstructive sleep apnea. Few studies have focused on sleep disturbances in adults with DS. We evaluate nocturnal sleep and circadian sleep wake pattern in adult subjects with DS both with subjective sleep measures and polysomnography studies (PSG).
Methods: Twenty subjects (12 male and 8 female) with DS participated in a cross-sectional analytical study. Only subjects with mild and moderate mental retardation and over 18 years were included (according to DSM-V criteria). Nocturnal sleep was objectively studied by two PSG: one adaptation PSG and one basal PSG separated within 7 days, and by subjective sleep measures: Pittsburgh questionnaire to evaluate sleep quality, Epworth Scale to evaluate sleepiness and Berlin Questionnaire to identify patients at risk for the sleep apnea.
The circadian rhythm of wake/sleep pattern was investigated with sleep diaries and actigraphy in the period between both PSG.
Results: There is a discrepancy between subjective sleep measures and PSG and actigraphy results. Subjective evaluations did not show any sleep disturbances and did not detect sleep apneas in adults with DS either as shown by the mean values of the different scales (Pittsburg 4.59± 3.95; Epworth 7.5± 5.09; Berlín 1.12±0.34). Objective measures on the PSG showed, decreases in total sleep time (304.57±87.05), in sleep efficiency (62.82±17.92) and REM sleep (9.99±5.88). The PSG also evidenced respiratory disturbances (apnea/hypopnea index: 30.05±30.69). Actigraphy data also showed lower sleep efficiency compared to the one reported in the sleep diaries (74.33± 14.11 vs 87.83± 10.64).
Conclusion: Adult subjects with DS present an important sleep disruption which is not detected by current subjective sleep measures, probably due to their intellectual disability, chronic presence or both. There is a need to develop new scales adapted to DS individuals. Further studies are necessary to investigate the consequences of these sleep disturbances on cognitive performance and Alzheimer Disease pathophysiology in this population. Treatment of the sleep related disorders might improve cognition and quality of life in this population.

42 - **Prevalence of daytime sleepiness and its related factors in patients attending in primary care center in Qazvin, Iran**
Presented by: Zohreh Yazdi

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Objective: Excessive daytime sleepiness (EDS) is a common problem plaguing society's health and insufficient sleep is the most common cause of it.
Methods: A cross-sectional study was done on 325 patients with various complaints who were attending in a primary care center from Qazvin. Information including age, sex, weight, height, education level, income, smoking history, marital status and working hour's status were collected for all patients. Also, patients' history about drug use and chronic disease were collected. Daytime sleepiness was assessed by Epworth Sleepiness Scale. Data was analyzed with the SPSS software

through multiple logistic regressions.
Results: 182 (56%) of subjects were females and 143 (44%) were male. The mean age and BMI was 38.2±14.1 and 25.3±4.7. Results from ESS showed that the 39.1% of people had daytime sleepiness. There was a significant association between daytime sleepiness and age, BMI, educational and working hour's status (P< 0.05). After adjusting for confounding factors, patients with daytime sleepiness had more complaints about poorer physical health (OR: 3.1; 95% CI 1.9-3.9) and weaker daily functioning (OR: 2.3; 95% CI 1.6-2.7). The rate of traffic accidents was statistically significant higher in patients with daytime sleepiness (P< 0.05).
Conclusion: This study showed that daytime sleepiness was a frequent symptom in a primary care center and was significantly associated with some factors in patients. It is necessary for physicians to have more attention to this problem.

66 - **Combined effects of alcohol and sleep deprivation on driving simulator performance using the alcohol clamp method**
Presented by: Joshua Gooley

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Objectives: Many alcohol-related vehicular accidents occur at night when individuals are partially sleep deprived, but few studies have examined the effects of combining alcohol and sleep loss on driving performance. We implemented the alcohol clamp method to examine the effects of a small dose of alcohol on simulated driving performance 2 hours after usual bedtime.
Methods and materials: In a within-subjects study, healthy ethnic-Chinese males (*n* = 12, aged 22-29 years) were kept awake for 24 consecutive hours in a laboratory setting on 2 occasions. Subjects were administered alcohol or placebo during each visit, with the order randomized and counterbalanced. Starting at midnight, an alcohol solution (6% in saline) was delivered intravenously for 2 hours using a Computer-assisted Alcohol Infusion System. Blood alcohol was clamped at 0.04 g/dL (half the legal limit for operating a vehicle in the USA), which was verified by taking frequent breathalyzer measurements. Participants completed 35-minute driving tasks 10 hours and 18 hours after their usual wake time using a PC-based simulator (DriveSim5; York Computer Technologies), as well as shorter 13-minute drives every 2-4 hours. Performance was assessed using the standard deviation of lane position (SDLP).
Results: The SDLP increased during sleep deprivation, and variability in lane position was nearly 3 times greater in the alcohol condition relative to placebo. Two hours after usual bedtime, the effects of alcohol on SDLP were equivalent to performance in the placebo condition after 22 h of sustained wakefulness.
Conclusions: A moderate amount of alcohol can substantially impair driving performance during the early part of the night. In future studies, it will be important to evaluate the interaction of blood alcohol and time spent awake on driving performance. Such information could be used to inform policies on safe driving practices.

188 - **Beneficial effect of morning light after one night of sleep deprivation**
Presented by: Antoine U. Viola

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Exposure to artificial light improves subjective well-being, mood, cognitive performance and supresses melatonin secretion; relative to light administration and exposure time. This photic influence might be especially useful to counterbalance the impact of prolonged wakefulness on sleepiness and performance. Here, we seek to evaluate the effect of early morning light on performance, mood, alertness, and melatonin, after one night of total sleep deprivation.
24 healthy young underwent a balanced cross-over design. The participants followed their habitual life rhythms prior to their admittance to the research laboratory to undergo one night sleep deprivation. During the sleep deprivation, cognitive performance was assessed every two hours.
The bright light exposure lasted for 30 minutes starting at 5 am. The three following lightening conditions were applied Luminette® (Lucimed, Belgium), Philips Energy-Light and control condition

with dim light exposure.
We observed a significant ($p < 0.05$) light-enhanced performance by the number of right answers on the PVSAT and the reaction time to the PVT, and decreased sleepiness characterized by the KSS. These results are of relevant not only for ergonomica and societal reasons, but medical investigations as well. The demonstration that light administration through light-emitting glasses is as efficient as conventional bright light therapy boxes may have direct societal and medical applications, most notably for shift workers.

216 - **Blue-enriched white light and bright light: effects on physiological arousal, mood and cognitive performance in nap-deprived healthy students**
Presented by: Taotao Ru

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The present study aims to investigate the influences of a nap in the mid-day deprived on physiological and cognitive performance and further examine if exposure to blue-enriched white light can be better to counteract the deleterious effects of sleep-deprived on physiological arousal, mood and cognitive performance compare to bright light and caffeine among healthy students.
Twenty-eight volunteers fulfilling all the criteria were enrolled in the formal study. All the applicants have habitual nap in the mid-day but sleep durations were not exceeded 1-h and not less than 0.5-h. All participants gave written informed consent and they were informed that any foods and drinks containing caffeine or alcohol were forbidden for two days before the start of the laboratory part.
The experiment was within subject designed and divided into nap-deprived session and formal experimental session. The nap-deprived for 40mins and the formal experiment was started consisted for 1h. During the formal experimental session, each of participants firstly completed questionnaires to evaluate their current sleepiness (the Karolinska Sleepiness Scale) and mood (used the Positive and Negative Affect Scale), then they were instructed to perform the cognitive tasks (PVT task, visual n-back task, oddball task and Go/No-go task) on computer. The experimental procedure was showed in Fig1.Every participant received one of four conditions (blue enriched white light, bright light, caffeine and room light) for one day and the order was randomized.
The newly development light-emitting diodes (LED)tubes (Philips masterT8)used in light treatment after sleep-restriction .The illumination was the same between the caffeine condition (4500k,80lux) and room light (4500k,80lux),but only bright light with highly luminance (500lux,4500k) and Blue-enriched white light with highly correlated color temperature (6500k,80lux). The whole experiment was conducted in the Research Center of Light and Physic-psychology Health at South China Normal University.
We anticipant that nap-deprived in mid-day induce negative effects on alertness, mood and cognitive performance, additionally, the deleterious effects of short-term sleep-deprived can be more efficiently counteracted by exposure to blue-enriched either white light or bright light. We final conclude that blue-enrich light would improve physiological arousal, cognitive performance and reduce negative emotion in treatment on nap-deprived healthy students.

435 - **Sleep loss negatively affects employability and perceived leadership skills**
Presented by: Tina Sundelin

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Objective: Previous research shows that sleep-deprived people are perceived as less attractive and more tired than their well-rested selves. Attractive people are more often ascribed qualities such as social competence, potency, and intellectual competence. These qualities are especially desirable for leaders, but also for employees. The objective of this study was to find out whether sleep loss and perceived tiredness might affect employability and perceived leadership skills, as well as perceived intelligence and trustworthiness.
Method: 24 people were photographed on two separate occasions, at least one week apart. In one photograph they had slept no more than 4h/night for two consecutive nights and in the other they had spent at least 8h/night in bed for two consecutive nights. The photographs were rated by 61 observers on leadership ability, employability, trustworthiness, and intelligence. The observers also rated

participants´ attractiveness and tiredness.
Results: When participants were sleep deprived, they were rated as less good leaders ($p < 0.001$), less employable ($p=0.001$), and less trustworthy ($p=0.01$) compared to when they had slept. Sleep-deprived participants were also rated as less attractive ($p=0.006$) and more tired ($p=0.011$). There was no difference in ratings of intelligence ($p=0.105$). Looking more tired was strongly related to being perceived as a poorer leader, less employable, less trustworthy, and less intelligent (p's< 0.001).
Conclusions: The study confirmed previous findings of sleep deprivation affecting attractiveness and perceived tiredness, and showed that sleep-deprived people are judged as being worse leaders, as well as being less employable and less trustworthy.

666 - **Performance and alertness after combined exposure to chronic and acute sleep loss and circadian misalignment**
Presented by: Eva-Maria Elmenhorst

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Objectives: Many individuals are exposed to combinations of acute and chronic sleep loss as well as repeated circadian misalignment in real life. A key question is whether the effects of chronic sleep loss accumulated during the work week can be completely eliminated by long sleep bouts during the weekend. Insight in the recovery process of performance and mood from sleep loss is needed to increase safety in shiftwork and other work environments.
Methods and materials: Ten healthy volunteers (3 females, mean (SD) age of 28.3 (4.2) years) were studied during a 65-day inpatient stay that included
(i) three baseline 24.0-hr days (16-hr wake),
(ii) a constant routine protocol (CR1, 41.33-hr wake),
(iii) a forced desynchrony (FD) protocol consisting of 12 consecutive 28-hr sleep-wake cycles (18.67-hr wake),
(iv) a CR protocol (CR2, 33-52-hr wake) that ended such that the individual´s circadian phase of awakening of the next segment would be the same as during baseline,
(v) a 5-day recovery segment with 24-hr days (16-hr wake), and
(vi) a CR protocol (CR3; 40.1-40.5-hr wake).
Performance was tested every two hours whenever the individual was awake with a 10-min Psychomotor Vigilance Task (PVT), a 2-min Addition test (ADD, number correct) and Visual Analog Scales (VAS) that included Alert-Sleepy scale. The ADD test results were expected to increase across the protocol since there is a learning component. Linear or Generalized linear mixed models were used to compare:
(i) Baseline Wake Periods (WP) 2 and 3 vs. last 2 Recovery WP;
(ii) CR1 vs CR3;
(iii) 1^{st} 6 WP vs 2^{nd} 6 WP of FD; and
(iv) 1^{st} 2 vs. last 2 Recovery WP.
Additional details of the protocol and original study results are in Gronfier et al 2007 (PNAS).
Results: PVT median RT and lapses worsened from BL to the end of Recovery, from CR1 to CR3, from 1^{st} to 2^{nd} 6 WP of FD. ADD correct results increased from BL to the end of Recovery, from CR1 to CR3, from 1^{st} to 2^{nd} 6 WP of FD, and from the 1^{st} to last 2^{nd} WP of Recovery. VAS alertness improved from CR1 to CR3.
Conclusions: The worsening of PVT median and lapses suggests an effect of combined exposure to acute sleep deprivation and circadian misalignment. To what extent this is due to incomplete recovery and/or other elements of the protocol requires further investigation. The stable or improved subjective alertness during these same times is consistent with the known discrepancy between subjective and objective metrics under these conditions.

8 - **Assessing the impact of physical activity on sleep outside clinical setting using data from a large population of connected devices users**
Presented by: Angela Chieh

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Objectives: The positive effects of physical exercise on sleep are becoming more widely acknowledged. At the same time, the emergence of connected devices enables people to monitor their physical activity and sleep. Our aim was to assess the impact of physical activity on sleep, using data from connected activity trackers.
Materials and methods: The study is based on an anonymized cohort of 9,000 adult users of the Withings Pulse
(WP), over 8 months. The WP tracks the number of daily steps as well as the durations of agitated and calm sleep phases. The study compared sleep characteristics following a day in which physical exercise was observed to that following a day without significant exercise. Collected data was classified according to the time of exercise: during the daytime (between 6am and 6pm), or during the evening (between 6pm and 2am).
Results: People who were physically active, compared to those who did not exercise, slept 15 minutes more (p < 10-6) and were in a calm sleep cycle for 19 minutes longer (p < 10-18). Moreover, they went to bed on average 36 minutes earlier (p < 10-30). Increase in sleep duration is significant in both women (17 minutes, p = 0.006) and men (13 minutes, p < 10-4). Those who exercised during the evening reported an earlier bedtime than those who exercised during the daytime (p < 10-30); however, no statistically significant difference was observed in sleep duration.Results also indicate that people who exercised wake up13% less during the night (p < 10-4).
Conclusion: The study shows a positive correlation between physical activity levels and sleep quality, assessed by the use of connected devices. The large amount of data coming from outside the standard doctor's office or hospital could lead to new insights to promote a more personalized and preventive health.

135 - **The alleviating role of ambient illumination to the negative effects of evening use of eReaders on sleep and next-morning alertness**
Presented by: Qingwei Chen

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Previous studies have demonstrated that evening use of electronic devices have negative effects on sleep and next-morning alertness. This study aims to investigate whether ambient illumination can alleviate the negative effects mentioned above.
4 levels of ambient illumination are employed: 10 lx, 40 lx, 70 lx, 100 lx. The reading device used is an LE-eBook (iPad 2). 12 participants completed 4 reading conditions but were randomized to the order. The participants were required to use the e-reader for 3 hours before bedtime for 4 consecutive evenings in each condition. The first day was used for the participants to familiar themselves with the lab environment and there was one day between each reading condition which participants were not requested for reading. All participants lived in a private room from 18 pm to 10 am during the 20-d protocol. The e-reader device was set to medium brightness throughout the 3-h reading section. Polysomnographic (PSG) was recorded during the final two sleep episodes and for several hours before and after the sleep episode of each condition. Sleep measures included sleep onset latency, total sleep time, sleep efficiency, and the time spend in each sleep stage. Participants rated their sleepiness using a computerized Karolinska Sleepiness Scale (KSS), which was completed several times: within 1-5 min after wake and then every 4-10 min for 1 h after wake time. Participants also completed the Karonlinska Drowsiness Test (KDT). Waking electroencephalogram (EEG) measures were recorded during KDT on two evenings and two mornings of each reading condition.
The predicted results are listed below. Participants spend the least time to fall in sleep , and have the longest rapid eye movement sleep, and rate themselves as most sleepy and their EEG show most power within the delta/theta frequency range under the 40 lx ambient illumination. In addition, not only did they awaken feeling more wake, it takes them less time to fully “wake up” and attain the same level of alertness than under the other three ambient illumination condition.
The alleviating effect of ambient illumination to the negative effects of evening use of eReaders on sleep and next-morning alertness will maximize when the level of screen brightness and the level of ambient illumination are close.

493 - **The effect of different sitting posture during short sleep on recovery from fatigue**
Presented by: Kohei Shioda

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Objectives: There is growing need for an effective nap on a chair because working adults, who decrease cognitive and physical performance with the time of day, could not sleep on a bed at lunch break in realistic situations. However, it remains unclear whether the sitting posture affects effectiveness of a nap against fatigue at the level of alertness and physical activity. The purpose of this study, therefore, is to investigate the effect of different sitting posture during a short nap on recovery from fatigue, using the test of critical flicker fusion frequency (CFFF) and interpolated twitch technique (ITT).
Methods: Healthy young adults with regular sleep habits voluntarily participated in three experimental conditions in random order: face down nap, lean back nap and no-nap conditions. These postures were defined by the hip joint angle. The test of CFFF, the value of which decreases with fatigue, is useful for assessing the arousal level (Curran et.al., 1990). Additionally, ITT is commonly used to assess voluntary activation (VA) of skeletal muscles (Merton, 1954). The reduction of VA is the sign of central fatigue (Gandevia, 2001). The volunteers performed CFFF test and isometric maximum voluntary contraction of elbow flexor muscles for assessing VA using ITT. This evaluation procedure was repeated after a 30-minute experimental rest (face down nap, lean back nap, or no-nap). The quality of sleep was evaluated by polysomnogram and subjective sleep index.
Results and conclusion: The value of CFFF before a nap was lower than that after a nap. Additionally, there were certain differences in the time of falling asleep and VA between conditions. The present study suggested the possibility that the difference of sitting posture during a nap was related to recovery from fatigue. In conclusion, concerning the recovery from fatigue, it is important to take a suitable posture when napping.
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19 - **Lipoprotein-associated phospholipase A2 levels as a predictor of cardiovascular risks in patients with COPD and obstructive sleep apnea**
Presented by: Maha Yousif

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Objective: To study the relation between Lp-PLA2 level as a marker of cardiovascular risks and arousal index in patients with OSA, COPD and overlap syndrome (COPD+OSA).
Patients and methods: Sixty participants were recruited, divided into 4 groups (15 in each group) based on their polysomnographic and spirometric data; group I (normal), group II (OSA), group III (COPD) and group IV (overlap syndrome). Fasting serum samples were used to estimate lipid profile and Lp-PLA2 concentrations.
Results: The apnea-hypopnea, arousal, desaturation indices, lipid profile and Lp-PLA2 levels were significantly increased in all patients groups compared to control. The arousal index and Lp-PLA2 level were significantly increased in overlap syndrome more than OSA and COPD patients. Lp-PLA2 level was independent predictor of arousal index in all patients groups.
Conclusions: Patients with overlap syndrome have a higher arousal index and Lp-PLA2 level hence more cardiovascular risks than either OSA or COPD alone. The Lp-PLA2 level may be used as an independent predictor of cardiovascular risks in patients with OSA, COPD and overlap syndrome.

429 - **Effects of CPAP on metabolic alterations in adipose tissue associated with OSA**
Presented by: Georgia Trakada

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Objectives: Obesity is closely associated with OSA and is characterized by an overgrowth of adipose tissue that leads to the formation of hypoxic areas within the tissue. Hypoxic status within the adipose tissue could contribute to the development of insulin resistance in adipocytes. CPAP is the treatment of choice in moderate to severe O.S.A. We hypothesized that correction of profound hypoxia of OSA by CPAP may ameliorate the dysfunction of adipose tissue independently of weight loss.
Methods and materials: Eight recently diagnosed subjects with OSA by full polysomnography were studied before and after 6 months with CPAP therapy. Diabetes and prediabetes ,cardiovascular disease and current smoking were excluded. All subjects underwent anthropometric measurements an OGTT the day after PSG and 6 months after CPAP treatment. Fat biopsies were obtained at the same time periods and adipose tissue samples of 300mg were obtained from abdominal fat. Fat cell size, extent of fibrosis, vascularity, inflammatory infiltration and tissue macrophages accumulation were microscopically evaluated on Eosin-hematoxylin and Masson Trichrome histochemical and CD34, LCA and PGM-1 immunohistochemical stains respectively.
Results: Mean Age of the group was 48±3 years,mean BMI 37±3 kg/m^2. At the end of the 6 months BMI was not changed, waist circumference was decreased by 1.09±0.08cm, fat mass was statistically decreased from 45,17 to 31,16 kg ($p< 0.002$) Fat free mass increase did not reach statistical significance. A marked decrease in LCA was observed followed by an increase in CD34. A positive correlation was observed between LCA and decrease in fat mass.
Conclusions: In conclusion restoration of hypoxia by CPAP treatment for 6 months led to an improvement of adipose tissue function.

606 - **Incidence and prevalence of temporomandibular disorders in patients with mandibular advancement device treatment for obstructive sleep apnea**
Presented by: Pedro Mayoral Sanz

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Purpose: This study aims to evaluate the incidence and prevalence of temporomandibular disorders (TMD) in patients receiving a mandibular advancement device (MAD) to treat obstructive sleep apnea using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD).
Materials and methods: Data from 225 patients were evaluated at baseline, from 187 patients after 120 days (visit II), from 169 patients after 210 days (visit III), and from 145 patients after 410 days (visit IV). The presence of TMD symptoms was evaluated through a questionnaire. TMD signs were assessed using the RDC/TMD.
Results: The prevalence of TMD was 23/225 (10,2 %) at baseline. After an initial decrease to 5.3 % on visit II, the prevalence increased to 7,9 % on visit III and finally demonstrated a decrease to 4.2 % on visit IV. The incidence of TMD was 5.3 % on visit II. This decreased on further visits and only two (1.9 %) patients developed TMD from visit III to visit IV.
Conclusion: The use of MADs may lead to the development of TMD in a small number of patients. Nevertheless, these signs are most likely transient. Patients with pre-existing signs and symptoms of TMD do not experience significant exacerbation of those signs and symptoms with MAD use. Furthermore, these may actually decrease over time.

54 - **Obstructive sleep apnea diagnosis and treatment in relation to cancer survival: a retrospective cohort study**
Presented by: F. Javier Nieto

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Objectives: Laboratory studies and experimental rodent models have demonstrated that intermittent hypoxia (one of the distinct pathophysiologic features of obstructive sleep apnea, OSA) promotes cancer growth and metastasis, possibly through its pro-angiogenic effects. Results of recent epidemiologic studies in population and clinical samples show an association between OSA with increased cancer incidence and mortality, but follow-up studies among cancer patients are lacking. The goals of this study are to determine if OSA diagnosis is associated with decreased survival among

cancer patients and whether this effect is mitigated by OSA treatment.
Methods and materials: Retrospective cohort study of 663 adult patients diagnosed with cancer referred to the University of Wisconsin Sleep Center and who received either an in-laboratory full polysomnography 82%) or a type III home sleep study (18%). Data extracted from the electronic health records included the apnea-hypopnea index (AHI, average number of apneas/hypopneas per hour of sleep), tobacco consumption, body mass index (BMI), treatment compliance (positive airway pressure, PAP), and mortality. Kaplan-Meier curves were used to compare the survival in the different groups; Cox proportional hazards regression models were used to estimate hazard ratios of mortality adjusted for age, sex, smoking, and BMI.
Results: A total of 64 deaths were observed over an average follow-up of 7.1 years (standard deviation 3.4 years). Compared to cancer patients without OSA, those with AHI≥5 who did not receive or did not comply with recommended PAP treatment had an adjusted hazard ratio of mortality of 3.3 (95% confidence interval, 1.4-7.4). In contrast, there was no statistically significant difference in mortality between cancer patients with AHI≥5 who received PAP treatment and those free of OSA.
Conclusions: The results of this study support the hypothesis that OSA is associated with a decreased survival in cancer patients and that PAP treatment ameliorates this association. These finding are consistent with epidemiologic and experimental studies suggesting that intermittent hypoxia might be promote cancer progression.

301 - **CPAP therapy induces favorable short-term changes in epicardialfat thickness, vascular and metabolic markers in apparently healthy subjects with obstructive sleep apnea hypopneasyndrome (OSAHS)**
Presented by: Konstantinos Kostopoulos

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Background: Obstructive Sleep Apnea Hypopnea Syndrome (OSAHS) is an independent risk factor for hypertension, coronary artery disease and diabetes mellitus. Epicardialfat has recently recognized as a new risk factor and active participant on cardiometabolicrisk. The aim of this study was to assess an independent relationship between sleep apnea severity, metabolic and vascular markers and epicardialfat, at baseline and after 3 months of continuous positive airway pressure (CPAP) therapy.
Materials and methods: Our study group consisted of 48 patients with suspected OSAHS and no prior history of cardiovascular disease or diabetes mellitus. All patients underwent full overnight polysomnography. Thickness of epicardialand visceral adipose tissue, brachial artery flow-mediated dilation (FMD), carotid intima-media thickness (cIMT), pulse wave velocity (PWV), plasma C-reactive protein (CRP) levels fasting glucose levels, HbA1c, homeostatic model assessment of insulin resistance index (HOMA) and lipid profile were measured at baseline and after 3 months of CPAP use in patients with moderate to severe OSAHS.
Results: In OSAHS patients(AHI>15/hour, N=28), epicardialfat correlated with fasting glucose(rho=0.406, p=0.04) and HOMA(rho=0.525, p=0.049) but was not associated with visceral fat(rho=0.126, p=0.595). EAT(p=0.022) increased across AHI severity along with PWV(p=0.045) and carotid IMT(p=0.034) while FMD(p=0.017) decreased. Therapy with CPAP reduced both epicardial(p< 0.001) and visceral fat(p=0.001). Alterations in epicardialfat across the follow-up were associated with changes in PWV(p=0.026) and HOMA(p=0.037) independently of major confounders.
Conclusions: Epicardialfat thickness was associated with OSA severity and may be an additional marker of cardiovascular risk as well as of future diabetes in these patients. CPAP therapy reduced epicardialfat, suggesting its potentially beneficial role in reducing cardiometabolicrisk in OSA patients.

674 - **Treatment of obstructive sleep apnea syndrome (OSAS) with mandibular advancement devices (MAD)**
Presented by: F. Javier Puertas

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Objective: The purpose of this study was to evaluate the effectiveness of mandibular advancement devices in consecutive patients diagnosed of Obstructive Sleep Apnoea Syndrome (OSAS), according to respiratory parameters, and the Epworth sleepiness scale (ESS).
Patients and methods: 41 patients (18 women) with a mean age of 54.2, diagnosed of OSAS by full night polysomnography (PSG) from September 2010 to January 2015 whit a preference for MAD therapy, after evaluation for surgery or that refused CPAP as initial therapy, were included in the study. Twenty patients were diagnosed as mild OSAS, 11 as moderate and 10 as severe OSAS patients. MAD was applied and adjusted individually, including upper airway surface measurements by CT-Scan; then clinical follow-up was conducted. A second PSG with MAD was performed at the end of the follow up period.
In order to determine the effectiveness of the MAD, different treatment success criteria were defined for each of the parameters studied. According to the apnea-hypopnea index (AHI), treatment success was defined as ≥ 50% reduction in the baseline AIH . Other parameters as the average and minimum oxygen saturation index, the sleep efficiency percentage, arousal index and the Epworth Sleepiness Scale (ESS) score were also compared before and after MAD treatment.
Results: The IAH baseline was reduced from 22.25 to 9.1, once the MAD was positioned. The success rate of MAD treatment according to the reduction of 50% of IAH parameter was 65.8% (27/41 patients). The improvement in IAH was statistically significant (p-value = 0.0001). Both, the oxygen saturation index and the sleep efficiency improved in the 63.4% and 68.3% respectively. The mean ESS score at baseline was reduced from 12.2 to 8.5 with the MAD therapy. The 78.1% (32/41) of patients had an ESS score < 10 after treatment.
Conclusions: These results show that MAD therapy improves clinical and PSG parameters in patients with OSAS not eligible for surgery that refuse CPAP treatment.

607 - **The influence of the amount of degree of vertical opening in the application of mandibular advancement device for obstructive sleep apnea patients**
Presented by: Pedro Mayoral

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Objectives: The purposes of this study were to estimate the effect of mandibular advancement device (MAD) and to evaluate the influence of the amount of vertical opening in the application of MAD for obstructive sleep apnea (OSA) patients.
Methods: From the patients who were diagnosed as OSA by polysomnographic study at Instituto del Sueño de Madrid from January 2009 to February 2013, the patients who chose MAD as treatment option were included in this study. All the patients´ data including clinical records and polysomnographic studies (both pre- and post-treatment) were reviewed and analyzed.
Results: Successful results were obtained in 182 patients of 225 patients (81%). In the follow-up period, mild discomfort of anterior teeth or temporomandibular joint (TMJ) were described in 23/225 (10,2 %) especially in the cases the amount of vertical opening were more than 2.0 mm. There was no direct relationship between the amount of vertical opening and clinical outcome.
Conclusion: MAD was effective treatment option for the OSA patients regardless of severity. For the prevention of potential dental complications, the amount of vertical opening should be considered at the time of MAD treatment.

125 - **Effect of tonsillectomy on obstructive sleep apnea**
Presented by: Thorbjörn Holmlund

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Objectives: To evaluate the effect of tonsillectomy on sleep apnea in adults with obstructive sleep apnea (OSA) and tonsilar hypertrophy.
Methods: A multicentre prospective interventional study, including 28 men and women were recruited

among consecutive patients referred to three Ear, Nose and Throat Clinics due to complaints of daytime sleepiness. The inclusion criteria were an apnea-hypopnea index (AHI) of ≥10, tonsil size 3 or 4 determined according to Friedman and age 18-59 years. The primary outcome was effects on the apnea-hypopnea index measured with polygraphy at 6 month after surgery. Secondary outcomes were daytime sleepiness measured with the Epworth Sleepiness Scale (ESS), quality of life measured with Functional Outcomes Of Sleep Questionnaire (FOSQ) and Short Form-36 (SF-36). In 7 patients a videoradiographic swallowing examination was performed and questions regarding dysphagia was answered before and 6 months after surgery.
Results: A significant decrease in mean AHI from preoperative values of 40,4(±30,1) to 7.0(±9,8) was found at 6-month follow-up after surgery. None of the patients showed deteriorated swallowing function after treatment.
Conclusion: Tonsillectomy should be considered as a first line treatment for adult patients with OSA and large tonsills.

669 - **Sleep habits and related factors in patients who underwent cardiac surgery**
Presented by: Buket Akinci

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Objective: The aim of our study is to determine the sleep habits and the compliants which can cause sleep disturbance in patients who underwent elective cardiac surgery.
Methods and materials: We included 42 patients (7 women, 35 male) who admitted to our clinic between and waiting for open heart surgery. In addition to demographic data; we evaluated sleep quality with Pittsburgh Sleep Quality Index(PSQI), quality of life with European Quality of life 5 Dimension (EuroQoL-5D) and pain with Visual Analog Scale (VAS).
Results: The mean age was 61.38±7.98 years and the mean of body mass index (BMI) was 27.6±4.03 kg/m^2. 47.6% of the patients had poor sleep quality (PSQI-total >5). 73.8% of the patients were falling asleep longer than 30 minutes. The mean of PSQI-total scores was 5.35±3, the mean of EuroQoL-5D scores was 0.68±0.29, the mean of VAS scores was 0.95±2.2. The quality of life (QoL) was significantly lower in patients with poor sleep quality ($p < 0.001$). Also, 35% of patients with poor sleep quality had daytime dysfunction. Significant relationships were found between scores of VAS and EuroQoL-5D scores ($r = -0.44$, $p = 0.003$), subjective sleep quality ($r = 0.31$, $p = 0.043$), sleep disturbances
($r = 0.34$, $p = 0.029$).
Conclusion: Patients who are waiting elective cardiac surgery suffer from pain and sleep disturbances. Sleep disturbances and low QoL after cardiac surgery can be caused by increased pain in patients who underwent cardiac surgery.
For prevention of sleep disturbances, pain severity should be evaluated and appropriate strategies should be applied for pain relief in patients who underwent cardiac surgery.

354 - **The effect of morphine on obstructive sleep apnoea - a *randomized double-blind placebo-controlled crossover trial***
Presented by: David Wang

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Objective: Deaths related to prescription opioids have increased substantially, often occurring during sleep when breathing is primarily regulated by automatic neurochemical control. Obstructive sleep apnea (OSA) and opioid interaction is a major issue for anesthesiologists with practice guidelines issued for perioperative opioid use despite there being no relevant controlled clinical trial. This study therefore evaluated the acute effects of a clinical dose of morphine on breathing during sleep in OSA patients.
Method: 60 male OSA patients attended 2 visits with at least 1-week apart. In a randomised crossover design, single dose of slow release oral morphine (40 mg MS Contin) or placebo was administered at 5:30 PM. Awake ventilatory chemoreflex tests were performed 3.5hrs post dose and prior to

polysomnography (PSG) monitoring. Outcomes were compared between the two drugs, and also within subgroups categorised by OSA severity (apnea hypopnea index (AHI) > median 12.5/hr), after testing for a treatment by severity interaction using Mixed Model analyses.
Results: The patients had a mean age of 44.4 yrs and body mass index (BMI) of 29.3 kg/m^2. Table 1 shows effects of morphine vs placebo on key PSG parameters. Morphine did not modify AHI but decreased oxygen saturation (SpO2) nadir by 1.3%, and increased sleep time with SpO2< 95% (T95) by 44.7 mins. Mean transcutaneous $TcCO_2$ was increased by 3.2mmHg (95%CI 0.8 to 5.6) in the severe half of OSA patients only (p=0.01). Change in awake ventilatory response to hypercapnia (slope) positively correlated with change in AHI (r=0.26, p < 0.05) during sleep.
Conclusion: Slow release morphine 40mg induced mild oxygen desaturation during sleep in OSA patients with mild hypercapnia observed only in severe OSA patients. Although AHI was not significantly affected by morphine use, the change in AHI positively correlated with the change in ventilatory chemosensitivity.

	Placebo mean(SD)	Morphine mean(SD)	Mean Difference (95%CI)	t-test	Treatment * OSA severity interaction
AHI (/hr)	19.1 (17.7)	20.7 (19.1)	1.6 (-1.9 to 5.0)	p=0.36	p=0.14
ODI (/hr)	14.3 (16.0)	15.6 (15.6)	1.4 (-1.6 to 4.3)	p=0.36	p=0.19
T90 (min)	4.9 (11.3)	7.8 (21.2)	2.9 (-2.0 to 7.8)	p=0.24	p=0.62
T95 (min)	109.1 (102.6)	153.8 (135.4)	44.7 (17.6 to 71.7)	p=0.002	p=0.28
SpO2 nadir (%)	87.2 (5.7)	86.0 (5.7)	-1.3 (-0.1 to -2.6)	p=0.03	p=0.32
Mean TcCO2 (mmHg)	45.1 (8.9)	46.2 (5.5)	0.6 (-2.0 to 3.2)	p=0.63	p=0.049

[Table 1. Morphine effect on key PSG parameters]

232 - **Sleep and quality of life in ARDS survivors**
Presented by: Christina Alexopoulou

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Objective: Acute respiratory distress syndrome (ARDS) is a common cause of morbidity and mortality in the Intensive Care Unit (ICU). Studies have shown that survivors form ARDS exhibit long-term neurocognitive impairment and perceived reduction in quality of life after ICU discharge. The aim of our study is to evaluate the sleep architecture and quality of life in ARDS survivors within 72 hours and at 6 months after hospital discharge.
Method and material: Patients with known sleep apnea syndrome were excluded from the study. Eligible ARDS survivors were evaluated in an ambulatory sleep clinic within 72 hours (1st visit) and at 6 months (2nd visit) after hospital discharge. At each visit the patients underwent a physical examination and completed the 36-item Short-Form General Health Survey (SF-36) which measures the health related quality of life and an overnight polysomnography (PSG).
Results: Twelve patients were studied. All but two patients completed both 1st and 2nd visit. We found a low Sleep Efficiency (72.8%) at 1st visit with no improvement 6 months later. Sleep architecture was also affected with stage N3 to be 7.75% of Total Sleep Time (TST) at visit 1, this percentage became normal (18.57% of TST) 6 months later. In addition, 75% of patients (9 of 12) had Apnea Hypopnea Index (AHI) >15 at visit 1. Six months later this finding remained in 40% of patients (4 of 10).
Quality of life was found to be worse than that of healthy controls in all aspects of health status, studied population at visit 1. All 8 aspects of health status were improved during the 6 months study period, although they remained lower than normal population.
Conclusion: ARDS survivors experience significant deterioration in their quality of life status with minor improvement 6 months later and a variety of sleep disturbances that seems to start getting better 6 months later.

62 - **A comparison of the clinical and polysomnographic profile of patients with chronic kidney disease (CKD) stage 3/4/5 with patients on maintenance haemodialysis (HD)**
Presented by: Sridhar Venkateswaran

S. Venkateswaran
Jurong Health Services, Singapore, Singapore

Objectives: To test the hypothesis that patients with CKD stage 3/4/5 will have a different clinical and polysomnographic profile to those on maintenance haemodialysis.
Methods: Prospective study involving adults aged≥21 either from the inpatient or outpatient pool, who had CKD stage 3/4/5 or who were on maintenance haemodialysis(HD) for a period>3 months. These patients had no known sleep disorders and all had a body mass index (BMI)< 30kg/m^2 at entry into the study. Baseline anthropometric measures were taken and Epworth sleepiness scale(ESS) was administered to all subjects. Recruited patients then underwent an overnight diagnostic sleep study. Differences between the two groups were compared.
Results: To date 13 subjects have completed the study. Five of these patients(all male) are on maintenance HD with a mean duration of 28 months. There are 10 men and 3 women with an average age of 59.5±8.0, mean BMI of 27.5±3.4kg/m^2. Their mean ESS score is 7.8±6.3. As a group they all had obstructive sleep apnoea(OSA) with with a mean respiratory disturbance index(RDI) of 32.1±21.3 with a REM RDI of 32.3±23.3. Only one patient had periodic limb movements in sleep(PLMS). Off all the polysomnographic variables the only significant difference between the two groups was in the percentage of stage N3 sleep with the CKD patients sleeping on average 22.4‰ compared to 7.9‰ slept by HD patients.
Conclusions: It appears looking at this small cohort that apart from the percentage of slow wave sleep(SWS), there were no polysomnographic differences between CKD patients and patients on HD. With larger numbers, more differences might be apparent. Obstructive Sleep Apnoea however was very prevalent and was present in all the patients. There may be certain mechanistic linkages to explain this. The study is ongoing.

11 - **Sleep status of non-sedated critically ill patients**
Presented by: Se Joong Kim

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Objectives: Many critically ill patients treated in the intensive care unit (ICU) experience sleep disruption. This study was undertaken to identify the sleep status of non-sedated critically ill patients in Korea medical ICU.
Methods and materials: This is a prospective study. Polysomnography recording was performed over 24 hour to assess the quantity and quality of sleep.
Results: Total 20 patients were enrolled. Median total sleep time was 03:43 (hh:mm, IQR: 00:49 - 06:10). The majority of sleep was stage 1 (median 03:02 [00:47 - 04 :34]) with scant stage 2 (median 00:00 [00:00 - 00:46]), REM (median 00:00 [00:00 - 00:15]) and absent stage 3. The number of waking episodes in 1 hour was a median of 14.0 (7.7 - 29.1). The APACHE II score showed a significantly negative correlation with total sleep time (r=-0.49, P=0.028). Patients who stayed more than 5 days in the ICU showed similar total sleep times. However, they showed significant reduction in night sleep time compared to patients who stayed less than 5 days (00:42 ± 0:46 vs 2:04 ± 1:25, P=0.012).
Conclusions: The quantity and quality of sleep in critically ill patients were poor. More severe disease influenced negative effects on sleep. Long duration of ICU stay disrupted circadian rhythm in critically ill patients.

412 - **A case of adult respiratory depression during sleep after oral tramadol intake**
Presented by: Y. B. Kaptan Cikirikcioglu

Y.B. Kaptan Cikirikcioglu[1], K. Cervena[1], S. Perrig[1], F. Espa[1], E. Claudel[1], J.-L. Pepin[2], V. Ibanez[1]
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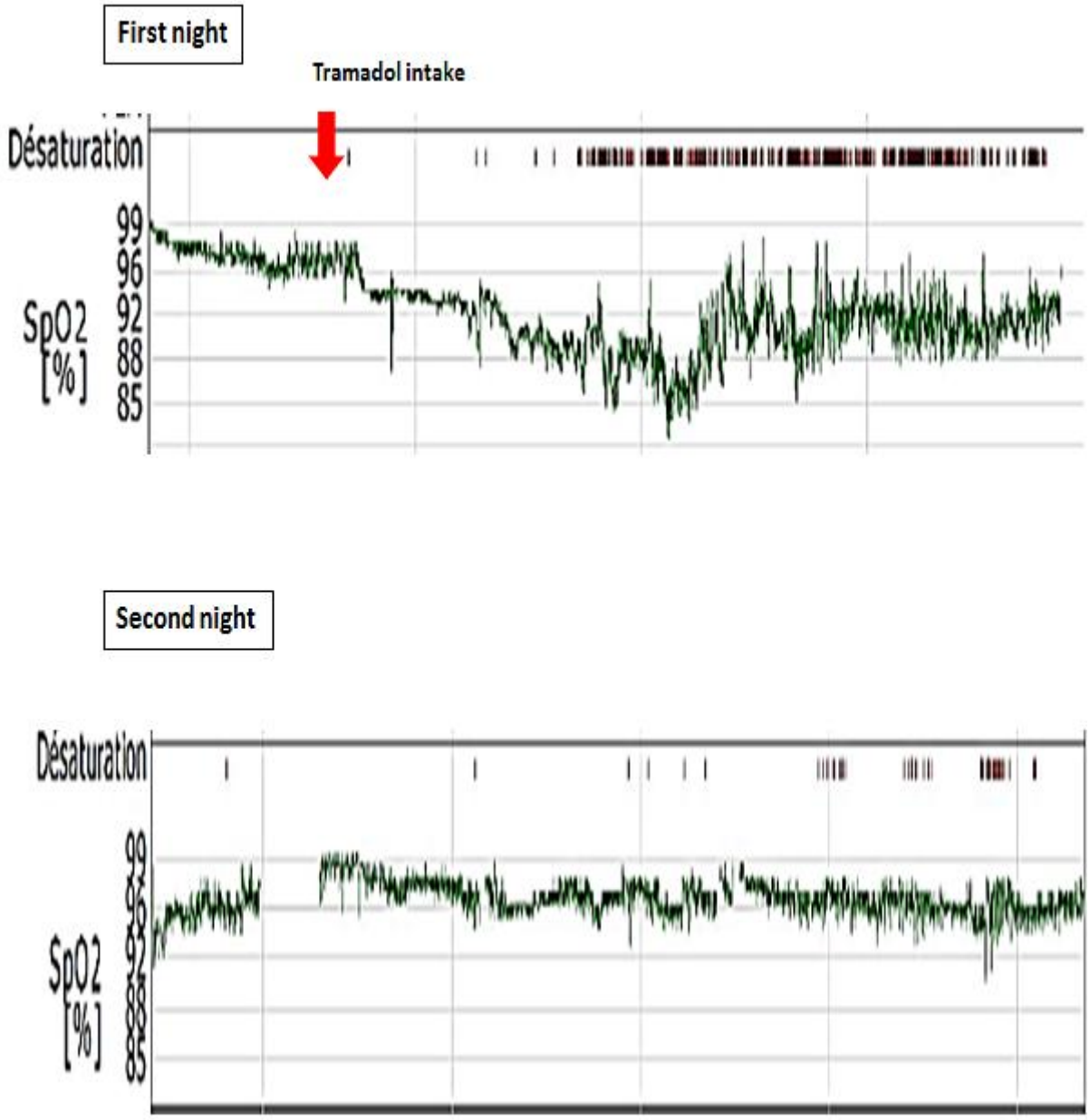
Objectives: To report a case of severe respiratory depression secondary to intake of single dose of tramadol.
Methods and materials: A 27 years old female (68.0 kg, BMI 23.3), in good general health, was referred to our laboratory with complaint of persistent excessive daytime sleepiness. Although a HLA-DQB1*0602 positivity, the patient was free of cataplexy, sleep paralysis and hypnagogic hallucinations. Her first polysomnographic recording (2010) did not show the Sleep Related Breathing Disorder; and no sleep onset rapid eye movement period was recorded during the night or during the Multiple Sleep Latency Test. In 2015 a new polysomnography was scheduled to rule out the suspicion of Narcolepsy type 2. The patient had 48 hours recordings including two polysomnographic nights. During the first night the patient awoke because of a headache and the video recording showed the self-administration of pain killer tramadol (300 mg). The second night the patient was not allowed to take any medication and the sleep technician closely monitored her behavior during the nighttime awakenings.
Results: The first polysomnographic night showed striking differences in respiratory patterns before and after the tramadol intake:
1) A progressive decrease in respiratory frequency (from 14 to 6 per min.);
2) A progressive and deep decrease in oxygen saturation which was not related to apneic or hypopneic events
(nadir SpO2 81%, 5 hours after tramadol intake).
Unfortunately, the transcutaneous PCO2 was not monitored (absence of comorbidities, low BMI and lack of information about opioids intake). During the second night, the respiratory frequency remained stable (above 12 per minute), and the nadir of oxygen saturation was 90%.



[Profile of SpO2 over 2 PSG nights]

Conclusions: Tramadol exerts its analgesic activity through the activation of the μ-opioid receptor, and through a weak inhibition of norepinephrine and serotonin reuptake. The O-demethylation of tramadol to its main effective metabolite, O-desmethyltramadol (M1), is catalyzed by cytochrome P450 (CYP) 2D6. This case of severe nocturnal bradypnea and hypoxemia secondary to self-administration of tramadol suggests, that this widely used centrally-acting analgesic modify
the sensibility of respiratory centers. In some patients, the measurement of plasmatic levels of

tramadol and M1, ideally combined with CYP2D6 genotyping, could be of interest, to identify the individuals at risk.
Study suported by SNF, project number 320030_149695

26 - **Sensor for apnea classification and detection**
Presented by: Guillaume Baffet

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CIDELEC, Sainte Gemmes sur Loire, France

Objectives: We are proposing an evolution of a sensor for apnea detection and classification. This sensor perceives pressure variations through the skin that indicate the presence or absence of respiratory effort during apneas.
Moreover, the sensor detect apnea from respiratory sounds from tracheal sounds in the frequency band 200Hz - 2000Hz.
Materials and methods: The sensor is a significant evolution of a sensor studied in [Meslier, 2002] (PNEAVOX Technology). The former sensor was made with electrets used in CID102 (CIDELEC, France), in the frequency band 0,1Hz - 10Hz and gave a good specificity 93,6% and sensitivity 99,4% to classify apnea as obstructive, mixed or central. This method induced a delay in the signal that reduced the potential for apnea classification especially for children.
To reduced the delay, we used a specific pressure sensor for respiratory effort detection and signal is filtered in the frequency band 0.02Hz-20Hz. We present a mechanical model of two dimensions and three degrees of freedom with thoracic, abdomen and neck to represent dynamic of sensor signal. Pneavox measurements were performed in polysomnograph CID102L8D and CIDLX (Cidelec, France) to evaluate the initial results in patients.
Results: First tests shows good potential for apnea classification and detection. Introduction of the specific pressure sensor removes signal delay and so improves the technology dynamic for short event detection (children diagnosing). Moreover, examples show that the method indicates respiratory efforts when belts are flat during obstructive apneas [Boudewyns, 1997], and so potentially resolves the lack of belt sensitivity. Mechanical modelling explains interactions between respiratory efforts and actions around the neck (muscles, ...).
Conclusion: PneaVox technology is an insteresting solution for sleep diagnostic, for adults and also for children as it perceives respiratory efforts and breathing
sounds with a good dynamic and without sensors placed on patient´s face.
Acknowledgements: We would like to acknowledge the CHU d´Angers (France), Charité Berlin (Germany), Hopital Necker (Paris France) for their help in testing material and improving sleep diagnostic tools for patients.

238 - **The sensitivity and specificity of the STOP-Bang questionnaire for identifying obstructive sleep apnea in Polish population**
Presented by: Helena Martynowicz

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Objectives: Obstructive sleep apnea (OSA) is the most common sleep-related breathing disorder, however most of the cases is under-recognized and under-diagnosed. Polysomnography (PSG) is the gold standard diagnostic test for OSA. The cost of PSG and too few sleep laboratories in Poland limit access to this tool. Therefore, there is a need for a simple and reliable diagnostic tool to screen patients at risk of OSA. The STOP-BANG is a simple obstructive sleep apnea screening tool. The aim of this study was to establish the use of the STOP-BANG questionnaire for OSA risk stratification in Polish population.
Methods and material: Patients completed the STOP questions and answered four yes/no questions (BANG self-reported) about their body mass index (weight and height), age, neck circumference, and gender, which were also assessed by laboratory technologists. Excessive daytime sleepiness was defined by an Epworth Sleepiness Scale (ESS)>10. Subjects also completed a self-reported questionnaire on symptoms or confounders that might contribute to or aggravate the incidence of obstructive apnea. All patients underwent a full in lab diagnostic overnight polysomnography. The

apnea-hypopnea index (AHI) on the polysomnography was used as gold standard for OSA diagnosis: none (AHI< 5), mild (5≤AHI< 15), moderate (15≤AHI< 30), and severe (AHI≥30).
Results: 44 patients were studied; 31 were male and 13 female with a median age of 50.66 ± 15.44 years, a body mass index (BMI) of 30.66 ±6.01, and Epworth Sleepiness Scale (ESS) score of 9.59 ± 4.58. This study shows that, in a polish population, a STOP-Bang score ≥3 has high sensitivity and low specificity. The sensitivity and specificity for AHI ≥15/h was 95,2% and 4,3% respectively.
Conclusion: Due to the high prevalence of undiagnosed OSA and common complications, a reliable screening tool is needed for a quick prediction of OSA. The Stop-Bang Questionnaire is excellent tool for identyfing due to its simplicity and relative ease of use. This study revealed that the STOP-Bang is a useful method for predicting moderate and severe OSA. It should be used further in screening for OSA in the Polish population.

201 - **Challenges of modified stop bang questionnaire regarding evaluation of obstructive sleep apnea syndrome in participants to driving schools from Cluj District, Romania**
Presented by: Doina Adina Todea

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At present it is now known that undiagnosed and untreated OSAS increases the risk of road accidents by up to 7 times. In this respect it is necessary to pay specific attention to this disease, both in terms of avoiding risk factors, as well as in terms of screening. We conducted an observational descriprive study, using the tool Modified Stop Bang Questionnaire, which was divided into 21 items, pre-formulated answers questions applied to a number of 936 persons enrolled in 3 driving schools from the district of Cluj in order to get or to extend their driving licenses or to get another category, during august 2014- march 2015. The majority of the respondents were aged between 18 and 50 years, and were male. The majority (63.40%) have already drive licence (so will be the professional level). Half of the respondents were normal weight, the others (43.22%) were overweight, and obesity had 10.80% of I and II degree. Majority have no arterial hypertension due to youg groups of age (72.34%). There is a statistically significant correlation between the presence of risk factors for OSA, daytime sleelpiness and the reponders need for knowledge and diagnosis for disease
($p< 0.002$, $p< 0.0001$).
Most respondents - 69.77%, 92.33%, 85.65% and 83.94% - say they do not have knowledge of the existence of obstructive sleep apnea nor of its effect in increasing the risk of falling asleep while driving, do not know any undiagnosed and untreated OSAS effect in increasing the risk of accidents, and no knowledge of the existence of any treatment for OSAS. Only a share of 7.67% of the respondents say that they have been tested for OSAS. The analysis of the opinion on some aspects of OSAS shows that the largest share of respondents - 70.40%, 95.10%, 87.10% and 95.89% - say that they agree with the investigation for the diagnosis of OSAS in case the risk factors are present, considered beneficial the effect of OSAS information campaigns on reducing the risk of traffic accidents in the patients undiagnosed and untreated. The opinion of most of the respondents (94.55%) shows the need to increase the level of medical education in order to reduce the number of traffic accidents in the patients with OSAS. The Modified StopBang questionnaire is usefful both as a screening method of the OSAS risk and as a method of information about OSAS of the population who want to obtain the driving license, therefore it would be appropiate to use it widespread.

596 - **Rethinking AASM guideline for split-night polysomnography in Asian patients with obstructive sleep apnea**
Presented by: Dong-Kyu Kim

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Study objective: Split-night polysomnography (SN-PSG) provides both a diagnosis and titration of continuous positive airway pressure over a single-night in patients with suspected obstructive sleep apnea (OSA). However, in Asian patients, the diagnostic validity of American Academy of Sleep Medicine (AASM) guidelines for SN-PSG remains uncertain. We examined whether the current criteria for the diagnosis of OSA from SN-PSG are available among Asian patients and also evaluated the

ideal apnea-hypopnea index (AHI) threshold for reliable SN-PSG.
Method: We investigated 134 consecutive patients who were diagnosed with OSA (AHI ≥ 5). We divided the raw data from the full-night study into two parts, and compared the data from the first 2 hours of sleep with the full-night sleep data to evaluate the diagnostic precision and accuracy of the first 2 hours of sleep.
Results: No difference in AHI was observed between the first 2 hours of sleep and the full night of sleep. A significant correlation between the AHI of the first 2 hours of sleep and the full night of sleep was observed for severe OSA patients (AHI ≥ 30) only. Moreover, a severe OSA criteria of AHI ≥ 30 was more significantly correlated with the full night of sleep than an AHI ≥ 40 (r = 0.831 and r = 0.778, respectively), which is the current criteria for SN-PSG. However, the diagnostic accuracy was the same for both criteria (87.3%).
Conclusions: This study suggests that the current AASM guidelines for SN-PSG may need to be modified in Asian patients.

470 - **Evaluation of autonomic function in patients with obstructive sleep apnea syndrome**
Presented by: DEMET Ilhan Algın

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Eskisehir Osmangazi University Faculty of Medicine, Eskisehir, Turkey

Objectives: Obstructive sleep apnea syndrome (OSAS) is a condition in which ever-repeating obstruction of upper airway during sleep. In the present study, we aimed to evaluate the autonomic functions in patients with moderate to severe OSAS.
Methods: Totally, 29 patients in Eskişehir Osmangazi University Medical Faculty, Sleep Center of the Department of Neurophysiology diagnosed as moderate to severe OSAS by polysomnography (PSG) and classified according to American Academy of Sleep Medicine (AASM) International Scoring were included in the study. The control group consisted 30 healthy individuals. Electrophysiological autonomic nervous system functions were evaluated by sympathetic skin response (SSR) for sympathetic nervous system and RR interval variability (RRIV) for parasympathetic nervous system during rest and after hyperventilation (HV).
Results: The patient group consisted 32 patients [5 women (15,7%) and 27 men (86,3%)] while the control group consisted 30 healthy volunteers [18 women (60%) and 12 men (40%)]. The mean age was 47.3±9.1 for the patient group and 43.5±12.2 for the control group. In the patient group, 13 patients had moderate OSAS and 19 patients had severe OSAS. No statistically significant difference was found between the mean SDY latency, RRIV and HV-RRIV between groups (p>0.05).
Conclusions: In our study, no stastistically significant autonomic dysfunction could be found in patients with OSAS. When compared with the controls. We aim to increase the sample size which has a homogenous distribution between cases.
Keywords: OSAS, autonomic, RRIV

419 - **Comparing a portable sleep apnea screener with standard polysomnography in sleep clinic patients**
Presented by: Zahra Banafsheh Alemohammad

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Occupational Sleep Research Center, Baharloo Hospital, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran

Objectives: Obstructive sleep apnea (OSA) is a common disease with serious consequences. Many portable devices have been developed to overwhelm some of limitations in the accessibility of the gold standard test, polysomnography (PSG). This study compares a portable sleep apnea screener to PSG in a sleep clinic population.
Methods: Patients admitted to the sleep lab with OSA or other sleep disorders were recruited during a 3-month period. These participants underwent one night simultaneous recording of PSG and a double channel portable sleep apnea screener in the laboratory. A sleep physician (certified by board of registered polysomnographic technologists) scored the PSGs manually according to standard criteria. Portable sleep apnea screener data were analyzed automatically with the manufacturer's proprietary software. We compared the apnea-hypopnea indices (AHI) from the PSG and the portable sleep apnea screener to assess the specificity and sensitivity of the device.
Results: One hundred and twenty patients completed the study. The mean age of the participants

was 42.4. Mean AHI from PSG and portable device were 31.7 and 30.8 respectively. Using a variety of AHI cutoff values (5, 10, 15, and 30) the sensitivities of the portable device were 96.9%, 88.6%, 87.2%, and 79.6% and the specificities were 45.5%, 71.9%, 69.0% and 90.1% respectively.
Conclusion: In sleep clinic patients, portable device demonstrated acceptable sensitivity and specificity in the lab when compared to standard PSG. The screening capability in the home needs to be verified by further evaluation.

333 - **Comparison between new generation pacemakers and polysomnography in sleep apnea diagnosis**
Presented by: Margarida Dias

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[1]Pulmonology Department, Centro Hospitalar Vila Nova de Gaia/Espinho, Vila Nova de Gaia, [2]Cardiology Department, Centro Hospitalar Lisboa Norte, [3]Pulmonology Department, Centro Hospitalar Lisboa Norte, [4]Faculty of Medicine, University of Lisbon, Lisbon, Portugal

Objectives: Sleep apnea syndrome (SAS) is associated with cardiovascular diseases. Some studies have shown a high prevalence of undiagnosed SAS in patients with pacemakers (PMs). New generation PMs have algorithms that identify sleep respiratory events. The aim of this study was to compare the respiratory disturbance index (RDI) evaluated by PMs (RDI-PM) with RDI of polysomnography (RDI-PSG).
Methods: Prospective study enrolling patients with indication for PM (Reply 200). Demographic, anthropometric and clinical data were collected. All patients underwent PSG. Correlation between RDI-PSG and RDI-PM of the same night was evaluated. The level of agreement (kappa) between these two methodologies regarding SAS diagnosis and severity was evaluated.
Results: 16 patients were included (69% men; mean age: 78±5 years; body mass index: 28±4 Kg/m^2). PSG diagnosed obstructive sleep apnea syndrome in 75% of patients (38% severe, 12% moderate, 25% mild). All patients with SAS had arterial hypertension, 75% had snoring, 42% witnessed sleep apnea, 17% restless sleep and 8% excessive daytime sleepiness (Epworth scale > 10).
Mean RDI-PM was 49±24/h and mean RDI-PSG was 57±22/h. There was no significant correlation between RDI-PM and RDI-PSG (r=0.245, p=0.361).
The level of agreement between PM and PSG in SAS diagnosis was fair (k=0.333). In 19% of patients, PMs indicated an RDI compatible with SAS that was not confirmed by PSG. There were no patients with SAS who have not been detected by the PM.
Regarding SAS severity, PM and PSG had also a fair level of agreement (k =0.227). In 45% of cases, there was no agreement between methods with respect to disease severity.
Conclusions: We found a high prevalence of SAS (75%) in patients with PMs. Most were asymptomatic or had few symptoms, supporting a low level of SAS suspicion, which could delay the diagnosis. Despite PMs don't replace PSG in SAS diagnosis, they may be useful in the detection of sleep respiratory events in patients who already have PM.

424 - **Criticizing STOP-BANG questionnaire elements as a legal tool for screening obstructive sleep apnea in Iranian commercial drivers**
Presented by: Khosro Sadeghniiat-Haghighi

K. Sadeghniiat-Haghighi[1], S. Nasootifar[1], O. Aminian[2], M. Saraii[3]
[1]Occupational Sleep Research Center, Baharloo Hospital, Tehran University of Medical Sciences, [2]Occupational Medicine Department, Tehran University of Medical Sciences, [3]Occupational Medicine Department, Baharloo Hospital, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran

Objectives: Sleepiness is one of the most important factors in motor vehicle accidents, especially in commercial drivers (CDs). Among different reasons of excess daytime sleepiness, Obstructive Sleep Apnea (OSA), has an important role. The STOP-BANG and the Epworth Sleepiness Scale (ESS) questionnaire are used for CDs medical examinations in Iran. This study is designed based on the judgment that drivers prefer not to report their symptoms honestly.
Methods and materials: In a cross-sectional study we have compared two groups of commercial drivers.
Group A are 52 drivers referring from Occupational Medicine Clinic to our Sleep Clinic because of

detecting high scores in the STOP-BANG questionnaire and approved having OSA in the polysomnography.
Group B are 87 volunteer commercial drivers referred to Sleep Clinic because of sleep related complains and OSA positive by polysomnography. The ESS score and the subjective items (snoring, tiredness, and observed apnea) and objective items (blood pressure, BMI, neck circumference, age and gender) compared between these two groups & their Correlation with AHI are assessed.
Results: Statistical analysis showed that snoring, tiredness and Observed Apnea (STO) scores was different between the two groups ($p < 0.0000$). Mean STO score was 0.8 for Group A and 1.75 for Group B. The STO of Group A showed a negative correlation with Apnea-Hypopnea Index (AHI) (-0.1324). On the contrary the STO Score for Group B was correlated with AHI (0.4432).
Conclusions: Subjective items of STOP-BANG and ESS questionnaires in commercial drivers requesting Health License, are not reliable. Consequently new cut-off criteria are needed or a new combination of factors should be considered for screening the OSA in Commercial Drivers.

65 - **Detection of central and obstructive apnea events using the photoplethysmography signal**
Presented by: Philip de Chazal

M. Jayawardhana[1], *P. de Chazal*[1,2]
[1]School of Electrical and Information Engineering, [2]Charles Perkin Centre of Obesity, Diabetes and Cardiovascular Disease, University of Sydney, Sydney, NSW, Australia

Objectives: To identify periods of central and obstructive apnea using the breathing effort estimated from the photoplethysmogram (PPG) sensor.
Methods: The low frequency respiratory induced intensity variations in the PPG signal are caused by alterations in intra-thoracic pressure and also changes in the sympathetic tone control of cutaneous blood vessels. Using a PPG derived breathing effort algorithm, we investigated using the PPG signal to distinguish between central and obstructive events.
PSG data, including DC-coupled PPG signals, were obtained from 16 patients from Charité Hospital, Berlin, Germany. The research protocol was approved by the hospital's Human Research Committee. An expert scored the respiratory events using AASM 2007 standard sleep scoring criteria. The events were combined into 3 classes - *normal*; *obstructive events* (included obstructive and mixed hypopnea and apnea events); and *central events* (central hypopnea and apnea events).
The estimated respiratory effort was calculated from the unfiltered infrared PPG signal using the method in [1]. First, for every heartbeat, the PPG peak-to-trough measurement and the pulse-to-pulse time were measured. Second, a band pass filter was applied to emphasise the breathing frequencies. Finally, principal component analysis was used to identify the main respiratory effort signals of interest. To distinguish between normal breathing, laboured breathing during obstructive apnea, and low-effort breathing during central apnea, the standard-deviation of the estimated respiratory effort in 10 seconds epochs was calculated.
Results: Figure 1 shows histograms of respiratory effort for an example patient for our 3 respiratory classes. While there is some overlap of the effort between the three classes, on average, the effort during obstructive events is higher than the effort during normal breathing which, in turn, is higher than the effort during central apneas. Extending our analysis across all subjects, we found that distinctly identifying obstructive apnea from normal breathing was achieved in 60% of subjects. Central apnea was distinguished from normal and obstructive apnea in 100% of subjects.
Conclusions: The PPG derived respiratory effort can be used to distinguish obstructive events and normal events from central events.

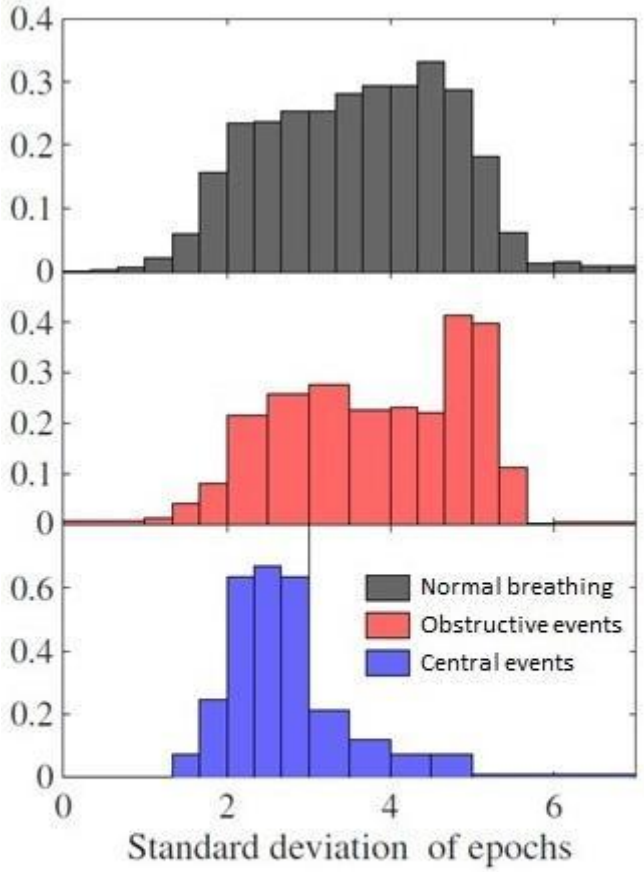

Figure 1: Histograms of the variability of the PPG derived respiratory effort signal for the 3 respiratory event classes.

[Figure 1]

References:

[1] Khandoker AH *et al*. "Investigating relative respiratory effort signals during mixed sleep apnea using photoplethysmogram", Ann Biomed Eng. 2013 41(10):2229-36.

576 - **Validation of a new method to assess respiratory effort non-invasively**
Presented by: Marta Serwatko

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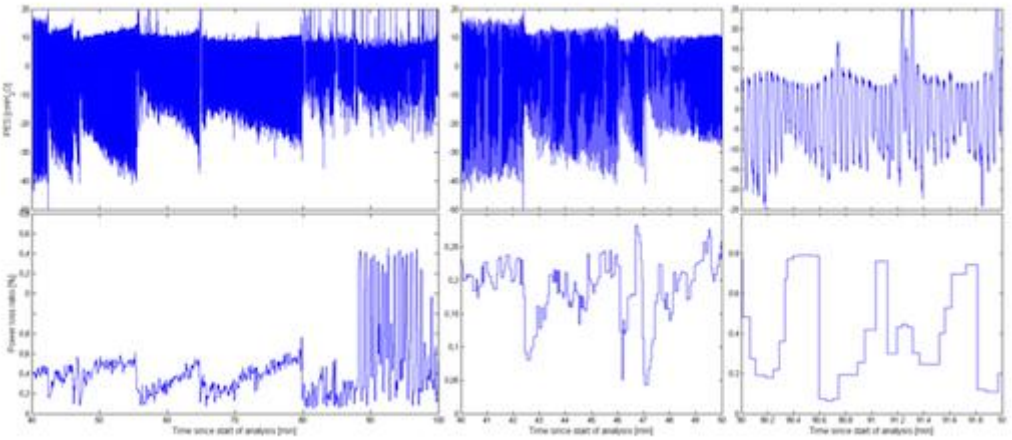
Objectives: A new non-invasive method to assess respiratory effort while sleeping will be evaluated. The respiratory movements of thorax and abdomen are measured with calibrated respiratory inductance plethysmography (cRIP) belts and compared with esophageal pressure (Pes) measurement.
Methods and materials: Thirty subjects were studied, undergoing nocturnal home polysomnography (A1, NoxMedical, Iceland) with simultaneous Pes measurement. Pes events were manually scored and defined as an abrupt change in the peak to peak (PP) value, when a crescendo pattern for >10 sec, from baseline (-10cmH_2O), was present. Events in cRIP were found by calculating the respiratory power loss (PL). The PL is the power lost to paradoxical movements in the thorax and abdomen while

an obstruction occurs. The PL can be quantified by comparing the power in the thorax and abdomen movements, to the power of the total respiratory movement, sum of the thorax and abdomen. The PL events were analyzed when Pes events were scored. Indices describing, separately, the Pes events and the PL events, based on the ratio of a scored event (i.e. pes event, apnea/hypopnea) and non-event (i.e. normal breathing), were assigned to each method, and the indices were subsequently compared.
Results: Preliminary results for the first 4 subjects (3 males and 1 female, mean ± standard deviation; BMI = 27.6 ± 4.6, age = 47.5 ± 13.5, apnea-hypopnea index = 14.8 ± 14.3) are shown. On average, the relative drop in the Pes index = 1.13 ± 0.25 and in the PL index = 1.40 ± 0.45 during Pes events. Comparing the drop in Pes index during apneas/hypopneas the mean relative drop was 1.86 ± 0.65 and in the PL index = 2.40 ± 0.69. The PL signal acts similarly to the Pes signal, with build-up and sharp changes at respiratory events. Figure 1 shows a period where the PL and Pes signals initially agree, however, some discrepancy appears towards the end of the measurement, when rapid eye movement (REM) sleep starts around minute 90.
Conclusions: Peak to peak values for Pes and PL increase during respiratory events compared to normal breathing. Respiratory effort calculated from cRIP is a new, promising method but needs further validation, e.g. during REM periods with its concurrent loss in muscle tone.



[Pes vs. cRIP]

Figure 1. Top panel: Esophageal pressure measurement of a sleeping patient. Bottom panel: The power loss per breath during the measurement period from calibrated respiratory inductance plethysmography.

571 - **Interscorer reliability in detecting sleep related respiratory events in chronic hypoventilation treated with non-invasive ventilation**
Presented by: Sigurd Aarrestad

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[1]Department of Pulmonary Medicine, Oslo University Hospital, Oslo, [2]Norwegian National Advisory Unit on Long Term Mechanical Ventilation, Haukeland University Hospital, Bergen, [3]Department of Thoracic Medicine, St. Olavs Hospital, [4]Department of Circulation and Medical Imaging, Norwegian University of Science and Technology, Trondheim, Norway, [5]Division of Pulmonary Diseases, Geneva University Hospitals, Geneva, Switzerland, [6]Institute of Clinical Medicine, University of Oslo, Oslo, Norway

Introduction: Obstructive and central apnoea and hypopnea may be present and may reduce the efficacy of non-invasive ventilation (NIV) in patients with chronic hypoventilation.
Aim: To measure the interscorer reliability of scoring frequency of apnea and hypopnea in patients under NIV treatment for chronic hypoventilation.

Methods: Overnight polygraphy was performed NIV in 42 patients with: neuromuscular diseases (n= 23), central- (n=3) or obesity hypoventilation syndromes (n=12) and restrictive thoracic disorders (n=4). The ventilator modes were; Bi-level ST; (n=35); pressure support volume targeted; (n=6) and volume controlled; (n=1).
Apnoea and hypopnea were scored according to the rules of the American Academy of Sleep Medicine. Hypopnea was scored if the flow reduction was associated with a 3 % desaturation or an autonomic activation scored from the pulse waveform. Hypopnea was scored as central or obstructive (OH). OH was scored in the presence of inspiratory flattening of the flow signal and/or an associated thoracoabdominal paradox during the event. Events were summarized as apnoea- hypopnea index (AHI), hyponea index (HI) and obstructive hypopnea index (OHI). The sleep studies were visually inspected and manually scored by two pulmonary physicians experienced in scoring sleep studies during NIV (scorer A and B) blinded to each other.
Results:

	Scorer A (mean ± SD)	Scorer B (mean ± SD)	Intraclass correlation (95% Confidence Interval)
AHI	8.0 ± 8.6	7.6 ± 9.0	0.98 (0.96 - 0.99)
HI	7.9 ± 8.6	7.2 ± 9.0	0.93 (0.88 - 0.96)
OHI	6.4 ± 8.3	7.1 ± 8.1	0.93 (0.87 - 0.96)

[Respiratory events and intraclass correlation]

Conclusions: In patients under non-invasive ventilation for chronic hypoventilation the interscorer reliability was excellent both for the scoring of apnoea and hypopnea overall and for the scoring of obstructive hypopneas.

199 - **Histamine transmission impacts on the comorbidity spectrum of murine narcolepsy caused by orexin neuron deficiency**
Presented by: Alessandro Silvani

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Objectives: the contribution of histamine signaling to the pathophysiology of narcolepsy is still unclear. We investigated whether the comorbidity spectrum of murine narcolepsy caused by orexin neuron deficiency is altered in the absence of histamine.
Methods and materials: mice lacking histamine (HDC-KO, n = 11), double mutant mice (DM, n = 7) lacking both orexin neurons and histamine, and congenic wild-type control mice (WT, n = 11) were instrumented with electrodes for sleep recordings and a telemetric transducer (TA11PAC10, DSI) to measure aortic blood pressure (BP). Breathing was measured non-invasively by whole-body plethysmography.
Results: sleep attacks fragmenting wakefulness, cataplexy, excess rapid-eye-movement (REM) sleep during the dark (activity) period, and increased sleep BP during and before REM sleep occurred in DM but not in HDC-KO compared with WT. Obesity occurred both in HDC-KO and DM and was more severe in DM. DM had more augmented breaths (sighs) than WT during non-rapid-eye-movement sleep, but did not show the expected increase in sleep apnea index. The variability of breath duration during sleep was lower in either DM or HDC-KO than in WT.
Conclusions: the main sleep and cardiovascular traits of murine narcolepsy with cataplexy do not require histamine signaling. Conversely, histamine deficiency enhances the metabolic comorbidity and protects from the respiratory comorbidity of murine narcolepsy.
Funding: University of Bologna.

261 - **Effects of roost site on sleep architecture in pigeons (Columba livia)**
Presented by: Ryan K. Tisdale

R.K. Tisdale[1]*, J.A. Lesku*[2]*, A.L. Vyssotski*[3]*, N.C. Rattenborg*[1]
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Objectives: Like mammals, sleep in birds consists of two states, rapid eye movement (REM) sleep and slow wave sleep (SWS). However, the extent of the similarities between REM sleep and SWS in birds and mammals has not been fully characterized. Shared aspects of these states are likely to be linked to fundamental aspects of their function. While attempting to optimize housing conditions, we examined whether birds alter their sleep architecture in response to potentially ecologically meaningful changes in environmental conditions, as observed in rodents.
Methods and materials: Eight adult pigeons were housed in pairs under a 12:12 photoperiod. EEG, 3-dimensional acceleration of the head, and video were recorded during 4 consecutive 24-hour periods. After a 12-hour post-handling period, the experimental trial began. On day 1, the birds had access to both high and low perches. On day 2, the high perches were removed and on day 3 the high perches were replaced. The EEG was scored in 4-second epochs as SWS, REM sleep, and wakefulness.
Results: When present, the birds slept on the high perch at night. The time spent awake did not differ significantly between the baseline (% of night = 25.8 ± 2.6) and low-perch nights (28.0 ± 3.3%). When the high perches were replaced, the birds spent less time awake (22.4 ± 2.5%; P=0.036) than during the preceding low-perch night. There were no significant changes in time spent in SWS across experimental conditions. The time spent in REM sleep decreased between the baseline (11.0 ± 0.7%) and low-perch nights (7.4 ± 1.0%; P=0.0065) and increased between the low-perch and the last high-perch night
(13.3 ± 1.2%; P=0.022).
Conclusions: This study demonstrates that birds are able to modulate their sleep architecture in a similar way to mammals in response to ecologically relevant changes in their environment. As observed in rats following a simulated predatory event, pigeons suppress REM sleep in response to a low perch. This response likely reflects an innate increase in perceived vulnerability to predation at night. The similar responses provide further evidence in support of avian and mammalian REM sleep representing similar functional states and also hint at similar regulatory mechanisms. From an animal welfare perspective, these findings suggest that the effect that housing conditions can have on sleep in birds should be taken into consideration when keeping captive birds.

110 - **A pharmacological screen to evaluate the influence of immediate early signaling pathways on local sleep**
Presented by: Andrea Spinnler

A. Spinnler, S.A. Brown
Institute of Pharmacology and Toxicology, University of Zurich, Zurich, Switzerland

Objectives: Immediate early genes (IEGs) are known to be upregulated during wake and almost silent during sleep in most cortical cells. Moreover, they are also expressed in a circadian fashion. Herein, we investigate the hypothesis that IEGs might serve as a cellular marker for sleep. IEG expression is regulated through multiple receptor-mediated signaling pathways. The goal of this work is to evaluate which pathways are the main contributors to IEG signaling during sleep, and whether one or more of these pathways regulates local sleep intensity.
Methods and materials: C57Bl/6J mice were implanted with a cannula protruding into the parietal cortex. EEG electrodes were implanted adjacent to the cannula and at the same locus on the contralateral hemisphere. Subsequently, pharmacological activators or inhibitors of IEG signaling were injected into cortical layer 2/3 via the cannula 90 minutes after light onset. EEG data were recorded in both hemispheres before, during, and after injection for 24 hours, and relative spectral power between hemispheres and relative to baseline was compared in each vigilance state.
Results: Effectiveness of IEG pathway activators and inhibitors was monitored by looking at local expression of c-fos, a prototypical IEG. As a further control, sleep was scored conventionally for each mouse. As expected, no local injection of any inhibitors changed global sleep structure or amount. By contrast, individual activators and inhibitors demonstrated state- and/or frequency band-specific effects upon local EEG power. Interestingly, these effects seemed to center upon either delta or theta and alpha frequencies, mainly in wake.
Conclusions: Local modulation of IEG signaling could modulate spectral density at specific

frequencies in vigilance state-dependent fashion. Therefore, individual IEG pathways might indeed play cellular roles in sleep-wake regulation.

145 - **Cholinergic basal forebrain structures are not essential for the mediation of the arousing action of glutamate**
Presented by: Zoltán Lelkes

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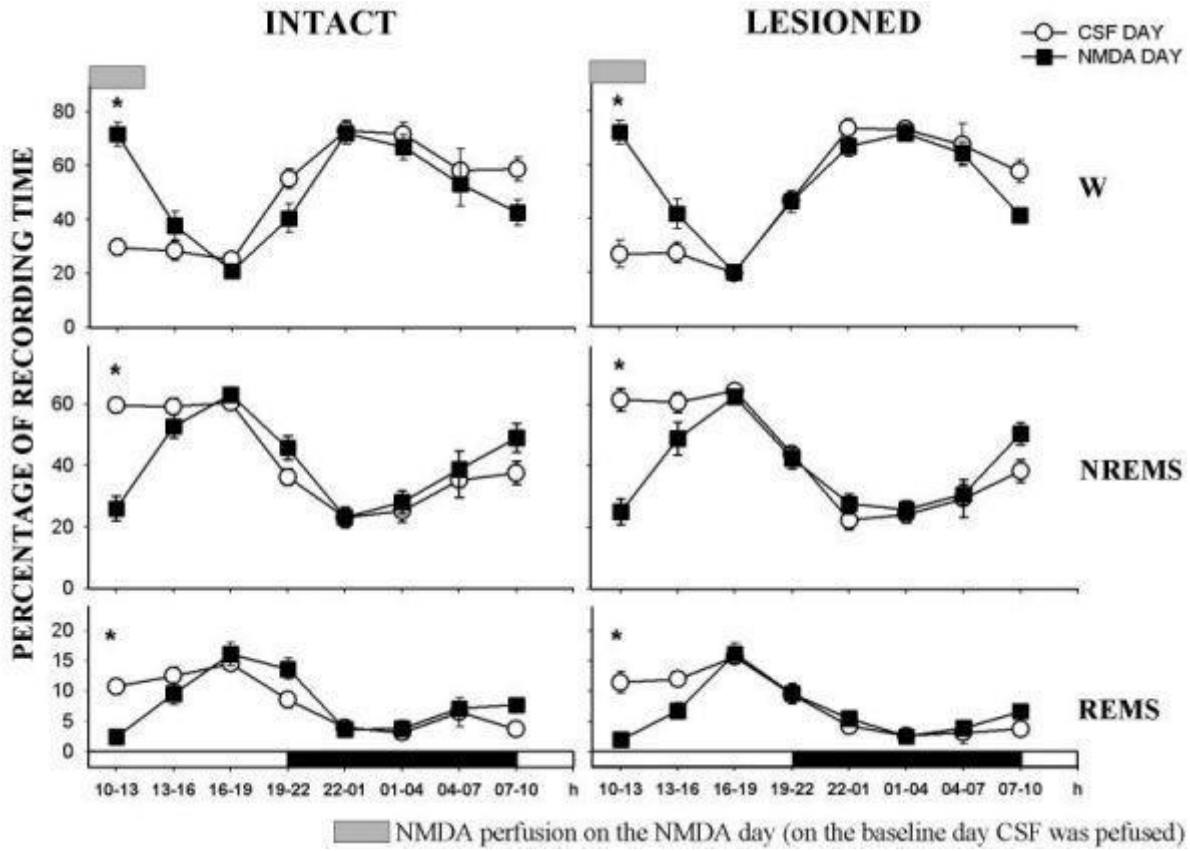

[Graf1]

Objectives: Cholinergic basal forebrain (BF) structures contribute to cortical activation and receive rich innervations from the ascending activating system. They are involved in the mediation of the arousing action of noradrenaline and histamine. Glutamatergic stimulation in the BF results in cortical acetylcholine release and suppression of sleep. However, it is not known to what extent the cholinergic vs. noncholinergic BF projection neurons contribute to the arousing action of glutamate (GLUT). To elucidate the roles of cholinergic BF structures, we administered *N*-methyl-D-aspartate (NMDA), a GLUT agonist into the BF in intact rats and after destruction of BF cholinergic cells by 192 IgG-saporin (SAP).
Methods and materials: In 8 Han-Wistar rats with implanted EEG/EMG electrodes and guide cannulae for microdialysis probes 0.23 µg SAP was administered into the BF, the 8 control animals received artificial cerebrospinal fluid (CSF). Two weeks later a microdialysis probe targeted into the BF was perfused for 3 h with CSF on the baseline day and with 0.3 mM NMDA on the subsequent day. Sleep-wake activity was recorded for 24 h on both days.
Results: NMDA exhibited a robust arousing effect both in the intact and the SAP lesioned rats. Non-REM sleep and REM sleep were decreased significantly during the 3-h NMDA perfusion (Graf 1).
Conclusion: Cholinergic BF structures are not essential for the mediation of the arousing action of GLUT.

399 - **Dopamine and glutamate release during resting wakefulness in the anterior default system**
Presented by: Tohru Kodama

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Physiological Psychology, Tokyo Metropolitan Institute of Medical Science, Tokyo, Japan

Objectives: Human neuroimaging studies have indicated that there are brain areas that are more active during the resting wakefulness period than during the attention-demanding cognitive task (default-mode brain activity). The default-mode brain activity is observed in the medial prefrontal (MPFC) and medial and lateral parietal areas, and is considered to be related to internal though process. We previously showed in the monkey dorsolateral PFC, which plays the most important roles in executive operation, an increase in dopamine (DA) release during a working memory (WM) task as compared during the resting period (REST). However, there has been no study to examine DA release in the default system in relation to WM task performance and rest. We thus examined in the monkey whether there would be an increase or decrease in DA release in MPFC during WM task performance as compared with during REST.
Methods and materials: We examined neurotransmitters release while the monkey was performing the WM task with a liquid reward and sitting quietly without task performance and without reward. DA and also glutamate (Glu) levels in the perfusate were determined by high-performance liquid chromatography and electrochemical detection system. We conducted 3-way ANOVA on neurotransmitter release as the area, neurotransmitter and the state of the animal as main factors.
Results: There was a main effect of significant difference in brain area ($F_{1, 389}$ =11.971, P< 0.01) but not in neurotransmitter and state factors. Post-hoc tests with Ryan's method revealed statistically significant differences (1) in DA release between the WM task and REST states both in MPFC ($F_{1, 389}$=3.874,
p< 0.05) and control area (SMA) ($F_{1, 389}$=18.276, p< 0.001). (2) in DA release during the WM task between MPFC and SMA ($F_{1, 389}$ =38.978, p< 0.001), (3) in % change between DA and Glu releases during the WM task in SMA ($F_{1, 389}$ =19.244, p< 0.001).
Conclusion: In the anterior default system, we observed increases in both the rCBF and dopamine release during resting wakefulness period as compared with the attention -demanding cognitive task period. Considering that increased DA in LPFC plays an important role for executive control, DA release in the anterior default system may play significant roles for mental operations associated with default brain activities.
Financial support: A Grant-in-Aid for Scientific Research (B) 25280052; Ministry of Education, Culture, Sports, Science &Technology of Japan.

260 - **Hypoglycemia and disturbances of sleep-waking cycle in rats**
Presented by: Eter Chijavadze

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Neurobiology of Sleep-Wakefulness Cycle, I. Beritashvili Center of Experimental Biomedicine, Tbilisi, Georgia

Objectives: Relation between sleep disorders and a risk for diabetes has presently been an issue of intensive debate. To unveil neurophysiological mechanisms of interaction between disturbance of sleep-waking cycle (SWC) and blood glucose level it is necessary to ascertain how this change affects SWC. Among other changes in the central nervous system functional state of metabolic genesis it is hypoglycemia that most commonly occurs in diabetes as well as in other diseases. Hypoglycemia is a set of symptoms that as a rule develops within a short time and is characterized by a number of features. One of the pronounced manifestations of hypoglycemia is a paroxysmal fit of drowsiness that differs from a typical pattern of hypoglycemic coma.
Methods and materials: Experiments were carried out on out bred albino rats. Hypoglycemia was produced by intra-peritoneal administration of Humulin, which has a short duration of action and with light deprivation method proposed by us causing more stable hypoglycemia. Blood glucose level was measured in controls and after procedures mentioned above. EEG recordings of SWC were made for 12 h.
Results: In the case of blood glucose level reduction obtained by both methods rats rendered more inert and less aggressive. Analysis of 12-h SWC dynamics in hypoglycemic rats has shown:
1. Latency of paradoxical sleep (PS) onset compared to baseline was reduced at the expense of change in the phase distribution - a considerable rise in deep slow-wave sleep (DSWS) and reduction

of light slow-wave sleep and wakefulness.
2. Total time of various SWC phases did not alter substantially. However SWC 12-h dynamics was altered. The highest content of DSWS was observed from 9-11 am not followed by PS increase and the highest content of PS (13-15 pm) hypoglycemic hypersomnia, occurred due to a rise of PS onset. These "peaks" coincided with the least concentration of blood glucose. At this time EEG showed high-amplitude activity.
3. Frequency of PS onset was increased.
4. Amount of self-deprived PS compared to baseline remained unchanged.
5. DSWS fragmentation was considerably reduced.
Conclusion: The present findings suggest possibility of using the animals with artificial blood glucose deficit as a model for hypoglycemic states while managing some problems of SWC disorders.

24 - **Sleep duration**
Presented by: Alain A. Gonfalone

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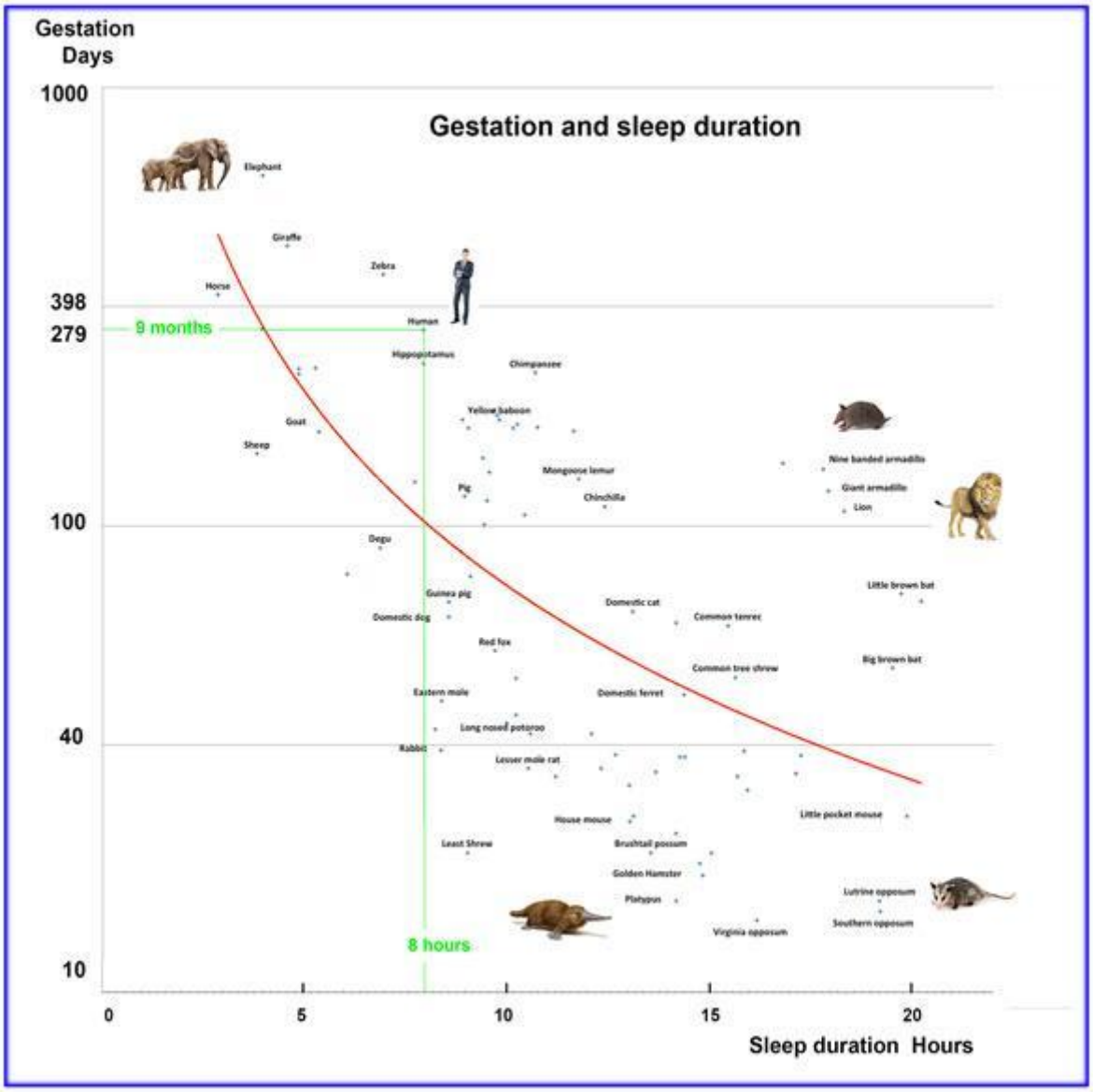
Introduction: The function of sleep has not been understood yet. A popular belief, proposes that sleep is beneficial to the body and the brain. This paper shows that there is a correlation between sleep and gestation among the mammals and an explanation based on brain maturity at birth is proposed.
Materials and methods: Theories proposed to explain the duration of sleep in mammals based on arguments like predation risk, length of hindguts, parasitical protection and weight, have been examined, but they are not conclusive or show too many exceptions.
This paper is essentially based on previous results and in particular on the paper from Lesku et al. which compile sleep parameters for 83 mammalian species. A few species were excluded like semi aquatic mammals while other were added like the lion and the elephant.
Results: The sleep duration of 83 mammals show a very strong inverse correlation with the gestation period.
In mammals, the amount of time asleep varies greatly, from 3 h in the donkey to 20 h in the armadillo, as does the amount of time devoted to NREM and REM sleep.
The amount of sleep is shown in a curve where data for all species fall approximately on the same line.
The explanation is based on the development of the brain at birth. The adaptation to the environment of a newborn depends on the degree of maturity of the brain. All elements of the terrestrial environment like gas, light, sound and gravity play a role in the necessity for sleep in each species. Sleep is a periodic and necessary need for the brain to reprogram adaptation to the daily environment.



[Gestation and Sleep]

Conclusion: The explanation for the duration of sleep is based on the gestation time. The brain development is different for different gestation length and sleep is needed to adapt to the environmental variables of the daily life.

511 - **Mild damage to arousal structures of the mesopontine tegmentum in traumatic brain injury**
Presented by: Philipp O. Valko

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Objectives: Coma and chronic sleepiness are common after traumatic brain injury (TBI). In patients with severe TBI, we found clear damage to the hypothalamus, with 41% loss of histamine neurons and 21% loss of hypocretin neurons. The rostral brainstem also contains several important arousal-promoting nuclei, but the integrity of these monoaminergic and cholinergic neurons has not yet been examined in TBI patients.

Methods and materials: We used immunohistochemistry and unbiased stereology to compare neuronal counts in the noradrenergic locus coeruleus (LC), in the serotoninergic median (MRN) and dorsal (DRN) raphe nuclei, and in the cholinergic pedunculopontine (PPT) and laterodorsal (LDT) tegmental nuclei of 8 patients with fatal TBI and 10 controls. After the head trauma, TBI patients survived 20±10 days (range 11-36 days). In prior work, we examined hypothalamic injury in all but one of these TBI brains.
Results: Mean age (68±11 years vs. 66±16 years, p=0.73) and sex distribution (5 subjects in both groups were male, p=0.66) did not differ in controls and TBI patients. Compared to controls, TBI patients had 17% fewer neurons in the DRN (105,584±14,272 vs. 87,733±19,428, p=0.04), but the number of neurons was not different in the MRN (53,706±16,225 vs. 55,375±9,216, p=0.80). TBI patients had a trend towards 29% fewer neurons in the LC (46,928±14,276 vs. 33,259±15,865, p=0.07). Controls and TBI patients had similar neuronal numbers in the PPT (68,048±13,825 vs. 65,024±11,108, p=0.62) and LDT (36,027±13,103 vs. 36,825±7,265, p=0.88).
Conclusions: TBI appears to cause less injury in mesopontine arousal structures than in the hypothalamus. Mild neuronal loss was most apparent in the dorsal mesopontine tegmentum (LC and DRN), and neurons in more ventrally located nuclei (MRN, PPT, LDT) seem more protected from trauma.
Acknowledgment: This study was supported by the Swiss National Science Foundation (grant No. 32003B-125504) and the Clinical Research Priority Program “Sleep and Health” of the University of Zurich.

558 - **The opioid system and sleep-wakefulness cycle in “depressive” and “non-depressive” rats**
Presented by: Manana Nemsadze

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[1]Research Center, Tengiz Oniani Laboratory of Sleep-Wakefulness Cycle Studies, [2]Institute of Biological Chemistry, Ilia State University, Tbilisi, Georgia

Objectives: The endogenous *opioid system* is thought to play a significant role in the regulation of mood. Moreover, personal history of major depression increases the risk of opiate abuse. Therefore, the assessment of the opioid system in the development of depression and in regulation of the sleep-wakefulness cycle (SWC) is particularly important. The present study evaluated the structure of diurnal SWC in correlation with μ-opioid (MOP) receptors density of non-depressive (“ND”) and depressive (“D”) rats.
Methods: The experiments were conducted on inbred adult rats (weight ~200g, n=15) by using the following tests and methods: The Porsolt, sucrose preference, polygraphic registration (Cadwell system) in light and dark periods; Western blot of MOP receptors. Statistical analysis was done with Student's *t*-criterion.
Results: In the “D” rats the index of depressiveness (time of immobilization) was 70-90%, in the “ND” rats - less than 60%. As expected, the “D” rats consumed less amount of sucrose solution. In the “D” rats the density of MOP receptors was higher in amygdala and nucleus caudatus ($p< 0.05$).
In diurnal SWC the duration of wakefulness in “D” rats was less ($p< 0.001$), and Paradoxical Sleep (PS) duration was longer ($p< 0.01$) compared with “ND” animals. When SWC were separately analyzed for light and dark periods, it was found that wakefulness in “ND” rats was longer both in the light ($p< 0.02$) and dark ($p< 0.05$) periods, while PS was significantly longer in "D" rats for both the light and dark periods. These SWC variations were correlated with high density MOP receptors in amygdala and nucleus caudatus in “D” rats as compared with the “ND” rats.
Conclusions: The correlation of the signs of depressiveness - changes in SWC as well as immobilization during forced swimming and anhedonia - with high density MOP receptors provides evidence that functioning of the endogenous opioid system is modified in depression.

276 - **Effects of sleep vs. simple passage of time on insight problem solving**
Presented by: Svenja B. Brodt

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[1]Medical Psychology and Behavioural Neurobiology, Eberhard-Karls-Universität Tübingen, Tübingen, [2]General and Experimental Psychology, Ludwig-Maximilians-Universität, [3]Parmenides Foundation, München, Germany

Objectives: Sleep has been shown to benefit a range of cognitive functions, including memory consolidation. While there is ample evidence for a quantitative effect of sleep on learned material, there is an ongoing debate whether sleep also promotes qualitative changes in how new material is represented. Insight problems often require reorganization of the problem representation or problem space in order to be solved and thus have already been employed to explore the role of sleep in qualitatively restructuring memory content. While some results suggest that sleep can help gain sudden insight e.g. into hidden rules underlying previously learned material, other studies emphasize the role of incubation time for solving insight problems. In the current study, we investigate the effect of both incubation time and sleep on solving different insight problem tasks.
Materials: In a 3h daytime nap vs. wake design, four groups of participants (total n=72) worked on various problem solving tasks, including classical as well as perceptual insight problems, anagrams, word and logic riddles. Participants attempted to solve the problems during a short initial 'encoding' phase and a longer second 'retest' phase. While two groups experienced a 3h 'incubation' interval between encoding and retest, which was either spent asleep or awake, the other groups spent an equal interval asleep or awake before the encoding phase, which was then immediately followed by the retest.
Results: We find that a time interval between encoding and retest, regardless of whether this interval is spent awake or asleep, can increase solution rates or solution times in both reasoning and perceptual insight problems.
Conclusions: We conclude that for the materials and time-window tested, there is no specific effect of sleep on the reorganization of encoded material leading to insight problem solving. However, it seems that for certain problems, the restructuring of the problem can take place during the time between forming the initial representation and later attempts at solving the task. This incubation effect is in line with insight models that assume that initial neuronal activation patterns must decay before the solution can emerge.

530 - **Neurofeedback for improving sleep and memory in primary insomnia - a double-blind EEG study**
Presented by: Manuel Schabus

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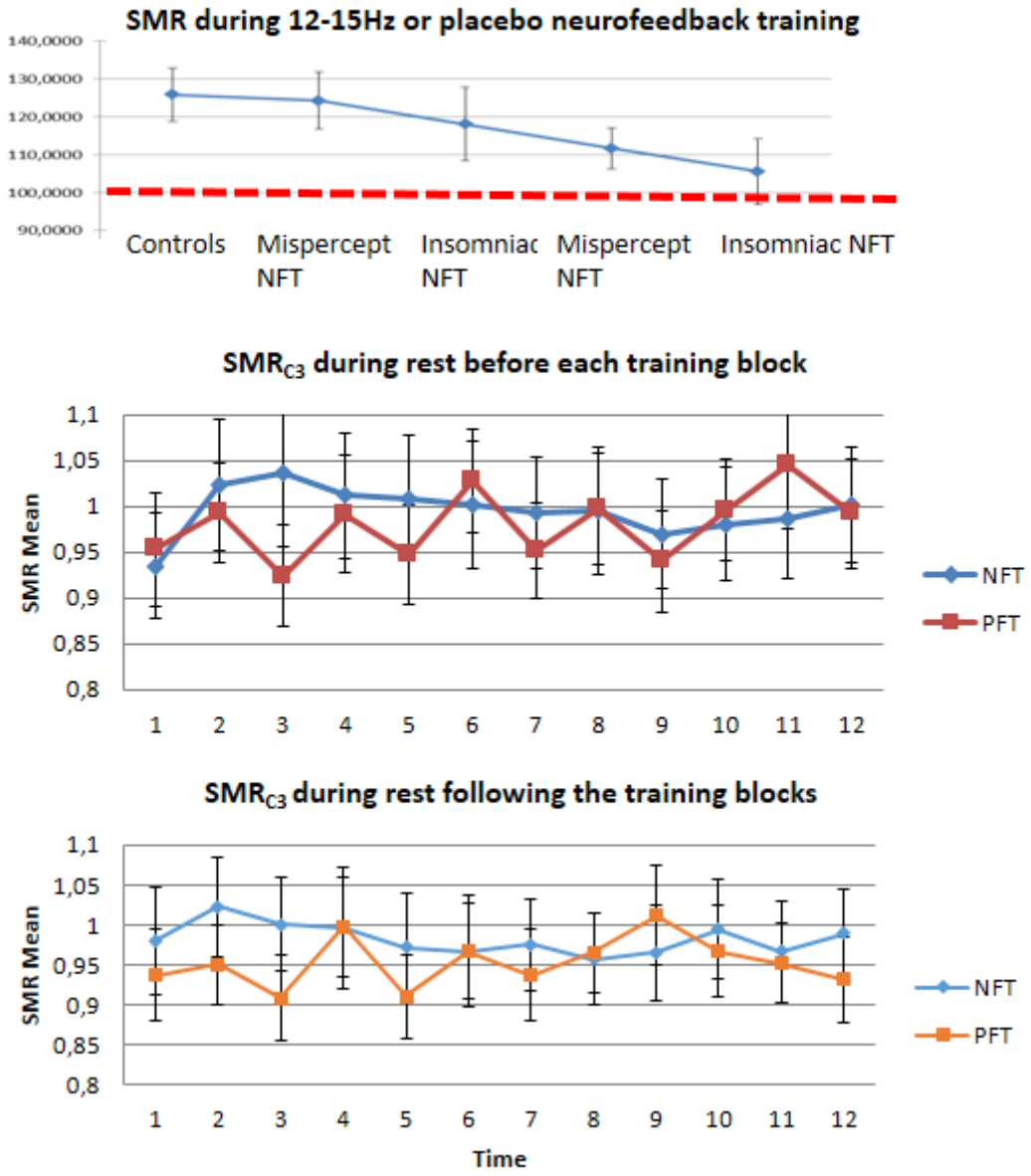
[1]Centre for Cognitive Neuroscience Salzburg (CCNS), [2]University of Salzburg, Salzburg, Austria

There is only scarce evidence supporting the efficacy of neurofeedback training (NFT) for improving sleep quality in primary insomnia. In the present study we compared SMR (12-15Hz sensorimotor rhythm) to placebo "neurofeedback" in a double-blind design and consequently analyzed their effects on
(1) subsequent EEG, as well as
(2) sleep quality and
(3) memory consolidation following 12 blocks of NFT over the course of several weeks.
30 subjects with clinical symptoms of primary insomnia (10 being sleep state mispercept patients) were contrasted with 12 healthy control also undergoing identical NFT as well as 36 healthy controls performing the first part of the study protocol focusing on memory consolidation.
Data revealed that all participants could increase their SMR rhythm during NFT with the healthier subjects showing better response (cf. Figure 1). However, resting EEG directly following the training did not reveal any enduring effect on EEG. Results also do not reveal any reliable effects on sleep onset, sleep duration or sleep maintenance. Subjective sleep quality shows a tendency towards an increases post training, yet identical for NFT and sham conditions. In summary, the findings do not support significant NFT benefits on sleep quality or memory if patients are having severe and chronic sleeping problems although the NFT training itself was successful. However, given this null-effect of NFT on behavior we have the unique opportunity to also test the sleep-dependent memory consolidation hypothesis with the same subjects and tasks (finger-tapping and word-pair learning) across 4 PSG-nights each.



[Figure 1]

469 - **Daytime light exerts direct non circadian positive effects on mood through melanopsin-based phototransduction**
Presented by: Laurent Calvel

L. Calvel[1,2], *J. Hubbard*[1], *L. Choteau*[1], *P. Chu Sin Chung*[1], *E. Ruppert*[1,2], *P. Bourgin*[1,2]
[1]CNRS UPR 3212, Institute for Cellular and Integrative Neurosciences, [2]Sleep Disorders Center, Strasbourg University Hospital, Strasbourg, France

Objectives: Light greatly influences circadian physiology and sleep either, indirectly through the phase shifting of circadian rhythms or directly, in a circadian independent fashion. Mood is also strongly affected by light, but the mechanisms involved remain poorly understood. The efficiency of light therapy for winter depression is explained by phase advancement of circadian rhythms, but additional mechanisms are involved. Thus, in the current study we sought to elucidate whether direct photic mechanisms affect mood and to determine the phototransduction pathways implicated.
Methods: To achieve this, male wild type and melanopsin (a retinal photopigment crucial for light detection) knockout mice (Opn4$^{-/-}$) were exposed to different luminance (< 10 lux, 150 lux, 600 lux) under standard 12h: 12h light dark cycle in order to respect the circadian phase. The behavioral test

battery included the sucrose preference test (SP), the forced swim test (FST), the tail suspension test (TST), and the elevated plus maze (E+M). All tests were performed under dim light (< 10Lux), between ZT 7 and ZT 10.
Results: Wild type (n=64) animals exposed for 7 days to lower light (< 10 lux, n = 26) developed anxiety and depression-like behaviors (resignation, anhedonia, anxiety), as opposed to those exposed to standard (150 lux; n = 17) or higher light intensities (600 lux; n = 21) (PS, FST,TST,E+M; p< 0,01). A dose response relationship between positive light intensity and depression-like responses for TST and E+M was observed in WT, but not in mice lacking melanopsin that responded indifferently to different light intensities (genotype x light effect, p< 0,001).
Conclusion: Mice are nocturnal and photophobic, yet the results first demonstrate that non circadian direct influence of light positively regulates mood with lower light intensity leading to mood alteration and that these effects are primarily mediated by melanopsin-based phototransduction.

254 - **Comparison of slow wave activity between recovery nights after acute sleep deprivation and after chronic sleep restriction**
Presented by: Angelina Maric

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[1]Department of Neurology, University Hospital Zurich, [2]Clinical Research Priority Program “Sleep and Health”, University of Zurich, [3]Child Development Center and Pediatric Sleep Disorders Center, University Children's Hospital Zurich, Zurich, Switzerland, [4]Department of Psychiatry, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States, [5]University Clinics for Child and Adolescent Psychiatry, University of Zurich, Zurich, Switzerland

Objectives: The extent of neurobehavioral impairments observed after sleep loss differs between individuals, with some being more impacted than others. This individual response is evident regardless whether the sleep loss is acute or chronic. Slow wave activity (SWA) is a well-established, electrophysiological marker of sleep homeostasis, with higher SWA after prolonged wakefulness. So far it is not known, if individual homeostatic responses of SWA are related across different conditions of sleep loss. Thus, we aimed at directly comparing the SWA increase after acute sleep deprivation (aSD) and chronic sleep restriction (cSR) in the same subjects.
Methods and materials: Sleep was recorded in nine male subjects using high-density electroencephalography (EEG; 128 electrodes) during a baseline night and during the recovery nights after aSD (40h) and after 7 nights of cSR (5h instead of 8h sleep/night). We compared the increase in SWA (EEG power density in the 1.25-4.5 Hz range) of the first sleep cycle in the recovery nights relative to the baseline night over clusters of electrodes corresponding either to the frontal, parietal, occipital or temporal lobes. Comparisons were performed by paired t-test. The relationship between the relative increase in SWA after aSD and cSR was investigated by partial correlations for the different brain areas, controlling for baseline levels of SWA.
Results: Compared to baseline, SWA was significantly increased after aSD as well as after cSR in all clusters (all p< 0.05). The relative increase observed after aSD was higher in all areas compared to cSR (smallest difference in the parietal cluster +32.4 ± 12.5% [mean ± SD], p< 0.001, largest difference in the occipital cluster +43.2 ± 14.2%, p< 0.001). The relative increase in SWA after aSD and after cSR was significantly correlated in all areas (correlation coefficient range: r = 0.78 (p< 0.05) for the frontal lobe to r = 0.90 (p< 0.01) for the temporal lobe).
Conclusions: The increase in SWA was larger after aSD compared to after cSR, but the individual homeostatic response was preserved over both conditions of sleep loss, i.e. subjects showing a larger increase after aSD did so after cSR and vice versa. Further analysis looking into the topography more closely and relating the individual homeostatic response to neurobehavioral impairments, might contribute to the understanding of the similarities and dissimilarities between the consequences of acute and chronic sleep loss.

97 - **Sleep pattern changes in the third trimester of pregnancy**
Presented by: Sandra Carvalho Bos

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Objective: To evaluate sleep pattern changes associated with the last trimester of pregnancy and its association with the severity of mother`s depressive symptomatology.
Methods: A total of 683 women participated in the study (M=30.3, σ=4.29 years; M=32.6, σ=3.48 weeks of gestation). Most women were Portuguese (86.7%, n=592); nulliparous (64.9%, n=443) and married or living with a partner (90%, n=615). Pregnant women were recruited at Health Medical Centres and/or Maternities (Coimbra, Portugal) when waiting for their routine prenatal medical appointment. Participants filled out a questionnaire booklet which included the Beck Depression Inventory-II (BDI-II; Beck et al., 1996).
Results: The most frequent sleep pattern complain was sleeping somewhat less than usual, 41.1% (n=281), followed by sleeping somewhat more than usual, 22.7% (n=155) and sleeping a lot less than usual, 11.4% (n=78). Waking up 1-2 hours earlier and not being able to get back to sleep was referred by 4.1% of the sample (n=28), sleeping a lot more than usual was reported by 2.6% (n=18) and sleeping most of the day by .7% (n=5). A total of 17.3% of pregnant women (n=118) referred not experiencing changes in their sleeping pattern. Significant differences were observed between the above groups relatively to the BDI-II total score ($p < .001$). Women without sleep pattern changes in late pregnancy reported less depressive symptoms than all the other groups (p values varied between < .001 and .017). Less depressive symptoms were observed in women who slept somewhat more or somewhat less than usual when compared to women who slept a lot less than usual or who woke up 1-2 hours earlier and couldn´t get back to sleep.
Conclusion: Pregnant women who reported sleeping a lot less than habitual and waking up 1-2 hours earlier with inability to get back to sleep experienced more severe depressive symptoms. These results can be relevant for clinicians when assessing sleep pattern changes in late pregnancy.
Acknowledgements: Portuguese Foundation for Science and Technology (Project reference: POCI2010/FEDER/SAU-ESP/57068/2004). Pregnant women and health staff are deeply acknowledged for their collaboration.

610 - **Chronotype and sleep quality in elite athletes**
Presented by: Luke Gupta

L. Gupta[1,2], *K. Morgan*[1]
[1]Clinical Sleep Research Unit, Loughborough University, Loughborough, [2]Physiology, English Institute of Sport, Bisham Nr. Marlow, United Kingdom

Objectives: The need to share public sports facilities, accommodate training routines into family, working/college life, distribute training volume across the day, and travel to national/international competitions all contribute to pressure on the sleep period in elite sport. Whether such pressure:
1) selects for; or
2) advantages 'morning' types among high-performance athletes is under-researched.
We investigated the chronotype distribution and sleep quality of self-assessed chronotypes among elite sports performers.
Methods and materials: Online assessments of sleep quality (PSQI), sleep and training schedules, fatigue impact, and self-rated chronotype (using a 5-point scale from “definitely” or “more” a morning type through “neither morning nor evening type” to “more” or “definitely” an evening type) were conducted among 394 (172 female) elite British athletes from a range of individual and team sports (78% international competitors). Training start times were categorised: < 0800; 0800-0900; >0900.
Results: Athlete chronotype distributions were not significantly associated with training start times ($\chi^2_{(8)}=14.66$; P=0.07). However, one-way ANOVAs showed clear and significant sleep quality ($F_{(4,389)}=4.7$; P=0.02) and fatigue impact ($F_{(4,389)}=4.5$; P=0.001) gradients across chronotype categories, with significantly poorer sleep (mean PSQI score±SD: 6.6±3.1) and significantly greater fatigue impact reported among the “definitely evening” types, intermediate sleep quality (5.5±3.0) and fatigue impact reported by those “neither morning nor evening” types, and superior sleep quality (4.7±3.1) and the lowest fatigue impact reported by the “definitely morning” types.
Conclusion: The results indicate that, for many elite athletes, chronotype may conflict with training schedules, contributing to poorer sleep quality and greater daytime fatigue among 'non-morning' types.

200 - **Sleep regulation: effect of sleep restriction and extension**
Presented by: Jelena Skorucak

J. Skorucak[1], *E. Arbon*[2], *D.-J. Dijk*[2], *P. Achermann*[1]
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Objectives: Sleep is homeostatically regulated: if sleep is restricted, then sleep intensity increases, and in case of excess sleep, sleep intensity decreases. However, some animal studies reported only an initial increase in slow-wave activity (SWA) during chronic sleep restriction, and then SWA values are maintained at or even below baseline levels. Our goal was to investigate sleep regulation in humans undergoing both, sleep restriction and extension.
Methods: Data of 25 subjects with polysomnographic recordings of two sessions (restriction and extension condition) were analysed. Each session consisted of 9 nights: baseline night (8 hours of sleep), 7 condition nights (6 or 10 hours of sleep), and a recovery night (12 hours of sleep) after ~40 hours of sleep deprivation. Power density spectra and slow-wave activity (SWA; power in 0.75 - 4.5 Hz range) were calculated. Slow-wave energy (SWE) reflects the total dissipation of sleep pressure during sleep, and was determined as cumulative sum of SWA in 30-min bins across the night.
Results: SWE in the 1st extension night was 6 % higher than in baseline, reached baseline levels in the 3rd and 4th night of extension and decreased to 92 % of baseline levels thereafter. SWE in the first restriction night was at 92 % of baseline levels, reached baseline levels in the 3rd and 4th night and decreased below baseline in restriction nights 5-7. Sleep deprivation resulted in a similar increase of SWA and SWE in both restriction and extension conditions and intraclass correlation coefficients (ICCs) were moderate (SWA: 0.46; SWE: 0.43).
Conclusions: Sleep deprivation led to a similar homeostatic response after both sleep extension and restriction but ICCs indicate that the response to sleep deprivation is only moderately trait like. The observed time course during extension and restriction needs further investigations. However, inter-individual differences were large and not all individuals may show the same response to extension and restriction.

391 - **Sleep deprivation distinctly affects visual and auditory conflict resolution scores of attention network**
Presented by: Asela S. Karunajeewa

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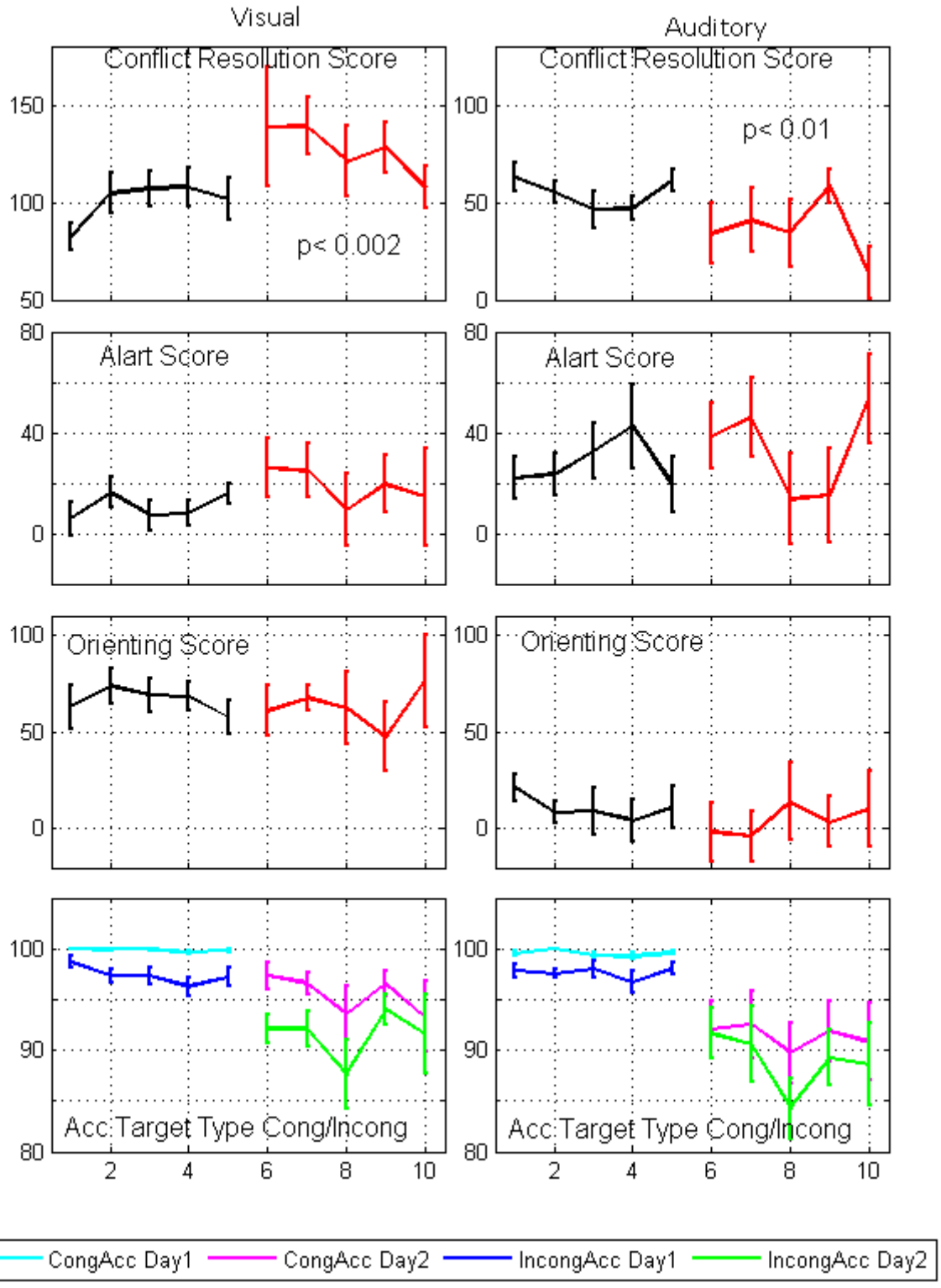
[1]Laboratoire de Sommeil, Hopitaux Universitaires de Geneve, Geneva, Switzerland, [2]Inserm U 1039, La Tronche, France, [3]Centre d'Investigation et de Recherche sur le Sommeil (CIRS), Lausanne, [4]Medecine Interne, Hopitaux Universitaires de Geneve, Geneva, Switzerland

Objectives: To determine the impact of excessive daytime sleepiness on visual and auditory attention networks by studying the changes in alerting, orienting and conflict resolution scores before and after sleep deprivation (SD).
Methods and materials: Thirteen normal volunteers (8 women and 5 men) participated in the study. Participants performed visual and auditory cued attention tests over 2 consecutive days separated by a night of SD. There were 5 sessions of tests per day, with 2 hours between sessions. Wakefulness maintenance test (MWT), was also performed in each session. Behavioural data were recorded in parallel with continuous 64 EEG channels. Alerting and orienting scores were assessed by comparing experimental situations with specific cue types, whereas conflict resolution score was obtained by contrasting incongruent with congruent target situations. Average reaction time (RT), attention scores and accuracy were obtained from all trials of each the day (sessions pooled). For statistical comparison between Day 1 and Day 2, Wilcoxon test for accuracy and paired sample t-tests for RT and scores were used.
Results: The sleepiness after the night of SD was documented by a significant decrease in sleep latency at the MWT. As expected, for all cue and target types in both visual and auditory modalities, there was a significant decrease in response accuracy and increase in RT with SD. While SD did not affect the alerting and orienting scores, the conflict resolution scores were significantly modified, with opposite changes for visual and auditory stimuli. Visual stimulation was associated with an increase of conflict resolution score (mainly due to a RT increase to incongruent targets), whereas auditory stimulation was accompanied by a decrease of conflict resolution score (mainly due to a RT increase to congruent targets). SD effect on response accuracy paralleled the RT data.



[Attention RT scores]

Conclusions: SD has a strong impact on attentional networks by decreasing overall performances (drop in accuracy and slower RT). Moreover, SD selectively affects the conflict resolution scores, representing a hallmark of executive functions. Cognitive slowing is therefore a consequence of the changes in vigilance associated with sleepiness. Competing functional brain systems could interact during SD, with opposite effects according to the sensory modality. SD influence behaviour mainly in presence of contradictory information.

Study suported by SNF, project number 320030_149695

567 - **Within-sleep auditory cueing rescues verbal neutral declarative learning from forgetting**
Presented by: Médhi Gilson

M. Gilson, P. Peigneux
Université Libre de Bruxelles (U.L.B.), Ixelles, Belgium

Objectives: Recent evidence suggests that reactivation during sleep of learning-related auditory or olfactory cues enhances memory consolidation for declarative spatial and verbal memory tasks. In the present study, we investigated whether targeted reactivation during a post-training afternoon nap enhances recall performance for a verbal material involving emotional components.
Methods: Twenty-one young adults learned 36 unrelated word-pairs (WPs; 18 being neutral and 18 being negative) associated with an emotionally congruent sound. Participants were instructed to memorize the WPs and to ignore the sounds. After the learning session, they underwent an immediate recall session and were then allowed to have a 90 minutes nap. During the nap, half of the associated sounds (9 neutral and 9 negative) were replayed several times during sleep stages N2 and N3. Recall performance for all learned WPs was then tested.
Results: Amongst the participants for whom at least one auditory reactivation (i.e. ≥ 18 sounds) was achieved (N=13), the decrease in performance between learning and retrieval was significantly lower for cued than non-cued WP (respectively -3.8% vs -12.8% of recalled word pairs; p=.03). A trend towards better recall performance for neutral reactivated WPs was observed (+1.7%), in comparison with non-reactivated WPs (-12%; p=.078). Negative WPs did not benefit from reactivation (-9.4% for reactivated and -12.8% non-reactivated WPs; p=1).
Conclusions: These results indicate that within-sleep auditory cueing benefits declarative memorization. Besides, these benefits might be more important for neutral WPs than for negative ones.

449 - **The role of REM-sleep in emotional memory processing: differing effects on item and source memory?**
Presented by: Roxanne Sopp

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[1]International Research Training Group 'Adaptive Minds' (IRTG 1457), [2]Clinical Psychology and Psychotherapy Unit, Saarland University, Saarbruecken, [3]Interdisciplinary Sleep Laboratory, Pfalzklinikum Klingenmuenster, Klingenmuenster, [4]Experimental Neuropsychology Unit, Saarland University, Saarbruecken, Germany

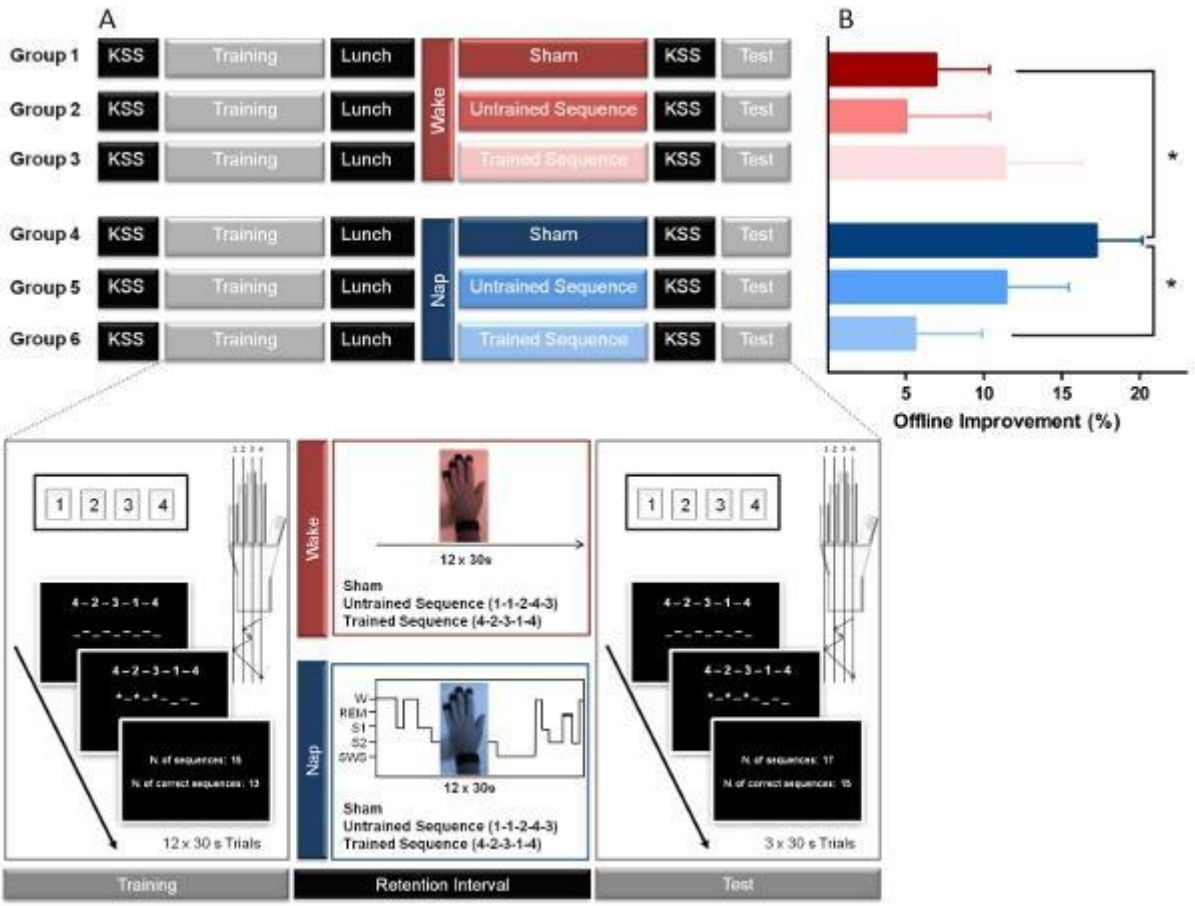
The effect of sleep on different memory systems has been the topic of extensive research. It has been shown that the physiological features of SWS support offline processing for contextual details of episodic memories, whereas REM-sleep appears to be associated with an enhanced effect of emotional arousal on memory formation. So far, it is unknown how this REM sleep-dependent effect interacts with the general enhancement of episodic memories for emotional events. Also the boundary conditions of this consolidation benefit, specifically whether it extends to associative (source) recognition memory, have not been thoroughly examined to date. The present study aimed at extending previous findings on differential effects of REM- and SW-sleep on emotional item and source memory using a split-night-design.
41 participants (M= 22.7 years) were allocated to two groups, one of which underwent encoding prior to sleep in the first night half and memory testing in between both sleep opportunities. The second group encoded emotional and neutral images after sleep in the first night half and took the memory test after the second night half. EEG was recorded during both sleep intervals.
Analysis of item memory revealed no baseline differences between both study conditions at pretest as well as no initial enhancement of emotional memory. However, when integrating post-sleep performance into the analysis, main effects of emotionality, time and a significant interaction emerged, indicating an enhanced retention of emotional as opposed to neutral material over sleep. Contrary to previous findings, no interaction involving the group factor was found, suggesting that this consolidation benefit was not exclusive to the late-night sleep condition. Inspection of the resulting effect sizes revealed a more pronounced effect in the late study condition. Overall source memory performance, which was assessed by recognition of the screen locations at which the images were presented, similarly decreased over time in the late study condition. This decline was highly significant

for neutral stimuli, but failed to reach significance for emotional stimuli, indicating a selective preservation of associative recognition of emotional events over late-night-sleep.
The results emphasize the role of late sleep in the retention of emotional memories, which extends to associative recognition and may reflected an arousal-induced facilitation of binding emotional images with perceptual features.

565 - **Stimulating sensory experience of motor skills during sleep hampers improvement**
Presented by: Sofia Isabel Ribeiro Pereira

S.I.R. Pereira[1], *F. Beijamini*[1], *F. Weber*[2], *R.A. Vincenzi*[1], *F. Cini*[1], *F.M. Louzada*[1]
[1]Universidade Federal do Paraná, Curitiba, Brazil, [2]University of Tuebingen, Tuebingen, Germany

Objectives: Memory consolidation can be enhanced by presenting specific contextual cues like odors and sounds during sleep. Rather than such cues, we aimed to recreate an integral part of the sensory experience of motor skill learning during sleep to study its influence on sleep-mediated consolidation.
Methods and materials: Participants (n = 88) performed the training session of the Finger Tapping Task (FTT) with their left hand across twelve 30s blocks. During a retention interval of 90 min including either daytime nap (Sleep group) or quiet wakefulness (Wake group) subgroups of participants received either no stimulation (Sham group), mechanical sensory stimulation on the fingertips mimicking the trained sequence (Trained Sequence group) or stimulation in a new sequence without any overlap with the trained one (Untrained Sequence group). Stimulation was initiated after 5 min of consecutive NREM 2 sleep or at an equivalent time point for the Wake groups (see Figure, part A). Performance improvement was assessed by the difference between the average number of correctly typed sequences in the 3 blocks of the test session and 3 last blocks of the training session.
Results: Overall sleep architecture did not differ between groups ($p > 0.1$). No differences in performance were found between groups before the retention interval ($p > 0.4$). After the retention interval, the Sleep Sham group outperformed the Wake Sham group ($p = 0.032$), suggesting a sleep effect on performance improvement. Mechanical stimulation during sleep with the trained sequence diminished this improvement (Trained Sequence group vs Sham group, $p = 0.033$). An opposite trend was observed in the Wake groups, but did not reach significance (see Figure, part B).
Conclusions: Re-exposure to integral parts of the sensory experience of a recently learned motor skill during a short sleep interval might disrupt rather than enhance sleep-mediated improvement, possibly by an active interference on the skill traces that hampers natural consolidation processes. This study was supported by CNPq project number 480055/2009-2, PIBIT/CNPq and CAPES scholarships.



[Experimental Design and Offlline improvement]

376 - **Volatile coffee components on memory in sleep deprived students**
Presented by: Jesús A. Moo Estrella

R.A. Quintal Ortiz, J.A. Moo Estrella
Sleep Laboratory, Autonomous University of Yucatan, Mérida, Mexico

The volatiles coffee components may have positive effects on memory, as proved with coffee intake.
Objective: Know the effect of the volatiles coffee components, on memory short and long term, after sleep deprivation.
Subjects and methods: 38 college students (66% female, mean age 20 ± 2 years), divided into two treatment groups (Tx1 = 12 without sleep deprivation to measure short-term memory, Tx2 = 13 with sleep deprivation to measure memory long-term) and a control group (n = 13). Three subtests were used of the NEUROPSI battery; attention and memory.
Results: In the words list test, the second (p = .044) and third trial (p = .044) showed differences, in which the Tx1 group (second trial M =12.91 ± 1.5, third trial M = 13.83± 1.1) recalled more words than the control (second trial M=11.76 ± 1.5, third trial M = 12.53 ± 1.5), likewise showed a higher score (p = .023) in the test of Figure Rey-Osterreith (Tx1 = 31.27 ± 3.52 vs 26.61 ± Control = 5.6). No differences in long-term memory were found (p> .05).
Conclusions: The volatile components of coffee improve verbal and visuospatial short-term memory, but not long-term memory, posterior to sleep deprivation.

425 - **What is the relationship between variation of sleep duration and emotion recognition ability?**
Presented by: Tina Sundelin

T. Sundelin[1,2], P. Laukka[1], H. Fischer[1], J. Axelsson[2]

[1]Stockholm University, [2]Karolinska Institutet, Stockholm, Sweden

Objective: Experimental studies suggest that sleep-deprived individuals struggle to recognize emotions of moderate intensity in others. However, these studies use emotional faces morphed with neutral faces and contradict each other regarding which emotions are affected. The objective of the current study was to investigate how natural variations in sleep relate to the ability to recognize emotions in others. For a more ecologically valid stimuli, we used a recently developed test with presentations of dynamic expressions of several different emotions.
Method: 291 participants filled out a sleep diary and performed an emotion recognition test. The test included audio clips, and video clips with and without sound, of actors conveying different emotions. Sleep measures for the previous night were assessed along with accuracy and reaction time of recognizing the emotions. The emotion displays were "easy" or "hard" depending on how difficult they were to categorize.
Results: Participants had slept between 0h and 11h (m=454min, sd=87min) with a good average sleep quality. There were no effects of sleep duration, quality, or sufficiency on emotion recognition, regardless of whether the emotion was easy or hard (p's > .05). In addition, neither of the sleep measures were related to reaction time.
Conclusion: Natural variations of sleep duration and quality were not related to emotion recognition ability. The results might be due to self-selection bias or lack of extreme sleep deprivation, but it is possible that when faced with ecologically valid displays of emotion, sleep duration has no, or very minute, effect on emotion recognition ability.

422 - **Altered regional brain activity in patients with psychophysiological insomnia to sleep-related stimuli**
Presented by: Yu-Jin G. Lee

Y.J. Lee[1], S. Kim[2], J. Park[2], J.-W. Choi[1], S.-J. Kim[3], N. Kim[4], D.-U. Jeong[1]
[1]Department of Psychiatry and Center for Sleep and Chronobiology, Seoul National University College of Medicine and Hospital, [2]Department of Psychiatry, Seoul National University Hospital, [3]Department of Medicine, Seoul National University College of Medicine, Seoul, [4]Gachon Neuroscience Center, Incheon, Republic of Korea

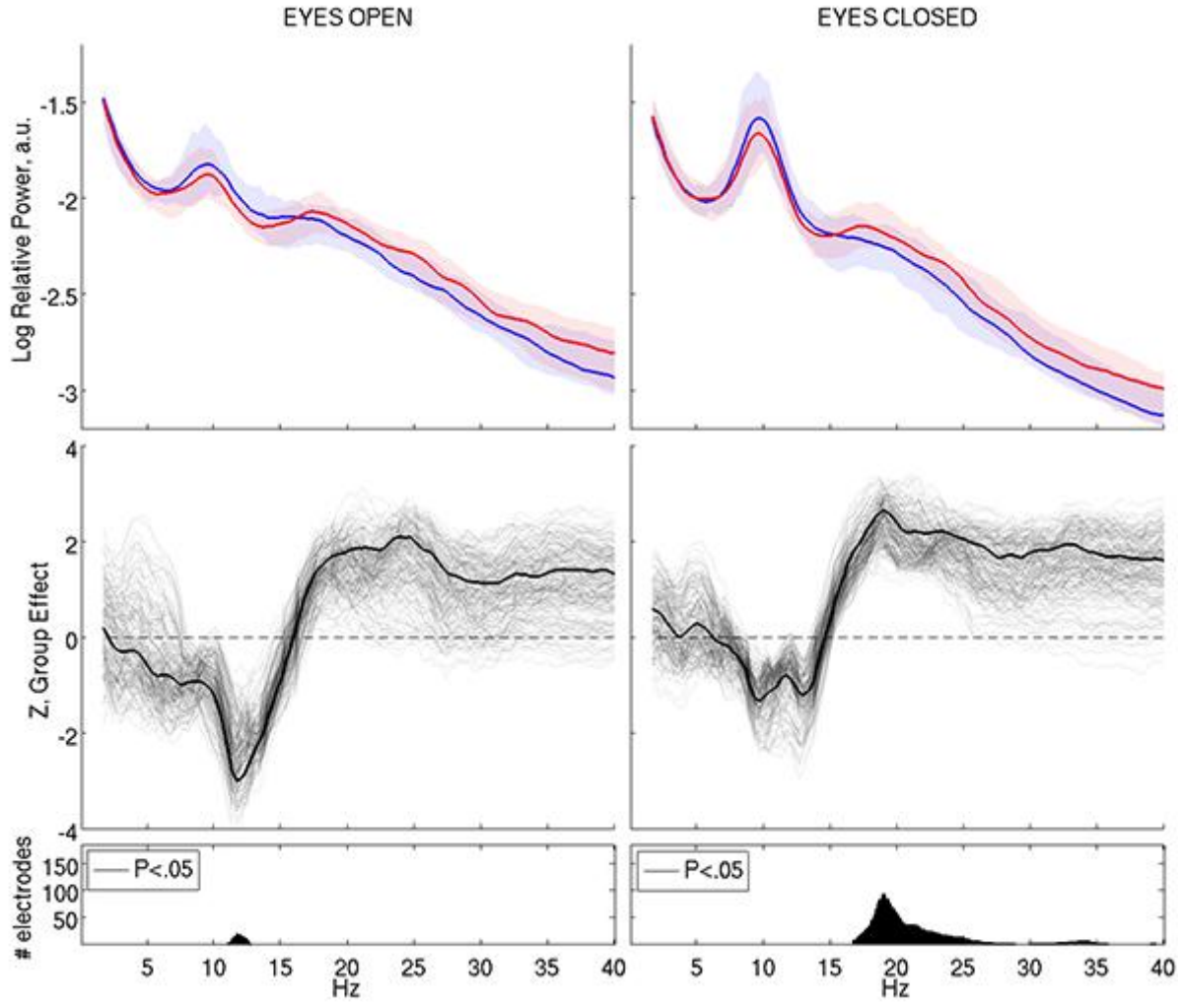
Introduction: Psychophysiological insomnia is known to be caused by hyperarousal state as its possible pathophysiology. In current study, we aimed to investigate neural correlates of psychophysiological insomnia using sleep-related stimuli.
Methods: Fourteen patients diagnosed as psychophysiological insomnia (INS: 44.8±11.5y, 10 females) on ICSD-2 and 19 healthy good sleepers (GS: 40.7±8.7y, 15 females) underwent brain fMRI while listening blocks of sleep-related sounds (sounds of alarm clock, heart beat, and ticking of clocks) and matched white noise. A whole-brain analysis was used for comparing neural activity to sleep related stimuli among two groups.
Results: Compared to GS group, INS group showed increased activation to sleep related sounds (vs. white noise) in both superior temporal gyrus, both middle temporal gyrus and left inferior parietal gyrus (all, *uncorrected p* < .005).
Conclusion: The current results revealed differential brain regional activations in psychophysiological insomnia patients from those in good sleepers to sleep related sound. Especially, brain regions with increased responses in our results were associated with auditory and sensory associations. Our results may support hyperarousal theory of insomnia.

657 - **Wake high-density EEG spatio-spectral signatures of insomnia: more beta and less high-alpha**
Presented by: Michele Colombo

M. Colombo[1,2,3], J.R. Ramautar[1], Y. Wei[1], G. Gomez-Herrero[1], Y. Sweere[1], Y.D. van der Werf[4,5], C. Cajochen[3], E.J.W. Van Someren[1,6]
[1]Dept. Sleep & Cognition, Netherlands Institute for Neuroscience (NIN), Amsterdam, The Netherlands, [2]Bernstein Center Freiburg, University of Freiburg, Freiburg, Germany, [3]Centre for Chronobiology, Psychiatric Hospital of the University of Basel (UPK), Basel, Switzerland, [4]Anatomy and Neurosciences, VU University & Medical Center, [5]Dept.Emotion & Cogniton, Netherlands Institute for Neuroscience (NIN), [6]Departments of Integrative Neurophysiology and Medical Psychology, Center for Neurogenomics and Cognitive Research, Neuroscience Campus Amsterdam, VU University & Medical

Center, Amsterdam, The Netherlands

Objectives: Whereas daytime complaints are a defining characteristic of insomnia disorder (ID), the majority of neurophysiological investigations focused on sleep. In the present study, we utilized high-density electroencephalography (HD-EEG) during wakeful rest prior to bedtime to investigate spatio-spectral profiles of ID at a fine grained resolution.
Methods: Participants (n=94, aged 21-72 years) were recruited through www.sleepregistry.org and included 51 people suffering from ID and 43 matched controls without sleep complaints. The Insomnia Severity Index (ISI) was above the subclinical cutoff of 7 in all ID participants and ≤7 in controls. (Morin et al, 2011). Exclusion criteria were any neurological, medical or psychiatric condition. Resting-state HD-EEG (256 channels) was recorded during evening wakeful rest in eyes-open and eyes-closed conditions of 5 minutes duration each. Relative spectral power was estimated at each channel and 116 frequency bin (resolution 0.332 Hz) in the 1.5-40 Hz range. Mass univariate Wilcoxon rank sum tests were performed within a Monte Carlo permutation approach combined with a Threshold Free Cluster Enhancement procedure, to find multiple comparison-corrected spatio-spectral differences at the group level.
Results: As compared to controls, the ID group showed a lower relative power in a narrow frequency band around 11.7 Hz (high-Alpha) over a bilateral-frontal and left temporal region during eyes-open. During eyes-closed, relative power was higher in a broad frequency band, peaking at 19.7 Hz (Beta), over a large global region.
Conclusions: Previous EEG studies in insomnia suggested beta power to represent a signature of arousal during sleep (Riemann et al., 2015); we here show that it is present most prominently near 20 Hz also during wakefulness. Low high-Alpha power in the eyes-open wake EEG of people with ID is a novel finding that merits further investigation.
Funding: NeuroTime - 520124-1-2011-1-FR-ERA



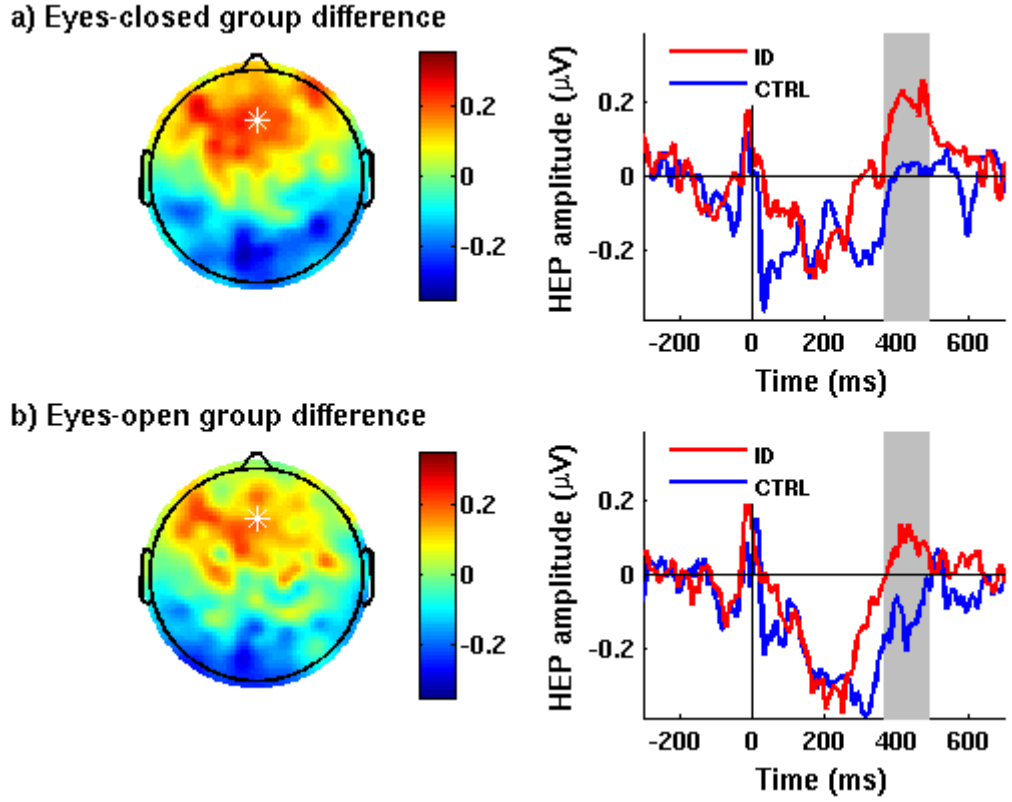
[Reduced high alpha, increased beta in insomnia]

Top panel: median, 5th and 95th percentiles are depicted within each group, for the average across scalp electrodes; Middle Panel: the group effect statistic, Z, from the sign-rank test is shown: a thin line for each electrode, a thick line for the average across scalp electrodes. Bottom panel: number of electrodes whose P value is below a significant threshold (multiple-comparison-corrected with the TFCE approach).

613 - **Heartbeat-evoked potentials indicate interoceptive hypersensitivity in insomnia**
Presented by: Yishul Wei

Y. Wei[1], J.R. Ramautar[1], M. Colombo[1,2,3], G. Gómez-Herrero[1], Y. Sweere[1], Y.D. Van der Werf[4,5], E.J.W. Van Someren[1,6]
[1]Department of Sleep and Cognition, Netherlands Institute for Neuroscience, Institute of the Royal Netherlands Academy of Arts and Sciences, Amsterdam, The Netherlands, [2]Bernstein Center Freiburg, University of Freiburg, Freiburg, Germany, [3]Centre for Chronobiology, Psychiatric Hospital of the University of Basel, Basel, Switzerland, [4]Department of Emotion and Cognition, Netherlands Institute for Neuroscience, Institute of the Royal Netherlands Academy of Arts and Sciences, [5]Department of Anatomy and Neurosciences, VU University Medical Center, [6]Departments of Integrative Neurophysiology and Medical Psychology, VU University & Medical Center, Amsterdam, The Netherlands

Objectives: Several studies showed that people suffering from insomnia disorder (ID) are characterised by trait or state hypersensitivity during wakefulness and sleep. These studies however only addressed sensory processing of external stimuli, but not interoception. Interoception can be studied by means of the heartbeat-evoked potentials (HEPs) that represent the brain response to one´s own heartbeat. The purpose of this study was to investigate whether insomnia is associated with HEP-indexed interoceptive hypersensitivity.
Methods: Participants (n=76) aged 21-70 years were recruited through www.sleepregistry.org and included 41 people suffering from ID and 36 matched controls without sleep complaints (CTRL). The Insomnia Severity Index (ISI) was above the subclinical cutoff of ISI>7 in all ID participants and ≤7 in controls. HEPs were obtained from resting-state high-density electroencephalography (hd-EEG) including electrocardiography (ECG), recorded during evening wakeful rest in eyes-open and eyes-closed conditions of 5 minutes duration each. Significance of group differences in HEP amplitudes and their topographical distribution over the scalp were identified by means of non-parametric statistics and threshold-free cluster enhancement. Exploratory regression analyses were subsequently carried out to investigate the relation between HEP amplitudes and ISI-item scores on three different sleep complaints: difficulty initiating sleep (DIS), difficulty maintaining sleep (DMS) and early morning awakening (EMA).
Results: In both eyes-open and eyes-closed conditions, ID showed a larger amplitude in the late component of the HEP than CTRL, significantly so at frontal and prefrontal sites within 372-492 ms after the R-waves. Among the three sleep complaint items, only the correlation of DMS with HEP amplitude reached significance.
Conclusions: People with insomnia show increased interoceptive sensitivity, as indexed by the brain´s response to one´s own heartbeat. Our results extend previous findings by showing that ID had altered brain responses not only to external stimuli, but also to internal ones. Interoceptive hypersensitivity seemed most disruptive to sleep maintenance.



[hep-figure]

Figure: Left: topographies of mean HEP difference (ID - CTRL) in the 372-492 ms time window in eyes-closed
(a) and eyes-open
(b) conditions.
Right: corresponding HEPs of each group at Fz (white asterisk). Grey areas highlight the time window of the late HEP component.

128 - **Sleep microarchitecture in chronic primary insomnia**
Presented by: Ali Salimi

A. Salimi[1,2,3], B. Hatch[2,3,4], M. Mograss[1,2,4], K. Packwood[2,4], S. Boucetta[1,2,3], O. Weiner[2,3,4], J. O'Byrne[1,2,3], M. Brandewinder[5], C. Berthomier[5], J.-P. Gouin[4], T.T. Dang-Vu[1,2,3]
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Objectives: Chronic insomnia affects 15% of the population with adverse effects on their quality of life. Two major brain oscillations during non-rapid-eye-movement (NREM) sleep, spindles and slow waves, are involved in sleep protection from external interference and sleep homeostasis, respectively. Given the importance of these oscillations in sleep regulation, disruptions in spindles and slow waves might contribute to sleep difficulties in individuals with chronic insomnia.
Methods and materials: 20 chronic primary insomniacs (15 F, mean age 39 years) and 15 good sleepers (11 F, mean age 34 years) underwent polysomnography. Spindle (10.5 - 16.75 Hz) and slow wave activity (0.7 - 4Hz) were computed from C4-O2 electroencephalography derivation during stages N2-N3 of NREM sleep, across the whole night and for each NREM sleep period separately. Differences in sleep microarchitecture variables were analysed using independent t-tests. Furthermore, in order to evaluate their association with daytime function impairment, correlational analyses were performed between these variables and the Epworth Sleepiness Scale (ESS), Beck Depression Inventory (BDI), and Beck Anxiety Inventory (BAI) within chronic insomniacs using Pearson´s correlation. For all analyses, significance was set at $p < 0.05$.

Results: Spindle variables (i.e., spindle density, duration, amplitude, power) did not exhibit significant differences between chronic insomniacs and good sleepers. Slow wave activity, however, was significantly lower in insomniacs during the first and the second NREM periods, compared to good sleepers (p= 0.031, p= 0.018, respectively). In addition, sigma spectral power during the first NREM sleep period negatively correlated with ESS (r= -0.531, p= 0.016).
Conclusions: These data suggest that chronic insomniacs as a group do not demonstrate deficits in sleep-protective mechanisms, however, at the individual level, insomniacs with lower sigma activity tend to display higher degrees of daytime sleepiness. On the other hand, compared to good sleepers, chronic insomniacs do show alteration in sleep homeostatic processes, as reflected by decreased slow wave activity at the beginning of the night. Future studies should further investigate the functional significance of these alterations, as well as the variations in sleep microarchitecture within subpopulations of insomniacs.

227 - **High prevalence of DSM-5/ICSD-3 insomnia, self-reported sleep problems and hypnotic use in patients visiting their general practitioner**
Presented by: Bjørn Bjorvatn

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Objectives: To estimate the prevalence of insomnia, self-reported sleep problems and hypnotic use among patients in general practice, and to evaluate whether the prevalence depends on gender and age.
Methods and materials: Questionnaire data collected by 66 medical students while deployed in general practice during their last year of medical school. A total of 1346 (response rate 74%) consecutive and unselected patients visiting their GPs answered sleep related questions.
Results: Insomnia was present in 53.6% (DSM-4/ICSD-2 diagnostic criteria) and 47.4% (DSM-5/ICSD-3 diagnostic criteria) of the patients. Sleep problems were self-reported by 55.8%, 18.0% reported much or very much problems. Hypnotic use was reported by 16.2%, daily use by 5.5%. Insomnia, self-reported sleep problems and hypnotic use were all more prevalent in females compared with males. Although hypnotic use increased with age, prevalence of insomnia was lowest in the oldest age group.
Conclusions: Insomnia, self-reported sleep problems, and hypnotic use were very prevalent among patients visiting their GPs. GPs should be aware that this might be a prominent health problem for a large patient group.

221 - **A descriptive study of insomnia between 6 and 12 year old children who admitted to department of pediatrics**
Presented by: F.Mujgan Sonmez

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Objectives: Insomnia and parasomnia are the most common sleep disorders in children. Insomnia is a sleep disorder characterized with difficulty of falling asleep or sleep resume, bedtime resistance or can't sleep independent. In school age children, insomnia frequency is 3-41%. Because insomnia is diagnosed with anamnesis and lack of sufficient study about this topic in childhood ages, this survey study was planned.
Material and methods: The study included 160 children, aged to 6 to 12, who admitted to any reason to department of pediatrics at Turgut Ozal University Medical Faculty between 1st January and 28th February 2013. According to ICSD-2 diagnostic criteria, a 48-item questionnaire including insomnia symptoms and signs, predisposing conditions, sleep patterns, demographic and social conditions was prepared. The survey by telephone or face to face interviews with parents of children filled out the forms. SPSS 16.0 software was used for statistical analysis.
Results: The study included a total of 160 children, 81 boys and 79 girls. Sixty nine insomnia cases were detected (35 boy, 34 girls). The prevalence of insomnia was similar in age groups. Insomina prevalence were higher in the groups of children who playing electronic instrument before going to

sleep, sleeping and bed sharing with someone, turned on the light at statistically significant level ($p < 0.05$). The most common problems encountered in the children who had insomnia were respectively, nervousness and irritability (61.4%), lack of attention and concentration (51.4%), self sad and feeling bad (30%).
Conclusion: Although the number of the study population were lower, prevalence rates insomnia were higher in accordance with the literature. These results suggest that questioning of signs and symptoms of sleep disorders are needed to the children to admitted outpatient clinics with different reasons, particularly and to raise awareness on the issue. We believe that these data in different age groups to address broader evaluation community health and a healthy upbringing of the younger generation may be important information.

363 - **Prevalence of insomnia and its related factors in healthy adults**
Presented by: Zohreh Yazdi

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Objective: Insomnia symptoms including difficulty in falling asleep, staying asleep, and early morning awakening are prevalent complaints in many societies. Insomnia has been associated with different adverse consequences for insomniac patients such as impaired quality of life and less productivity at work. The aim of this study was to determine prevalence of self-reported insomnia and its related factors in the general population of Qazvin, Iran.
Methods: In this cross sectional study, we evaluated 309 adults from 20 to 45 years old. Subjects with chronic disease were excluded from the study. A randomly selected sample of adults from Qazvin city completed the self-administered questionnaire. Demographic and socioeconomic data were collected. Presence of insomnia and its severity was detected by Insomnia Severity Index (ISS).
Results: mean age of participants was 32.3±12.1, and the participants were aged between 18 and 44 years. Of the total study population, 170 were female (55%), and 139 were male (45%). Mean body mass index (BMI) was 22.5±62.5. Mean duration of work per day was 8.9±2.3 hours. Forty five of participants (14.5%) were working in rotating shift. Results from ISS questionnaire showed that prevalence of insomnia in our sample was 28.4%. Logistic regression analysis showed that only age (OR=2.5), shift work (OR=3.7), duration of work hours per day (OR=2.9), and BMI (OR=3.8) were associated with higher risk for insomnia.
Conclusion: Insomnia was common in our population. More attention is needed to insomnia and its risk factors in primary clinic.

290 - **Effects of individualized aerobic exercise on sleep among overweight Finnish men with chronic insomnia**
Presented by: Xiao Tan

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Objective: Little is known about the effects of long-term aerobic exercise on overweight and physically inactive men with chronic insomnia. This study aimed to determine the effects of six-month individualized aerobic exercise intervention on sleep among overweight middle-aged men with chronic insomnia and physically inactive lifestyle.
Methods and materials: Fifty-one overweight Finnish men (Body mass index=29.6±4.2 kg/m^2) aged 30 to 65 with complaints of chronic insomnia were randomized into exercise (n=25) or control (n=26) group. Exercise group undertook six-month aerobic exercise based on their baseline fitness level and with progressive and variable intensity and time (60−75% of VO2max and 30−60min per-session), while control group remained their lifestyles. Objective sleep quality was measured by ballistocardiography (mattress sensor) for seven nights. Subjective sleep quality was assessed by seven-day sleep log and Nordica sleep disorder questionnaire. All measurements were taken both before and after intervention. Analysis of covariance with repeated measures was used to detect between- and within group differences.

Results: Using intent-to-treat methods, exercise group showed shorter objective sleep onset latency (SOL, mean in mins: 14.3 vs 17.0; *p*=0.032), and higher subjective sleep quality (SSQ, mean in 1-4 scale: 2.7 vs 2.4; *p*=0.043) than control group after six months' intervention. Efficacy analysis showed reduced objective SOL (*p*< 0.001), objective wake after sleep onset (*p*=0.007), subjective nocturnal wakes (*p*=0.012), and increased objective sleep efficiency (*p*=0.001), SSQ (*p*=0.019) in exercise group after intervention, while these variables did not differ by time in control group.
Conclusions: Six-month individualized aerobic exercise could improve both objective and subjective sleep quality among overweight men with chronic insomnia and physically inactive lifestyle.

195 - **Neurofeedback training of the sensorimotor rhythm in insomnia does not change sleep-EEG parameters or sleep quality in the long term**
Presented by: Maria-Teresa Gnjezda

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There is only little evidence supporting the efficacy of neurofeedback training (NFT) as a non-pharmacological therapeutic tool to enhance sleep quality in insomnia. In the present study we used NFT with the aim to modulate the sensorimotor rhythm (SMR). The SMR frequency band between 12-15 Hz is known to be dominant during quiet but alert wakefulness and is prevalent in light NREM sleep in the form of sleep spindles. The question of the present study was whether patients suffering from insomnia could increase their SMR-rhythm and sleep quality on the long term in a double-blind design. 20 subjects with clinical symptoms of primary insomnia, 10 mispercept insomniacs and 12 healthy control subjects were tested. A counterbalanced within-subjects design (12 NFT sessions) was adopted. Each patient participated in SMR-NFT as well as sham-Pseudofeedback (PFT) training blocks (12 each). EEG baseline recordings were scheduled before and after each training session. Data revealed that participants could increase their SMR rhythm during NFT. If beta oscillations were trained during PFT these also increased, suggesting that various EEG-parameters can be modulate within 12 NFT sessions. The healthier the subject the better was the response to the “treatment”. However, no significant long-term effect could be shown in EEG baseline-measurements directly following training. Preliminary results could also not reveal any reliable effects on sleep onset, sleep duration or sleep maintenance. Subjective sleep quality finally showed a tendency to slightly increase after both NFT and PFT conditions. In summary, the findings do not support significant NFT benefits on insomnia if (elderly) patients are suffering from chronic insomnia. Possibly, patients suffering from chronic insomnia need more than 12 NFT sessions to show significant effects on subsequent sleep episodes.

298 - **Effects of diaphragmatic breathing, progressive muscle relaxation and guided imagery on sleep, perceived stress, and cortisol salivary levels in primary insomnia sufferers: a randomized controlled trial**
Presented by: Angeliki Konsta

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Objectives: To evaluate the short-term effect of three simple behavioural relaxation techniques, in particular diaphragmatic breathing, progressive muscle relaxation and guided imagery on primary insomnia sufferers. We used a parallel-group design, with participants randomly assigned to diaphragmatic breathing, progressive muscle relaxation and guided imagery (n=27) or a control arm (standard care n=26).
Methods and materials: The study was conducted at the outpatient Sleep Study Units of Eginition Hospital and of Evangelismos Hospital, and at the Occupational Medicine Service of Hellenic Telecommunications Organization of Athens.
Fifty-three patients meeting criteria for primary insomnia according to Diagnostic and Statistical Manual of Mental Disorders (4th edition, text revision) (DSM-IV TR) were enrolled. Participants in the

intervention group were instructed to follow sleep hygiene, healthy diet and exercise and to use audio CD-assisted diaphragmatic breathing, progressive muscle relaxation and guided imagery twice a day for two months. Participants in the control group were just instructed on sleep hygiene, healthy diet and exercise. Questionnaires measured insomnia, stress, depression and sleep quality. Salivary cortisol levels were also assessed as an objective physiological measure of stress.
Results: Within the treatment arm, insomnia, sleep quality, depression, perceived stress and salivary cortisol leves were all significantly reduced.
Conclusions: Diaphragmatic breathing, progressive muscle relaxation and guided imagery were found to benefit patients with primary insomnia as far as the subjective and physiological indices of stress and the symptoms of primary insomnia are concerned.

309 - **Role of physiotherapy in improving poor sleep quality in students**
Presented by: Zubia Veqar

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Objective: To find out the role of interferential therapy(IFT), hot packs(HP) and exercises in improving sleep quality as depicted by Pittsburgh Sleep Quality Index(PSQI) in Indian university students.
Methods: It is a pretest-posttest control-group design.It was a part of a larger study conducted at Jamia Millia Islamia.Ethical clearance was taken before the commencement of the study.The students aged between 18-40 years who were poor sleepers as identified by PSQI were recruited. Subjects were randomly allocated after they signed the informed consent.A detailed history along with the demographic data was taken.Group 1 was the control group,group 2 was the experimental group with Interferential therapy, self paced walk and hot pack and Group 3 was thermal agent group.Reassessment was done after four weeks.
Results: Sixty one patients were enrolled.Twenty one patients were recruited for group 1, twenty subjects each for the group 2 and group 3.The three groups were found to be comparable by analysis of variance and no significant differences was found in the age and BMI.Fifty two subjects (85.24%) of subjects completed the study.The Analysis of variance for the post test value(PSQI G30) for between the group analysis revealed a significant difference with $F(2,49)= 20.04$, $p< .001$. The results were highly statistically significant hence post hoc analysis was done, the results of which revealed that the subjects of group 2 showed a highly significant decrease when compared to group 1($p< .001$) and group 3($p=.001$). Group 3 showed a non significant effect as compared to group1($p=.058$).Hence the results denote that out of the three groups only group 2 shows a significant decrease in the symptoms of poor sleep quality as compared to group 1 and 3.The results of within group analysis represented that the sleep quality of the subjects showed a significant improvement in group 2 but there was no such improvement in group 1 and 3.
Conclusion: There was a significant decrease in the day 30 scores of PSQI in the experimental group .The experimental group(interferential therapy, hot pack, exercise) seems to have a positive change in the subject's sleep quality as compared to control group(no intervention) and thermal agent Group (Hot pack).The improvement in sleep quality in group 2 subjects may be because of interplay of various factors viz. vasodilatation, elevation of body temperature, effects on autonomic nervous system, alteration in the various neurotransmitter.

55 - **Effect of a heavy (“weighted”) blanket on sleep in insomniacs**
Presented by: Gaby Badre

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Objectives: Many people suffer from poor sleep, which is increasing with modern stressors. Pharmacological and behavioral methods typically treat sleep disorders, but there is a need for simpler methods. Weighted blankets have shown a positive impact on sleep in autism and dementia. We aimed to investigate whether the use of a heavy blanket has a positive impact on sleep.
Methods and materials: 31 subjects with chronic insomnia (> 3 months) took part. We used a chain weighted blanket (8 kg) of chain construction. The study was a 4 week protocol, with habitual sleep in the first and last weeks, with blanket use in the intermediate weeks. Subjects filled in a sleep diary and

reported their sleep quality in a visual analogue scale and in Karolinska Sleepiness Scale (KSS) daily. They rated the use of the blanket in a questionnaire at the end. Objective measures were obtained: continuous actigraphy and 2 polysomnography (PSG) recordings (1st and 3rd week). Based on the PSGs a specific movement analysis (USleep) was done. Analyses of variance were made on the normalized data. Significance was set at $p < 0.05$ significance, although $p < 0.1$ was considered as a potential true effect.
Results: Both sleep quality ($P=0.005$) and KSS (0.068) were improved with the blanket, with a strong correlation between them ($R=0.57$ $P=0.001$).
Actigraphy: Mean sleep bouts ($P=0.035$), immobile time (%) ($P=0.096$) and sleep time (%) ($P=0.072$) increased with blanket use. The dark average activity ($P=0.032$) and total activity score ($P < 0.001$) decreased. Sleep latency and time in bed decreased with the blanket if the subject used additional sleep medication ($p=0.009$).
PSG: Spindles index was significantly decreased ($P=0.003$). Considering only the 21 subjects who liked the blanket, wake after sleep onset was decreased ($P=0.004$) and Total Sleep time (TST) increased with the blanket ($P=0.016$).
USleep: Movements were decreased the next to last hour prior to waking up (number $P=0.075$, total duration $P=0.001$) with the blanket.
Subjective reporting: The subjects liked sleeping with the blanket ($P=0.03$), found it easier to settle down ($P=0.032$), did not mind the weight of the blanket ($P=0.012$), found increased security ($P=0.042$) and improved sleep (P 0.004), feeling more refreshed in the morning ($P=0.045$).
Conclusions: The chain weighted blanket had a positive impact on sleep, both subjectively and objectively. Its use may help in insomnia and be an interesting non-pharmacological alternative approach.

650 - **A screening tool to evaluate sexsomnia in legal cases**
Presented by: Jerker Hetta

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Sexsomnia is rather newly described parasomnia, which comes into attention to sleep experts especially when legal considerations are asked for.
Some requirements for a diagnosis have been proposed, for instance inclusion of a polysomnographic recording (hypersynchonized delta, or aiming at find treatable sleep disorders). In court cases PSG is not always possible and not even required, partly because the limited availability and high costs.
Here we present a screening instrument with 10 items aiming at giving a score that can classify the suspected individual as likely or not likely to have performed sexsomnia. All items were given a score between 0-4 points. The items were questions about:
Occurrence during the first period in sleep, confusional awakening, amnesia, earlier episodes, other sleeping difficulties, other parasomnias, heredity, sleep debt, excusing or hiding, alcohol, body contact. One question about possible REM sleep behavior disorder was also included.
Conclusion: Preliminary calculations show that a score ≥ 30 is considered very likely to be sexsomnia, above 20 possible, and lower scores unlikely to be sexsomnia.

306 - **Haloperidol-induced sleepwalking: a case report**
Presented by: Ali Aşkar

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Introduction: Sleepwalking (SW), also known as somnambulism,is characterized by episodes of complex motor behavior that is initiated during sleep,including rising from bed and walking about.Sleepwalking is more common during childhood and adolescence.Sleepwalking cases have been caused by jet lag; the consumption of narcotics, sedatives, and alcohol;cardiac problems;and other medical conditions such as epilepsy,asthma, and apnoea.The present report describes a patient whose sleepwalking was triggered by haloperidol treatment and whose psychosis was triggered by bariatric surgery.
Case report: A 40-year-old male presented with an episode of pschosis and severe insomnia following bariatric surgery.He was seen in our psychiatry department with symptoms of insomnia,auditory and visual hallucinations,and depressive features.His symptoms started one month

after bariatric surgery.We prescribed him haloperidol 1 mg at bedtime.In the following weeks,his sleep remained poor and he was observed by his family walking around the house, apparently confused and unresponsive.His laboratory tests, electroencephalography, and brain magnetic resonance imaging findings were normal. Haloperidol treatment was stopped and risperidone 25 mg was initiated every two weeks for his psychosis.His psychotic symptoms and sleepwalking symptoms decreased within weeks.
Discussion: A wide range of behavioral symptoms may ocur after surgery, including new-onset or recurrent depression, hallucinations, true psychosis,mania,anxiety symptoms, impulsivity, and acute post-traumatic stress disorder.
SW's etiology and pathophysiology are not clearly understood.SW induced by medication has been reported for hypnotics, antipsychotics,lithium,antidepressants, benzodiazepines, diphenhydramine, methaqualone, and topiramate.As reported above, several antidopaminergic drugs have been associated with SW.
In the present case, there was no clinical or biochemical evidence for an organic cause of the psychotic reaction.We think that psychosis was associated with bariatric surgery and sleepwalking was associated with haloperidol treatment because there was no other organic etiology or medication that could have induced psychosis.The sleepwalking symptoms appeared three weeks after haloperidol was prescribed and decreased with risperidone treatment.
Psychosis may always occur secondary to surgery, and neuroleptic treatment may cause sleepwalking.We think that this case is important because of these reasons.

481 - **Risperidone-induced somnambulism**
Presented by: Nükhet Yigitbasi

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Parasomnias are a category of sleep disorders which involves arousal, abnormal and unpleasant experiences in emotions, behaviors and movements. One disorder belonging to this category is somnambulism (1). Somnambulism has been reported with the use of classical antipsychotics (2). However, to our knowledge, there have been a few reports of somnambulism associated with the use of atypical antipsychotics.
Somnambulism arises during slow-wave sleep (2) and reflects impairment in the normal mechanisms of arousal from sleep, resulting in partial arousals during which motor behaviors are activated without full consciousness. Drug-induced somnambulism may represent a physiological state during slow-wave sleep that mimics primary somnambulism. We present a case of somnambulism induced by risperdione in a patient with no previous history of somnambulism.
A 45-year-old male presented with the symptoms of irritability, depressive features and severe insomnia. He also had a diagnosis of diabetes mellitus for 15 years. He had taken sitalopram 20mg/d for the past 4 months before the admission. Additionally we prescribed him risperidone 0.5mg/d. After 4-5days with the initial of risperidone, he was observed sleepwalking: for 5 minutes, he wandered around his room, tidied it, organized his clothes, and then went back to sleep. He was apparently confused and unresponsive. As the treatment was ceased, the sleepwalking stopped. He reported no personal or family history of epilepsy, somnambulism, or other parasomnias. A computerized tomography scan of his head and EEG were normal. He was switched from risperidone to quetiapine; the somnambulism ceased after discontinuation of risperidone.
Discussion: Previous studies on pathogenesis of somnambulism indicated enhanced serotonergic activities. Atypical anti-psychotics, including olanzapine and risperidone, increase slow wave sleep via blockade of serotonin receptors (5-HT2C), which leads to sleepwalking. The mechanism through which atypical antipsychotics trigger sleepwalking is yet to be elucidated.
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344 - **Shape analysis of subcortical structures in idiopathic rapid eye movement sleep behavior disorder**
Presented by: Shady Rahayel

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Idiopathic rapid eye movement sleep behavior disorder (iRBD) is considered as a risk factor for the development of synucleinopathies such as Parkinson´s disease. Gray matter abnormalities in iRBD patients involve both volume and cortical thickness. Another technique, vertex-based shape analysis, allows for quantification of surface differences in subcortical structures and overcomes some limitations of voxel-based quantification. No study has yet studied shape of subcortical structures involved in cortico-subcortical loops in iRBD patients in comparison to other volume-based techniques. Forty-one patients with a PSG-confirmed diagnosis of iRBD (mean age, 65.2 ± 6.4; 33 men) and 41 controls (mean age, 63.4 ± 9.0; 26 men) matched for age and sex underwent MRI examination. Voxel-based morphometry (VBM) was used to investigate gray matter volume at a whole-brain level. Subcortical structures (i.e., putamen, caudate nucleus, globus pallidus, and thalamus) were studied for volume and surface displacement, the latter quantified through vertex-based shape analysis. Voxel- and vertex-wise generalized linear model analyses were performed using permutation-based non-parametric testing (using 10,000 permutations). For VBM analysis, absolute total intracranial volume and age were used as covariates. No covariates were used in structure-based volumetric analyses since analyses were done on volumes normalized for brain size. Shape analysis was done in the MNI152 standard space, thus normalizing for differences in brain size. VBM reveals reductions in gray matter volume in the frontal lobes (ventromedial, dorsolateral, and motor cortices) and the basal ganglia. Surface-based volumetric analyses show reduced volume of the right putamen and the left globus pallidus. Studied through shape analysis, 3 clusters of abnormal surface displacement in the left putamen (medial and lateral surfaces) and 1 cluster in the left globus pallidus were identified. Patients with iRBD present with both global volume and shape abnormalities in the putamen and globus pallidus, along with reductions of gray matter local volume in the frontal lobes. However, although volumetric and shape analyses converge on showing abnormalities in the left globus pallidus, both techniques seem complementary in showing abnormalities in the putamina. This study was supported by grants from the Canadian Institutes of Health Research, the Fonds de Recherche du Québec - Santé, and the W. Garfield Weston Foundation.

357 - **Electroencephalographic changes in idiopathic REM sleep behavior disorder without mild cognitive impairment**
Presented by: Young Rong Bang

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Objectives: Electroencephalographic (EEG) slowing has been reported in patients with idiopathic REM sleep behavior disorder (iRBD), which was more evident in iRBD with mild cognitive impairment (MCI) than without MCI. However, EEG changes in iRBD without MCI need to be more thoroughly investigated in a large sample with the use of comprehensive EEG protocols.
Methods: A total of 60 polysomnographically confirmed iRBD patients and 32 sex and age-matched healthy controls were included, and all participants had apnea-hypopnea index < 15. The Korean version of the Consortium to Establish a Registry for Alzheimer's Disease Assessment Packet Neuropsychological Assessment Battery (CERAD-K-N) was administered and waking EEG was recorded from five cortical regions with five frequency bands for 15 minutes. Patients with abnormal cognitive function were clinically re-evaluated for confirmative diagnosis of MCI. Power spectral analyses by fast Fourier transforms were performed on EEG data.
Results: MCI was diagnosed in 10 subjects (16.7%) in iRBD patients and 3 (10.7%) in controls, and thus, 50 iRBD [-]MCI patients and 29 controls were finally analyzed. In PSG data, total sleep time ($p=0.005$) and sleep efficiency ($p=0.002$) were decreased and wake after sleep onset ($p=0.034$) was increased in iRBD [-]MCI patients compared to controls. After adjusting sleep variables, patients with iRBD [-]MCI tended to show lower general cognitive functioning than controls, though statistically not significant with correcting multiple comparisons (Mini Mental State Examination, 26.74±2.41 vs

27.97±1.59, p=0.017). However, in EEG data, dominant occipital frequency and mean power spectrum in occipital region were significantly slower in iRBD [-]MCI patients compared to controls (9.27±0.32 Hz vs. 9.48±0.37 Hz, F=4.423, p=0.011).
Conclusions: Patients with iRBD patients, even those without concomitant MCI, showed subtle EEG slowing in posterior cortical regions before they had definite decline of cognitive function. Changes of EEG might precede cognitive declines in patients with iRBD.

353 - **A quantitative study of REM without atonia in healthy sleep**
Presented by: Shin-Hye Baek

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Objective: Rapid eye movement (REM) without atonia (RWA) is essential for diagnosis of REM sleep behavior disorder (RBD). In contrast, there is no quantitative threshold for RWA in RBD and studies for RWA in healthy sleep are largely lacking. We quantitatively investigated RWA in people who has no history of dream enactment.
Methods and materials: This was a cross-sectional analysis from the ongoing prospective cohort study, the Korean Genome and Epidemiology Study (KoGES). We included 2,868 adults (male 49.3%, range 50-80 years, 59.1±7.2) who participated in the KoGES evaluation, 2012-2013 were utilized in this study. All subjects were asked to fill out the RBD Screening Questionnaire, and healthy people was defined when the score was less than 5. Fifteen thousand subjects underwent polysomnography (PSG) and 681 PSG of healthy subjects was included. Tonic, phasic, and any EMG activities of mentalis during REM sleep on PSG were quantified.
Results: The difference in mentalis EMG activity measures over the respective age groups was not significant (P > 0.05). Men and women did not differ in respect to mentalis EMG activity measures (P > 0.05). Results remained unchanged when entering both age and sex in a linear regression model (P > 0.05).
Conclusions: Results of this study demonstrated no sex- or age dependent difference in any of the EMG activity measures. Quantification of RWA in middle aged healthy subjects is first step toward early diagnosis of RBD.

528 - **Paroxysmal agitated sleep-related episodes in adolescents and adults: atypical NREM parasomnias or sleep-related seizures? A clinical and video-polysomnographic study**
Presented by: Giuseppe Didato

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Objectives: Differential diagnosis between parasomnias and sleep-related epileptic seizures may be based on anamnestic clinical criteria, but also on neurophysiological data, particularly when history is not reliable.
We present twelve patients with paroxysmal sleep-related episodes, characterized by agitated behaviour, whose diagnosis was difficult because of ambiguous anamnestic and neurophysiologic results. Some of them were previously diagnosed as affected by sleep epilepsy.
Methods and materials: Twelve patients (mean age 28 years, range 13-48, four males and eight females) presented high frequency nocturnal episodes with onset during late childhood/adolescence or adulthood. The episodes were characterized by sudden onset usually followed by sitting on the bed, screaming, pedalling, sometimes standing up or running away, terrified facial expression, no recall of the event. The frequency was high, almost every night, in some patients increasing while growing up. They occurred mainly during the first half of the night. Menstrual cycle could facilitate the episodes in two women. Family history was positive in three cases.
Results: Video-polysomnographic recordings (VPSG) documented several nocturnal episodes in each patient. Electro-clinical features of the episodes were not univocal, duration ranged from a few seconds to a few minutes, but the great majority occurred during slow wave sleep. Interestingly, some aspects of the documented episodes resulted different from what was previously reported by the

patients or their relatives. Neither epileptic ictal activity nor interictal epileptiform discharges were observed. Sleep structure showed a mild to moderate fragmentation. Brain MRI was uninformative. We interpreted that these patients were affected by NREM parasomnias with atypical features. Therefore, they were treated with drugs aimed at stabilizing sleep (Melatonin or 5 Hydroxytryptophan) and the majority of them showed a good response, with disappearance or significative reduction of the paroxysmal episodes.
Conclusions: The neurophysiological characterization of the paroxysmal sleep-related episodes by VPSG allowed us to identify some important electro-clinical features that resulted essential for the diagnostic conclusion and for the effective treatment of this group of patients, who showed difficult to classify sleep-related episodes.

415 - **Psychological treatment for chronic nightmares - randomized controlled trial with two active treatments and wait-list control**
Presented by: Susanna Jernelöv

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Objectives: Nightmares are a prevalent parasomnia affecting 2-6% of the population. Disturbed sleep, fear and distress during night and/or day, expectancy anxiety and impaired functioning are common. In addition, nightmares seem to contribute to the development and maintenance of psychiatric problems, and rates of suicide have been reported higher in individuals with nightmares.
Different forms of Cognitive Behavioral Treatments (CBT) have been studied to treat nightmares. Applied Relaxation (AR) has some empirical support but Imagery Rehearsal Therapy (IRT) is so far the most empirically supported treatment.
Self-help-CBT with therapist support, including Internet-delivered CBT (ICBT) is effective for a wide range of conditions, including insomnia. Some self-help treatments for nightmares have been tested, but often non-supported and so far no ICBT-studies have been reported. The aim of the present study was to evaluate and compare the effectiveness of IRT and AR as ICBT-treatments for nightmares.
Methods and materials: This randomized controlled trial compares two six-week long guided ICBT-programs, IRT (n=74) and AR (n=73) with each other and with a wait-list control group (WL; n = 28). DSM-V criteria were used for diagnoses, and idiopathic nightmares were the main target of the intervention. Treatment consisted of step-by-step modules delivered on a web-platform including a secure message system where patients reported homework and received feedback by a therapist with thorough training in CBT, spending approximately 10-15 minutes each week on a patient.
Primary outcomes measured at post-treatment and nine months after treatment were nightmare frequency (number per week) and nightmare related distress as measured by a two-week diary. Insomnia and depression were measured with self-report questionnaries as secondary outcomes.
Results: Preliminary results for 135 patients showed significant superiority of IRT compared to both AR and WL on frequency and distress at post-treatment. Both active treatments showed effect on insomnia severity compared to WL, and symptoms of depression decreased in all groups. Effect-sizes were in the small to moderate range. Final results for post-treatment and nine-month follow-up are presently analyzed and will be presented.
Conclusions: IRT as an ICBT treatment for nightmare disorder is promising, showing superiority to an active control on diary rated nightmare frequency and severity, and a small effect on insomnia severity.

667 - **Migraine and REM sleep behaviour disorder**
Presented by: Nesrin Helvaci Yilmaz

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Objective: REM sleep behaviour disorder (RBD) and migraine are two different diseases the source of which is shown to be the brainstem. Our aim in this study is to examine the relationship between the

two diseases.
Methods: The study is conducted in two main parts; in the first part, the patients with migraine are assessed in terms of RBD with RBD assessment questionnaire. Afterwards, the patients who received 5 or over, meaning the patients diagnosed with 'dream enacting behaviours' were called on the phone and recommended to take polysomnography (PSG). In the second part of the study, the patients which have accepted this have been taken a one night PSG records.
Results: Among the 230 people, who have participated in the questionnaire of REM sleep behaviour disorder, 51 of them (22.2%) have received 5 points and above. Eleven patients among fifty-one have taken PSG. Among these 11 patients, whose both electrophysiological and video monitorization records are taken, 6 of them (54.5%) have been diagnosed with RBD.
Conclusion: According to these results, we conclude that in the migraine disease, which is common in the society, RBD has high frequency. Controlled studies with higher number of patients are required.

31 - **Association between dysfunctional beliefs and attitudes about sleep and insomnia in three groups of psychiatric patients**
Presented by: Zohreh Yazdi

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Objective: Dysfunctional beliefs about sleep are recognized to be associated with sleep disorders in general population. The author investigated frequency of dysfunctional beliefs and attitudes about sleep in three groups of patients suffering from psychiatric disorders (Major depression, bipolar and anxiety patients).
Methods: Study sample for this cross sectional study consisted of 150 patients with psychiatric disorders referred to psychiatry clinic of teaching hospital, Qazvin University of medical sciences, Qazvin, Iran. Inclusion criteria was patients with major depression, bipolar and anxiety disorders who were able to respond to questions. Fifty patients in each group were selected. All patients completed dysfunctional beliefs and attitudes about sleep (DBAS) and insomnia severity index (ISI). Data were analyzed by SPSS software version 19.
Results: The mean scores of DBAS were 46.4±12.1, 44.4±9.5, and 42.8±9.8 in bipolar, anxiety and major depression patients, respectively. The frequency of insomnia in our patients was 36%, 41%, and 47%, respectively. A positive correlation DBAS scores and insomnia was found in three groups ($P< 0.05$). Some dysfunctional beliefs about sleep predicted sleep disturbance to a greater extent than others.
Conclusion: Like general population, psychiatric patients have high frequency of dysfunctional sleep beliefs. Regarding the relationship between dysfunctional beliefs and attitudes about sleep with insomnia, future work is needed in this area for better management of patients.

629 - **Utility of polysomnography in the evaluation of non REM parasomnias - assessing evidence for trigger factors**
Presented by: Nishani Baskaralingam

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Introduction: Non-REM parasomnias are some of the commonest parasomnias which present to clinics. The AASM does not recommend routine use of polysomnography in the diagnostic evaluation. Some studies have suggested that Non-REM parasomnias may be triggered by factors such as sleep disordered breathing and periodic limb movements of sleep. However, such evidence had only been shown in small non controlled studies.
Objective: The aim of this study is to look at the utility of polysomnography in the evaluation of patients presenting with a history suggestive of a Non-REM parasomnia. We sought to identify by polysomnography trigger factors and other co-morbid pathology associated with Non-REM parasomnias.
Methods: A search of sleep clinic letters through the patient electronic records identified adult patients who had presented with features suggestive of a NREM parasomnias. The clinic letters and the polysomnography results were reviewed.

Results: A total of 560 patients were identified. Sleep terror and sleep walking were the most prevalent NonREM parasomnias. Other sleep pathology was found to be present in more than 10% of the patients. Snoring was reported 1 in 4 patients. Features of REM behaviour disorder suggestive of an overlap syndrome were noted in 17.9%. Obstructive sleep apnoea was noted in 16.4% of the patients and periodic limb movements of sleep were seen in 10.4% of patients.
Conclusions: We can conclude that polysomnography is essential in the diagnostic evaluation of patients with a suspected Non-REM parasomnia as it identified a significant amount of co-morbidity and trigger factors.

471 - **REM sleep without atonia (RSWA): which sleep disorders are associated with RSWA other than REM sleep behavior disease?**
Presented by: Hava Özlem Dede

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Introduction: REM sleep without atonia (RSWA), the loss of normal REM sleep skeletal muscle tonus, is the physiologic substrate of REM sleep behavior disorder (RBD). In this study, we evaluated the clinical and demographic characteristics of patients with RSWA diagnosed during polysomnography (PSG), and analyzed other sleep disorders associated with RSWA.
Methods: All PSG recordings performed in Istanbul University Cerrahpasa Faculty of Medicine Sleep Disorders Department between January 2013 and December 2014 were examined. PSG recordings and scoring were done according to latest criteria defined by AASM: phasic and tonic muscle activity from submental (SM) muscle and phasic muscle activity from anteior tibialis (AT) muscle were separately analyzed. The demographic, clinical an PSG data of all patients with RSWA were recorded, including gender, age, body mass index, the presence of systemic illnesses, sleep organization, and sleep disorders.
Results: Among 959 patients, 129 patients had RSWA (13%). Forty four patients (34.1%) were females. The mean age was 51.6 ± 17.0 years. In 121 patients, RSWA was present only in SM, 3 patients had RSWA only in TA, and 5 patients had RSWA in both SM and TA. Of 129 patients, 66 patients (51.1%) had clinical RBD. Among remaining patients with RSWA without clinical RBD, 53 patients (84.1%) had obstructive sleep apnea syndrome; the mean respiratory disturbance index was 20.6, 17 patients (26.9%) had periodic leg movements in sleep (PLMS). The mean PLMS index was 10.4/hour. Of other sleep disorders, 5 patients (7.9%) had narcolepsy, 6 patients (9.5%) had NREM parasomnia. Five patients (7.9%) were under medication with an antidepressant drug. Eight patients (12.6%) had neurodegenerative disorder and parkinsonism.
Conclusions: RSWA is commonly observed during clinical practice in sleep medicine, mostly in association with other sleep disorders, not only in sleep related breathing disorders but also in sleep related movement disorders, narcolepsy and NREM parasomnias. It should therefore be emphasized that in the presence of RBD, either secondary cases or associated disorders should be evaluated by polysomnography. Our findings also showed that even in the absence of RBD, RSWA is common in association of sleep disorders and clinicians should be aware of a higher RBD risk in these patients with RSWA in clinical follow-ups.

149 - **Pain in sleepwalking: a clinical enigma**
Presented by: Régis Lopez

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Objectives: Sleepwalking is a disease model for specific slow-wave sleep disruption with dissociation of the brain activity that may interest the regions involved in nociception. Our objectives were to assess the frequency of chronic pain, headache and migraine in sleepwalkers compared to normal controls, to study the impact and determinants of pain in sleepwalkers, and to report the frequency of analgesia during injurious parasomnia episodes.
Methods: One hundred adult patients with sleepwalking were evaluated for disease characteristics, sleep (polysomnography, daytime sleepiness, and insomnia), pain (chronic pain-multidimensional pain inventory, headache and migraine), depressive symptoms and quality of life in comparison to 100 adult controls. Pain perception was assessed during injurious episodes of parasomnias.

Results: Lifetime headache, migraine and chronic pain at time of study were significantly associated with sleepwalking in crude associations. Sleepwalkers reported more frequently than controls the occurrence of daytime sleepiness, depressive and insomnia symptoms with increased risk of sleepwalking persisting only for headache and migraine after adjustments (OR=3.80; OR=10.04 respectively). Compared to pain-free sleepwalkers, those with chronic pain (n=44) were more likely older, with higher daytime sleepiness, insomnia and depressive symptoms, without any difference in polysomnography assessment. Among the 47 sleepwalkers experiencing at least one lifetime violent parasomnia behavior, 78.7% perceived no *pain during episodes* leading them asleep despite serious injury.
Interpretation: Sleepwalkers had an increased frequency of chronic pain, migraine and headache together with an alteration of pain perception during severe episodes of parasomnia that suggests a link between dissociation of the brain activity and nociception dysregulation.

520 - **The new ICSD-3 MSLT/PSG criteria for the diagnosis of narcolepsy will not increase frequency of narcolepsy diagnosis**
Presented by: Peter Geisler

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Objective: The 3rd edition of the International Classification of Sleep Disorders (ICSD-3) revised the diagnostic criteria for narcolepsy. Among other changes, it states that “a sleep onset REM period (SOREMP) (within 15 minutes of sleep onset) on the preceding nocturnal polysomnogram (PSG) may replace one of the SOREMPs on the MSLT”. We investigated whether this additional criterion would impact on the diagnostic classification of hypersomniac patients according to MSLT/PSG parameters.
Methods: Database review.
Results: From our records we identified 540 unmedicated patients evaluated with a 5 session MSLT and previous PSG for differential diagnosis of hypersomnia from 2001 to 2013. Among them, 89 fulfilled the ICSD-2 criteria for narcolepsy (≥ 2 SOREMP and mean sleep latency (MSL) ≤ 8 min) in the MSLT. Forty patients presented with 1 SOREM and an MSL ≤ 8 min, and were thus candidates for diagnostic reclassification. Out of these, only one single patient showed a SOREMP in the preceding nocturnal PSG. PSG SOREMPs were more frequent in patients fulfilling the ICSD-2 criteria for narcolepsy (2 MSLT-SOREMPs: 3/31; 3 MSLT-SOREMPs: 5/19; 4 MSLT-SOREMPs: 7/22; 5 MSLT-SOREMPs: 14/17).
The Number of SOREMPs in the MSLT was correlated (bivariate Spearman's rho < .001) with mean sleep latency in the MSLT (rho = -.44), REM latency in the preceding PSG (rho = -.37) and age (rho = -.27).
Conclusions: The new provision in the ICSD-3 that a SOREMP in the nocturnal PSG preceding the MSLT may replace one of the SOREMPs in the MSLT will probably have only a minor effect on the diagnosis of narcolepsy.

165 - **A case report of narcolepsy, presenting with leading symptom - frequent vivid hypnagogic hallucinations**
Presented by: Kiril V. Terziyski

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Objectives: This is a case report of atypical presentation of narcolepsy and concomitant complex sleep apnea.
Materials and methods: A 71-year-old male with a history of loud snoring and excessive daytime sleepiness (EDS) for 20 years and newly occurred (4 months) hypnagogic hallucinations of people and „monsters with horns and chimes” every night, and ambiguous data of sleep paralysis and cataplexy. Neurological examination and electroencephalography were normal. Computed tomography concluded chronic cerebrovascular disease and mild cortical atrophy. No psychiatric disease was present. History for arterial hypertension, ischemic heart disease, chronic heart failure, chronic obstructive pulmonary disease, second-grade obesity and glaucoma, without therapy change in the last 6 months. The patient underwent a split-night polysomnography (PSG) and multiple sleep latency

tests (MSLT) on the next morning and 5 months later.
Results: The PSG showed complex sleep apnea with apnea-hypopnea index (AHI)=90.7/h in the diagnostic part, that decreased with continuous positive airway pressure (CPAP) treatment (at optimal pressure 14 cm H_2O) to AHI=49.6/h, at the expense of central (24.3/h) and mixed (7.9/h) events. A significant improvement was present in mean oxygen saturation (SpO_2) (from 84.5% to 88.9%), lowest SpO_2 (from 66.0% to 80.0%) and average desaturation (from 8.9% to 4.5%). Rapid eye movement (REM) sleep latency was 1.0 min from sleep onset. Sleep architecture, calculated for the whole night was N1 - 2.8%, N2 - 39.0%, N3 - 19.8% and REM - 38.4% of TST=376.0 min. MSLT results showed mean sleep latency of 0.9 min with 3 SOREMPs.
The patient was diagnosed with narcolepsy and prescribed Venlafaxin 75 mg once daily and Modafinil 100 mg once daily in the morning. No hallucinations were present. A week later CPAP treatment at fixed pressure 14 cmH_2O was initiated. Two weeks after that the patient reported complete resolution of the EDS and the other symptoms. Device follow up (at day 86) showed perfect compliance with average daily usage of 7.2 hours and average AHI=8.5/h. Control MSLT showed no sleep during the nap opportunities.
Conclusions: The peculiarity of this case is the presentation of narcolepsy with leading symptom - vivid and frequent hypnagogic hallucinations, which were completely resolved with Venlafaxin. The combination of narcolepsy with OSA is frequent, but the addition of central sleep apnea may complicate CPAP treatment and EDS resolution.

462 - **Post vaccination narcolepsy-cataplexy**
Presented by: Ulf Kallweit

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Introduction: Narcolepsy-cataplexy (NC, or narcolepsy type 1, NT1) is suggested to be an immune-mediated disorder affecting genetically predisposed individuals coupled with exposure to environmental factors. Environmental factors include infectious diseases (streptoccal and H1N1 virus infections) and vaccination. An increased number of NC after H1N1 vaccination with Pandemrix® has been reported from several European countries. The specific composition of Pandemrix® is assumed to be causal: a higher amount of polymeric H1N1 virus nucleoprotein (NP) was detected when compared to another H1N1 vaccine, Arepanrix®.
We aimed at assesing the presence and characteristics of NC following other vaccinations than Pandemrix®.
Methods: A retrospective chart review and prospective data assessment of NC patients was conducted at two major sleep centers in Germany and Switzerland. Demographics, clinical, laboratory, and sleep laboratory data, and extraction of information on vaccinations (e.g. vaccination card) was performed.
Results: Overall data from 148 patients with NC were analyzed. There were 16 (11%) cases following Pandemrix® and seven (5%) following other vaccinations.
Out of these seven, there were five boys/ men. Mean age (at the time of vaccination) was 16 years (range 7-36). First symptoms (excessive daytime sleepiness and/or cataplexy) occurred 5.5 weeks (mean) after vaccination. Patients were vaccinated for: tick-borne encephalitis (4); seasonal influenza (1), tetanus (1), hepatitis B virus (1). In 4/7 patients, a higher vaccine dosage than recommended or an accelerated vaccination schedule was applied. All patients were HLA DQB1 0602 positive.
Conclusion: Other vaccinations besides of Pandemrix® are associated with the occurrence of NC. In the majority of cases, high antigen dosages have been applied. This was also the case for Pandemrix®. Our findings implicate, that maybe not the specific composition of a vaccine but the high antigen dosage in general (and thus severe immunological activation/ response) might be relevant for the release of the immune-mediated process finally resulting in the destruction of hypocretin cells-narcolepsy.

322 - **Narcolepsy in elderly: case-control study**
Presented by: Petra Kovalska

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Objectives: Narcolepsy is a life-long disease. Very little is known about its progress in advanced age. Therefore we focused on various aspects of narcolepsy in patients over 60 years of age.
Methods and materials: 47 patients (20 men and 27 women) aged 61-87 years, previously diagnosed with narcolepsy according to ICSD 2 (5 of them without cataplexy), underwent semi structured interview and filled out a set of questionnaires. The data were completed with their medical records. 46 sex- and age-matched non-narcoleptic controls provided equal information. The data from the two groups - narcoleptic patient group (N) and non-narcoleptic control group (C) - were statistically compared.
Results: We found higher body mass index (BMI) (mean 31.1 versus 27.5, p=0.003) in N. Arterial hypertension, coronary heart disease, hypothyreosis, diabetes and oncological diseases were represented equally in the both groups. More cases of medically treated depression were found in the history of C (6.4% N vs 21.7% C). Geriatric Depression Scale score was however higher in N (5 versus 2.4, p< 0.001). N had higher score in Epworth Sleepiness Scale (17.1 vs 4.4, p< 0.001), lower in the attention part of Addenbrooke´s cognitive examination (16.7 vs 17.3, p=0.02) and in Short Physical Performance Battery (8.2 vs 9.8, p=0.01). Both groups had comparable factors of achieved level of education, number of children, marriages and jobs during their lifetime. However, in total N spent significantly less years at work. Reaching retirement age C tended to stay at work whereas N left their jobs (mean 2.2 vs 5.4 years working after retirement, p=0.01). At the age of 60-70 C also slept less in comparison to N (8.9 vs 7.1 hours a day, p< 0.001). At any other age reported time spent daily sleeping was equal. Lastly, N smoked more cigarettes than C during lifetime (32 vs 9.3 years in average, p< 0.001; 16.9 vs 4.9 cigarettes per day in average, p< 0.001).
Conclusions: Several differences not including only sleep habits were found between the narcoleptic and non-narcoleptic groups. Elder narcoleptics appear to leave their jobs earlier although their morbidity apart from narcolepsy seems to be similar to non-narcoleptics. They have much higher BMI and suffer from lower physical performance, lower ability to concentrate, higher depressiveness and sleepiness according to the standardized scales.
Supported by the Czech Ministry of Health grant NT 13238-4/2012

624 - **Description of a Portuguese narcoleptic population**
Presented by: Ana Viegas

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Objectives: To describe specific characteristics of a Portuguese narcoleptic population, particularly in what concerns the differences between:
1) Population with definite diagnosis of Narcolepsy (N) and cases of suspected Narcolepsy (SN);
2) Narcolepsy with (NC) and without cataplexy (NWC);
3) Children and adults according to the age of disease onset;
4) Positivity or not for HLA DQB1*0602.
Methodology: 231 Portuguese patients of both genders were selected. Patient classification was performed according to the ICSD-2 via a clinical interview with the application of the Narcoleptic Sleep Inventory and Epworth Sleepiness Scale, a type I PSG followed by MSLT and HLA typing. 177 represent the N and 54 are cases of SN. Descripitive statistics and chi square analysis were used.
Results: The patients have high academic qualifications (N=54.5%; SN=67.9%) and a very small percentage is unemployed (N=0.6%; SN=1.9%). Patients with negative HLA presented higher graduation.
The main distinction between N and SN is the average number of SOREM's (N=2.0;SN=0.4). The positivity of HLA DQB1*0602 is low in both groups (PN=52.5%; PWN=33.3%). In SN nightmares and dreams are frequent complaints (dreams=51.9%; nightmares=14.8%).
NC (67.8%) was more prevalent than NWC (32.2%). The average number of SOREM's is higher in NC (NC=3.1; NWC=2.4) whereas the mean REM latency in MSLT is lower (NC=3.9;NWC=6.4 minutes). In NC, sleep paralysis (NC=40.8%; NWC=21.1%) and hallucinations (NC=47.5%; NWC=26.3%) are common while dreaming is more frequent in NWC (NC=28.3%; NWC=52.6%). HLA DQB1.0602 was more prevalent in NC (NC=57.7%; NWC=37.1%).
Children and adult narcoleptic differ in the delay in diagnosis (children=15.6; adults=6.9 years), average number of SOREM's (children=3.4; adults=2.6) and prevalence of nightmares (children=33.3%; adults=13.6%).
HLA positivity was associated with lower mean REM latency in MSLT (HLA positive=3.8; HLA negative=7.0 minutes) and higher average number of SOREM's (HLA positive=2.9; HLA

negative=2.4).
Conclusions: Suspected narcolepsy is an interesting and complex issue.
In the present data there are no significant differences with narcoleptic cases since the main difference relates to a classification issue.
Furthermore, depression might be more relevant.
The prevalence of HLA DQB10602 is lower than usually stated in the literature.
The longer diagnostic delay in children, also observed by others, enhances the diagnostic difficulties in this age group.

100 - **Correlation of patient and clinical global impression of change in disease status in a clinical trial of JZP-110 for the treatment of narcolepsy**
Presented by: Jed Black

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Introduction: JZP-110 is a wake-promoting agent that appears to have a distinct mechanism of action that improved objective and subjective symptoms of excessive sleepiness in adults with narcolepsy in a 12-week trial [Black, et al. *J Sleep Res* 2014;23(Supp 1):32-33]. This post hoc analysis evaluated the correlation between the patient and clinician perspectives for overall change in disease status.
Methods: Adult patients with a diagnosis of narcolepsy were enrolled in a phase 2b, double-blind, placebo-controlled, parallel-group study and were randomised to receive 12 weeks of once-daily placebo (n=49) or JZP-110 (n=44) 150 mg/day (weeks 1-4) and 300 mg/day (weeks 5-12). Change in disease status from baseline was assessed at 1, 2, 4, 6, 8, and 12 weeks using the Clinical Global Impression of Change (CGI-C) and Patient Global Impression of Change (PGI-C) scales, both scored using a 7-point Likert-type scale from 1="very much improved" to 7="very much worse." This analysis used a Spearman correlation to evaluate the relationship between the CGI-C and PGI-C at week 12 using a last-observation-carried-forward imputation approach for the entire population.
Results: Data were available from 90 patients between the 2 groups who were similar in demographic and clinical characteristics. At week 12, JZP-110 resulted in significantly more patients with improvement on the CGI-C (86.0% vs 38.3%; $P< 0.0001$) and PGI-C (93.0% vs 38.3%; $P< 0.0001$) than placebo. A large percentage (74.4%) of PGI-C scores matched the CGI-C scores. The correlation between the PGI-C and CGI-C scores was strong and statistically significant (Spearman $r=0.868$; $P< 0.0001$).
Conclusion: There was good concordance in the clinician- and patient-reported assessments of change in disease status among patients with narcolepsy treated with JZP-110, as indicated by a strong and statistically significant positive correlation between the CGI-C and PGI-C scores.

340 - **Intermediate decline of CSF orexin (hypocretin) and significant obesity in Prader-Willi syndrome patients compared with narcolepsy and idiopathic hypersomnia**
Presented by: Takashi Kanbayashi

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Introduction: Prader-Willi syndrome (PWS) is an acquired neurodevelopmental disorder caused by deletion in chromosome. Patients with PWS often exhibit excessive daytime sleepiness (EDS), increased appetite, and obesity. As well as in narcolepsy, orexin (hypocretin) may be responsible for the symptoms. However, report regarding the correlation between obesity and orexin level in PWS is scarce. Here we discuss the relationship between obesity and orexin level in PWS patients, compared

with narcolepsy and idiopathic hypersomnia (IHS) patients.
Methods: We examined orexin levels in the cerebrospinal fluid (CSF) of 10 patients with clinically and genetically confirmed PWS with EDS, compared with 37 cases of narcolepsy patients with cataplexy, and 13 cases of IHS patients. Patients' body mass index (BMI) at the time of CSF examination was determined. All patients are Japanese and aged 15 to 50 years old.
Results: CSF orexin level (mean ± S.D.) in PWS, narcolepsy, and IHS was 194 ± 45 pg/ml, 79 ± 75 pg/ml, and 291 ± 74 pg/ml, respectively. BMI (mean ± S.D.) in PWS, narcolepsy, and IHS was 34.4 ± 8.5, 23.4 ± 4.0, and 22.6 ± 2.1, respectively. Orexin level in PWS was significantly higher than narcolepsy, and lower than IHS. BMI was significantly higher in PWS than narcolepsy and IHS.
Conclusion: Orexin level and BMI was higher in PWS than narcolepsy patients. Intermediately decreased orexin level in PWS patients suggests that both impaired secretion and receptor function of orexin may play a role in exhibiting symptoms such as sleepiness, increased appetite and obesity.

46 - **Transcranial direct current stimulation (tDCS) improves vigilance and daytime sleepiness in a patient with organic hypersomnia following reanimation**
Presented by: Christoph Nissen

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Objectives: This study investigated whether bi-frontal anodal transcranial direct current stimulation (tDCS) can improve vigilance and daytime sleepiness in a 52-year-old patient with organic hypersomnia after reanimation due to an allergic reaction 10 years earlier. Anodal tDCS increases excitability in target cortical areas presumably increasing arousal via cortico-thalamo-cortical feed-back loops.
Methods and materials: The study comprised an initial proof-of-concept phase. Three sessions of anodal stimulation and three sessions of sham stimulation (single blind) were administered in an alternating order on consecutive days. Vigilance, operationalized as reaction speed in the psychomotor vigilance task (PVT), was assessed prior to and after the stimulation protocol. In the second phase, three sessions of anodal stimulation on consecutive days were followed by one month of clinical monitoring with daily subjective ratings of daytime sleep. The tDCS protocol comprised repetitive (2 times 13 min, interstimulus interval 20 min) bi-frontal anodal stimulation (1 mA over each stimulation electrode FP1/FP2, reference electrodes P3/P4).
Results: In the initial proof-of-concept phase, the analysis of variance of reaction speed revealed a significant Time (prior to vs after stimulation) and Condition (anodal vs sham stimulation) effect as well as a significant interaction. The reaction speed significantly deteriorated following sham stimulation and improved following anodal stimulation compared to baseline. In the second phase, the analysis of subjective ratings showed a significant reduction of daytime sleep over two months.
Conclusions: The findings provide initial evidence for the improvement of vigilance and daytime sleepiness in organic hypersomnia through bi-frontal anodal tDCS. This might offer a novel treatment strategy for hypersomnia, a condition with limited treatment options.

214 - **Clinical and polysomnographic determinants of sleepiness in a South East Asian population**
Presented by: Rahmat Siti Nur Zakiah

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Objectives: Excessive daytime sleepiness is common in patients with obstructive sleep apnoea (OSA). The apnea hypopnea index (AHI), which is a marker of OSA severity is a poor predictor of sleepiness. It remains unclear whether hypersomnolence in OSA patients is driven by sleep fragmentation, hypoxemia induced brain changes or the increased incidence of confounding factors such as increased age or obesity [1]. We sought to identify demographic, clinical and polysomnographic predictors of somnolence in our local Southeast Asian population.
Methods and materials: A retrospective analysis of polysomnography (PSG) studies and clinical data

from patients seen between January 2012 to December 2014 at the Sleep Disorders Unit, Singapore General Hospital. Baseline demographic and clinical variables and the Epworth sleepiness scale (ESS) were recorded at the initial visit. Inpatient attended video polysomnography was performed. Scoring was done as per the 2012 American Academy of Sleep Medicine recommended criteria.
Results: 2554 patients were included and 71.4% were male with median age of 46 years. The presence of mild (AHI 5-15) moderate (AHI 15-30) and severe OSA (AHI >30) were 22.7%, 20.8% and 33.4% respectively. Correlates of ESS are shown in table 1. Differences between sleepy (ESS **≥** 10) and non-sleepy (ESS < 10) patients are shown in table 2. Malay patients are also significantly more likely to be sleepy than other races (*p*=0.047). Stepwise multi-logistic regression analysis was performed and the only independent predictors of being sleepy were nadir SpO_2 < 80% (OR1.69, CI 1.37-2.07, p< 0.001) and age (OR 0.98 per each year increase, CI 0.98-0.99, p< 0.001) even after adjusting for BMI and OSA severity. AHI was only a weak predictor and only significant when analysed as a continuous variable.

Correlation with ESS score	Spearman's Correlation Coefficient	P-value
BMI	0.0471	0.017
AHI	0.0960	<0.01
Sleep Onset Latency	-0.1170	<0.01
Age	-0.1403	<0.01
Neck Circumference	0.0750	<0.01
Arousal Index	0.0763	<0.01
SpO_2 Nadir	-0.0976	<0.01

Table 1. Clinical and polysomnographic correlates of ESS

Characteristic	Sleepy (ESS ≥ 10)	Non-sleepy (ESS < 10)	p-values
Patients (n)	1017	1537	
Male (%)	74.1	69.6	0.012
Age (years)	43.4 ± 14.5	46.7 ± 14.4	<0.001
BMI (kg/m²)	28.4 ± 6.8	27.7 ± 5.8	<0.001
Neck Circumference (cm)	39.5 ± 4.4	38.8 ± 4.4	<0.001
Sleep Efficiency (%)	83.0 ± 12.4	80.3 ± 13.7	<0.001
AHI (/h)	31.3 ± 30.8	24.7 ± 25.0	<0.001
Nadir SpO_2 saturation (%)	79.5 ± 12.8	82.3 ± 10.4	<0.001
Sleep onset latency (in min)	17.5 ± 23.2	19.3 ± 23.5	0.04
Arousal index (/h)	26.1 ± 25.3	20.4 ± 18.5	<0.001

Table 2. Clinical and polysomnographic differences between sleepy and non-sleepy patients. Data are presented as mean ± SD, unless otherwise stated. *p<0.05

[Correlates for ESS & Differences btwn predictors]

Discussion and conclusion: In this large retrospective cohort of patients undergoing polysomnography, nadir SpO_2 < 80% was found to be the strongest independent factor for being sleepy, whereas obesity and severe OSA were not. This supports the hypothesis that sleepiness in OSA patients may be a result of recurrent hypoxemia induced brain changes, which may not fully respond to CPAP therapy.

Reference: 1 - Panossian, L. A.; Veasey, S. C. Daytime Sleepiness in Obesity: Mechanisms Beyond Obstructive Sleep Apnea - A Review. Metabolic Regulation of Wakefulness - Panossian and Veasey. Sleep 2012; 35(5):605-615

416 - **A probable case of recurrent hypersomnia presenting repeated stupor episodes**
Presented by: Tsuyoshi Kitajima

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Objectives: Reccurent hypersomnia (RH) is a rare disorder characterized by recurrent episodes of hypersomnolence with various behavioral alternations, followed by intervals of complete remission. Primarily patients awake to eat or void even when they are in the episodes, and incontinence is not observed. We describe a case of probable recurrent hypersomnia presenting repeated 'stupor' episodes including incontinence, whereas each episode was followed by abrupt and complete remission.
Methods and materials: A case report of 23 year-old male patient.
Results: One day, a socially well adapting young man was found 'unconscious' in his room without going to his work, and was admitted to a hospital. Various tests could find no abnormality. After 18 days, he abruptly 'awoke', and was discharged without definite diagnosis. Four months later, a same episode recurred, and he was admitted to our hospital. He looked 'asleep', rolling over by himself or even slightly moving in response to our directions; but he did never wake up to eat or void, and tubal feeding and diapers were needed. Head MRI, blood and CSF tests were all normal. EEG showed slow alpha activity or REM sleep, without paroxysmal discharge. After 29 days he abruptly came back to full consciousness and normal mental state, and he had no memory of the episode. Psychotic symptoms were all denied. Since then similar episodes were repeated, followed by fully recovering intervals. 24-hour polysomnography, conducted during an episode, showed 15.7 hour of total sleep time and 6.1 hour of total REM sleep. CSF orexin was 168 pg/ml, lower than normal value, during an episode; whereas next three measurements, conducted during another episode or just after other episodes ceased, showed normal values. Idiopathic recurrent stupor was denied because flumazenil failed to reverse the symptoms during an episode.
Conclusion: Based on these findings, including decreased CSF orexin and excessive REM sleep propensity during the episode, we diagnosed his symptoms as an atypical form of RH. Behavioral alteration of RH might result in stupor state in this case. It is focused on whether lithium carbonate, with which he has been free of episode for 10 months, can prevent relapses for a long time.
Acknowledgments: We thank Dr. Kanbayashi (Akita University) for orexin measurements. This is not an industry-sponsored study. The authors have no conflict of interests to declare with regard to this study.

656 - **Positive sleep misperception in idiopathic hypersomnia?**
Presented by: Andrea Rodenbeck

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Excessive daytime sleepiness (EDS) almost daily persisting for more than three month is the essential symptom of the idiopathic hypersomnia (IH) without long sleep time classified by the ICSD2. DSM 5 meanwhile introduced the new term ‚major somnolence disorder'. Nocturnal sleep by definition should be between 6-10 hours documented by interview, actigraphy, or sleep logs in the first diagnostic step. In a study on the effect of modafinil in IH patients we had the chance to investigate this concept by assessment of daily sleep wake diaries.
We investigated 28 patients (35.3 ± 12.7 ys., 16 m, 12 f) suffering from IH according to ICSD2 established by clinical interview by sleep experts, PSG and MSLT. A standardized sleep-wake diary was filled out over one week by each patient, the intake of stimulants (8 subjects) was stopped at least one day before starting the diary. Results were given as the mean over the week or as number of days/nights per week.
Daytime naps at least 3 times a week were seen in 17 patients, 9 of them showed difficulties in

initiating and/or maintaining sleep. Mean sleep latency over all patients was 14 ± 11.7 min, in 8 patients more than 15 min. In average we found 6.6 nocturnal awakenings per patient and week, only 10 patients showed less than 3 nights nights without being awake. Mean wake time was 71.5 ± 93.5 min per week, meaning that 14 patients reported awakenings in at least 3 nights the week with a duration of more than 5 min each. 3 patients slept less than 6 hours on average, 2 more than 10. The time lag between morning wake up and rising up was more than 20 min in 9 subjects.
The results indicated that beside the EDS there exists also features of an insomniac disorders in more than the half of the investigated patients. Difficulties in initiating and/or maintaining sleep were independent of taking daytime naps more or less than 3 times a week. Since all patients were diagnosed by experienced sleep experts by clinical interviews, it could be suggested that IH patients without long sleep time overestimate their sleep supporting the concept of the Shapiro group, who published the concept of "a positive sleep stage misperception" in 2007. This concept was not proven in IH until now. Another explanation is that this group of patients may have an insomniac disorder but without the typical hyperarousal resulting in somnolence instead of tiredness.
Supported by Cephalon Germany GmbH

85 - **Prospective study of factors predicting diurnal hypersomnia in myotonic dystrophy type 1 (DM1)**
Presented by: Luc Laberge

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Objectives: Diurnal hypersomnia or daytime sleepiness is a frequent and incapacitating symptom of myotonic dystrophy type 1 (DM1). To date, no prospective cohort study of DM1 patients has examined clinical predictors of change in daytime sleepiness.
Methods and materials: Two-hundred patients were evaluated in 2002-2004 (mean age (SD)=47.0 (11.8)) (Time 1). Nine years later, in 2011-2013 (mean age (SD)=52.1 (10.6)), 115 of these were re-evaluated using the Daytime Sleepiness Scale (DSS) (Time 2). The Wilcoxon signed-rank test and a stepwise multiple linear regression analysis were used to respectively estimate change in daytime sleepiness scores and to identify clinical predictors of daytime sleepiness score changes over the 9-year study period. Age, sex, BMI, CTG repeats, muscular impairment, diabetes, depression, pain, difficulty in climbing stairs, forced vital capacity, mean habitual sleep duration, mean habitual bedtime, psychological distress, and intellectual quotient at Time 1 were used as independent variables in the regression.
Results: Daytime sleepiness scores increased over the 9-year period (mean DSS(SD) varied from 4.5(2.9) to 5.3(3.4); $p< 0.05$). Stepwise multiple regression results for change in daytime sleepiness scores between Time 1 and Time 2 (adjusted $R^2=0.2$, $p< 0.001$) revealed that diabetes ($p< 0.01$), higher CTG repeat number ($p< 0.05$) and shorter habitual mean sleep duration ($p< 0.05$) are associated with a greater increase in daytime sleepiness scores.
Conclusions: These preliminary results show that CTG repeat length has a predictive value for daytime sleepiness change in DM1 patients. Results also suggest that habitual longer sleep duration may act as a protective factor against increases in daytime sleepiness. Moreover, it is acknowledged that daytime sleepiness is associated with the metabolic syndrome but further research must document the mechanisms by which diabetes increases the likelihood to present higher daytime sleepiness levels.

226 - **Excessive daytime sleepiness as the presenting symptom of myotonic dystrophy type 1**
Presented by: Marit Otto

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Objectives: Patients with myotonic dystrophy type 1 (DM1) frequently suffer from excessive daytime sleepiness (EDS) and REM sleep dysregulation as well as obstructive and central sleep apnoea. We report a case of EDS, sleep onset REM periods, and complex sleep apnoea as the presenting symptoms of DM1.

Methods and materials: A 60 year old male was referred for EDS. He was working in a high academic position where his employer was worried about repeated involuntary naps at work and insisted on medical evaluation. The patient himself remembered unintended sleep in monotonous situations for many years which had neither bothered him nor interfered with his career. No cataplexy, hypnagogic hallucinations or sleep paralysis were reported. Past medical history revealed cataract operation in his forties but no endocrine or cardiac disease or muscular symptoms. Three cousins had early cataracts.
Results: Clinical examination showed a body mass index of 23 and slight frontal baldness. The neurological examination was normal with no facial or limb paresis, no muscular atrophy, and no signs of myotonia. Polysomnography (PSG) showed moderate obstructive sleep apnoea (Apnoea Hypopnoea Index (AHI) 19.5) and was otherwise normal. Multiple sleep latency test (MSLT) revealed mean sleep latency (MSL) of 4.5 minutes and 3 sleep onset REM periods (SOREMPs). Magnetic resonance imaging showed extensive, confluent white matter lesions. The patient did not experience any improvement in EDS after initiation of continuous positive airway pressure (CPAP) treatment.
A new PSG showed mainly central apnoeas (AHI 33) and an ECG with sinus bradycardia.
In the meanwhile, a 1st degree relative of the patient was investigated for distal muscular weakness and genetically diagnosed with DM1. This led to a genetic evaluation of our patient which revealed a borderline CTG expansion in the DMPK gene in a heterozygous pattern (5 and 82 CTG repeats). With this expansion, DM1 symptoms may be observed in a varying degree.
Conclusion: EDS and REM sleep dysregulation together with complex sleep apnoea may be the presenting symptoms of DM 1 even in the absence of overt muscular symptoms. Thorough history with focus on other DM1 associated features and family history may help to establish the diagnosis.

450 - **Atypical NREM sleep EEG synchronization in Williams syndrome**
Presented by: Ferenc Gombos

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Objectives: Williams syndrome (WS, 7q11.23 microdeletion) is a rare neurodevelopmental disorder characterized by mild to moderate mental retardation, learning difficulties, atypical sleep EEG features, cardiovascular abnormalities, high sociability and empathy and a distinctive cognitive-linguistic profile. Recent findings suggest that NREM sleep EEG coherence reflects the programmed unfolding of neuronal networks during ontogenetic development in children. Based on this thesis here we aim to depict the neurodevelopmental atypicalities of WS syndrome by a deliberate analysis of NREM sleep EEG synchronizational features.
Methods and materials: Weighted phase lag index (WPLI) of all-night NREM sleep EEG records (21 mastoid-referred derivations of the 10-20 system sampled at 1024 Hz/channel) of 20 WS and 20 age- and gender matched typically developing (TD) subjects was calculated for standard frequency bands. Group comparisons were performed by one-way ANOVA. We used Benjamini-Hochberg correction for controlling false discovery rate caused by multiple testing.
Results: An overall increase in the EEG synchronization of WS subjects was evident. This increase was due to enhanced synchronization of theta (4.75-7.25 Hz), high sigma (13-15 Hz) and beta (15.25-30 Hz) activity both intra- and interhemispherically. In turn, the synchronization of the NREM sleep EEG alpha frequency (7.5-10.75 Hz) activities of WS subjects was characterized by a striking decrease. Spatial patterns of decreased alpha and increased high sigma synchronization were characterized by striking similarity.
Conclusions: The NREM sleep EEG of WS subjects is characterized by wide range overconnectivity (theta, high sigma, beta) and a frequency-specific underconnectivity (apha waves). Overconnectivity might result from atypical developmental process affecting the overall neural architecture in 7q11.23 microdeletion, while underconnectivity is most probably related to the dysfunctional alpha generating system and an acceleration of thalamocortical oscillatory dynamism in WS. Indexes of specific neural dysfunctions related to sleep organization and function, neural network dynamism and the generation of alpha oscillations are of potential importance in unravelling the pathways of gene-behaviour relationship in WS.
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02.11.2015 - 08:30-09:30

Stress, Mood, Anxiety and Sleep in the Development

567 - **Within-sleep auditory cueing rescues verbal neutral declarative learning from forgetting**
Presented by: Médhi Gilson

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Objectives: Recent evidence suggests that reactivation during sleep of learning-related auditory or olfactory cues enhances memory consolidation for declarative spatial and verbal memory tasks. In the present study, we investigated whether targeted reactivation during a post-training afternoon nap enhances recall performance for a verbal material involving emotional components.
Methods: Twenty-one young adults learned 36 unrelated word-pairs (WPs; 18 being neutral and 18 being negative) associated with an emotionally congruent sound. Participants were instructed to memorize the WPs and to ignore the sounds. After the learning session, they underwent an immediate recall session and were then allowed to have a 90 minutes nap. During the nap, half of the associated sounds (9 neutral and 9 negative) were replayed several times during sleep stages N2 and N3. Recall performance for all learned WPs was then tested.
Results: Amongst the participants for whom at least one auditory reactivation (i.e. ≥ 18 sounds) was achieved (N=13), the decrease in performance between learning and retrieval was significantly lower for cued than non-cued WP (respectively -3.8% vs -12.8% of recalled word pairs; p=.03). A trend towards better recall performance for neutral reactivated WPs was observed (+1.7%), in comparison with non-reactivated WPs (-12%; p=.078). Negative WPs did not benefit from reactivation (-9.4% for reactivated and -12.8% non-reactivated WPs; p=1).
Conclusions: These results indicate that within-sleep auditory cueing benefits declarative memorization. Besides, these benefits might be more important for neutral WPs than for negative ones.

58 - **Things that go bump in the night: frequency and predictors of nightmares in anxious and non-anxious children**
Presented by: Candice Alfano

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Background: Nightmares are considered normative developmental phenomena but are also linked with anxiety. Whereas only 3-5% of all children report frequent nightmares, up to 80% of children with generalized anxiety disorder (GAD) experience nightmares on a frequent basis (Alfano et al., 2006; Alfano, Ginsburg, & Kingery, 2007). However, data are primarily based on parent retrospective reports which could be biased by the presence of daytime child anxiety. Alternatively, children´s fearful nighttime behaviors may produce increased levels of arousal at bedtime, elevating the likelihood of nightmares.
Methods: The current study examined the frequency and predictors of nightmares among 7 - 11 year old children with a primary generalized anxiety disorder diagnosis (n=42) and children with no psychiatric diagnosis (n=44) using both prospective and retrospective child and parent reports. The current study was approved by all appropriate institutional review boards and all families provided informed consent to participate. All children underwent comprehensive psychiatric evaluation including structured diagnostic interviews to assess inclusion/exclusion criteria. For 7 consecutive days, children completed brief phone interviews (and wore wrist actigraphs) about their sleep on the prior night including whether or not they experienced a nightmare.
Results: Both children with GAD and their parents reported significantly more nightmares than controls based on retrospective reports, but the groups did not differ when nightmares were assessed daily across a one-week prospective period. This results was supported by findings of similar total sleep time and nighttime wake episodes between groups. Girls also reported more nightmares than boys during the one-week assessment. Controlling for sex and group, child sleep anxiety and pre-sleep somatic arousal predicted parent but not child report of nightmares.
Conclusions: Retrospective reports of nightmares by clinically-anxious youth and their parents appear inflated compared to prospective accounts. Clinical levels of anxiety could directly bias children's perception/memory of nightmares such that dreams are recalled as more threatening/frequent over time. Parent may assume pre-sleep anxiety to give rise to child nightmares. Rather than actual dream mentation, endorsement of frequent nightmares may be an epiphenomenon

of childhood anxiety disorders rooted in established cognitive-affective biases.

252 - **Contribution of short and problematic sleep to internalizing and externalizing problems and wellbeing in adolescence: causality or genetic pleiotropy?**
Presented by: Marije C.M. Vermeulen

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Objectives: Short and problematic sleep have been associated with psychological problems in adolescence, but causality remains to be elucidated. In a genetically informative twin design we investigated whether short or problematic sleep causally contributes to internalizing (INT) problems (e.g., anxiety, depression), externalizing (EXT) problems (e.g., aggressive behaviour) and subjective wellbeing (SWB) or alternatively, whether associations result from common underlying genetic or shared environmental factors.
Methods and materials: Sleep and psychological functioning were assessed with self-report questionnaires over ±2 years in 12803 twins (13-20 years, 42% male, 2148 monozygotic pairs) from the Netherlands Twin Register. Pairs were both cross-sectionally and longitudinally classified as either concordant or discordant for sleep duration and sleep problems. Resulting subgroups were compared on INT, EXT and SWB.
Results: Cross-sectionally, short and problematic sleep were associated with more INT and EXT and low SWB. Longitudinal analyses showed that a reduction in sleep duration experienced by one individual of an identical twin pair was not accompanied with a stronger increase in INT and EXT or decrease in SWB as compared to changes in the co-twin with unchanged sleep duration. However, an increase in sleep problems experienced by one individual of an identical twin pair was accompanied with a stronger increase in INT and EXT as compared to the within-individual changes of the co-twin with unchanged sleep quality.
Conclusions: Results do not support a causal contribution of sleep duration on psychological functioning and rather suggest pleiotropy of genetic effects. In contrast, both cross-sectional and longitudinal within twin pairs analyses suggest a causal contribution of problematic sleep to behavioural problems.

248 - **#sleepyteens - is social media use related to sleep quality, self-esteem, anxiety and depression in adolescence?**
Presented by: Heather Cleland Woods

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Objectives: As of March 2015, Facebook has 1415 million users, Twitter 288 million and approximately 90% of adolescents are on social media (SM). SM is a relatively recent phenomenon and as such, has yet to be extensively researched. However, new evidence is increasingly supporting a link between social media use and various aspects of wellbeing, particularly during adolescence. Adolescence is a period of increased vulnerability for the onset of depression and anxiety (McLaughlin & King, 2015). Poor sleep quality is also prevalent in adolescence (Telzer, Fulgini, Lieberman & Galván, 2013), and is associated with depression, anxiety and low self-esteem (Alfano, Zakem, Costa, Taylor & Weems, 2009; Fredriksen, Rhodes, Reddy & Way, 2004). Evidence is increasingly supporting a link between SM use and wellbeing, particularly during adolescence. Since adolescence is a vulnerable period for development of long-term issues, it is essential that we understand how adolescents' SM use relates to these factors. The current study aims to investigate how adolescents' SM use relates to sleep quality, self-esteem, anxiety and depression. Furthermore, this study is the first to examine how emotional investment in SM relates to these aspects of wellbeing.

Materials and methods: In this cross-sectional correlation study, 467 adolescents completed subjective measures of overall and night-time SM use, as well as measures of sleep quality, self-esteem, anxiety, depression and emotional investment in SM.
Results: Overall SM use, night-time specific SM use and emotional investment in SM were each significantly related to poorer sleep quality, lower self-esteem as well as higher anxiety and depression levels. Together, SM measures explained 13.5% of the variance in sleep quality and night-time specific SM use remained a significant predictor of poor sleep quality after controlling for anxiety, depression and self-esteem.
Conclusions: The current results highlight not only timing of SM use as impacting on sleep quality but, importantly, emotional investment in SM as contributory factors that merit further investigation with relation to adolescent sleep quality, wellbeing and development. The results of this study also have the potential to inform interventions aimed at improving adolescents' sleep quality or educating young people and parents about the impact of social media.

648 - **Classification of habitual sleep patterns and perceived sleep disturbance using latent class analysis in college-bound high school seniors: associations with sex and depressive mood**
Presented by: Tamar Shochat

T. Shochat[1,2], K.M. Sharkey[1], D.H. Barker[1], E. Van Reen[1,3], B.M. Roane[1,3,4], C. Gredvig-Ardito[3], M.A. Carskadon[1,3,5]
[1]Alpert Medical School, Brown University, Providence, RI, United States, [2]Faculty of Social Welfare and Health Sciences, University of Haifa, Haifa, Israel, [3]Sleep for Science Laboratory, EP Bradley Hospital, Providence, RI, [4]Health Science Center, UNT, Forth Worth, TX, United States, [5]University of South Australia, Adelaide, SA, Australia

Objectives: Depressive mood (DM) in youth has been studied in association with distinct dimensions of sleep including sleep timing, duration, and quality. Late bedtimes, early rise times, short sleep durations and poor sleep quality are all correlated with DM, and sex differences are apparent for both sleep and DM. Using Latent Class Analysis (LCA), we aimed to capture distinct multi-dimensional sleep types in high school seniors and to examine DM and sex in these groups.
Methods and materials: Students accepted to Brown University (n=1451; mean age = 18.4±0.3; 648 M) in 2010-2014 completed a survey near the end of high school. Indicators for latent class analysis (LCA) included continuous variables of reported school night bedtime (BT), rise-time (RT), and non-school night minus school night BT (DBT) and RT (DRT); categorical variables sleep onset latency (SOL, 0=< 15 m, 1=16-30m, 2=>30m), number of arousals (NOA, 0=none, 1=1-2, 2=>2), naps per week (0=none, 1=1-2, 2=>2), and perceived sleep quality and disturbance based on PSQI subscales 1 and 5, respectively
(0-2, higher scores indicating worse sleep). DM was defined as the total score on the Center for Epidemiologic Studies-Depression Scale (CES-D). Two-way ANOVA tested the differences in CES-D by classes and sex.
Results: LCA generated a 3-class solution with entropy of 0.62 (see Table for descriptives within classes). Sex was distributed equally across classes. Class ($F_{(2,1443)}$=28.4, p< 0.01) and sex ($F_{(1,1443)}$=35.0,
p< 0.01) differences were found for CES-D. Pairwise comparisons showed significant class differences in CES-D (C: 13.9(9.0) > A: 12.2(8.2) > B: 9.5(7.0)), and females had higher CES-D in all classes.

Class (N)	BT	RT	DBT	DRT	SOL (0,1,2)	NOA (0,1,2)	NAPS (0,1,2)	PSQI1 (0,1,2)	PSQI5 (0,1,2)
A (751)	22.95 (0.6)	6.50 (0.7)	1.46 (0.9)	2.70 (1.3)	43,43,14	46,5,50	57,27,16	10,69,21	0,89,11
B (428)	23.47 (0.6)	6.68 (0.6)	0.98 (0.9)	2.60 (1.2)	95,5,1	96,1,3	59,31,10	40,57,3	30,70,0
C (272)	24.84 (0.7)	6.84 (0.7)	0.44 (1.2)	3.39 (1.4)	78,17,5	84,2,15	11,35,54	7,60,34	10,83,7

[Mean (SD) / Percentages (rank variables)]

Conclusions: Latent class analysis of sleep patterns and disturbances identified 3 sleep "phenotypes". The phenotypes in our sample of high school seniors indicated sleep subtypes that differed in depressive mood symptoms. The sleep patterns/disturbances that characterized these groups may add to our understanding of how sleep and mood symptoms associate in older teens.
Support: NIMH MH079179

02.11.2015 - 08:30-10:30
Biological Rhythmus and Circadian Disorders

305 - **Are individual differences in sleep and circadian timing amplified by use of artificial light?**
Presented by: Andrew J.K. Phillips

A.J.K. Phillips, K. Swaminathan, E.B. Klerman
Brigham and Women's Hospital / Harvard Medical School, Boston, MA, United States

Objectives: Within the human population, there is great inter-individual variability in the timing of sleep and circadian rhythms. This variability has been attributed both to differences in:
(i) sleep and circadian physiology, and
(ii) patterns of light exposure.
Here, we use a previously-validated model of human sleep and circadian physiology to test the hypothesis that physiology-driven differences in sleep and circadian timing are amplified by use of artificial light.
Methods and materials: The model takes physiological parameters and light/dark patterns as inputs, and gives sleep/wake patterns and timing of the circadian melatonin rhythm as outputs. We tested the model under two conditions:
(i) a natural light/dark cycle, and
(ii) a "realistic" light/dark cycle that included attenuation of natural light due to working indoors and use of artificial light during hours of wakefulness when natural light levels would be low.
Within these conditions, we determined the relationship between the intrinsic circadian period (within the physiological range 23.5-24.7 h) and the model's predicted timing of entrained sleep onset, sleep offset, and dim light melatonin onset (DLMO). In addition, we simulated these conditions within a work week, where the model was required to awaken for work at a fixed time for five days of the week and allowed to sleep freely on weekends.
Results: Under both conditions, a longer intrinsic circadian period resulted in delayed sleep and DLMO timing relative to shorter circadian periods. Under the realistic condition, variation in sleep and DLMO timing across the physiological range of intrinsic circadian periods was increased by a factor of about two relative to variation under the natural condition. When work weeks were simulated, we found that if the intrinsic circadian period was very long (24.7 h) or very short (23.5 h), there was a significant mismatch in sleep and DLMO timing between week days and weekends, also known as social jet-lag. Social jet-lag was significantly worse under realistic conditions than under natural conditions.
Conclusions: These findings suggest that individual tendencies to have very advanced or very delayed schedules can be greatly exacerbated by self-selected modifications to the natural light/dark cycle, including reduced daytime light exposure and use of artificial light outside of daytime hours. This has important implications for therapeutic treatment of advanced or delayed sleep phase disorders.

394 - **Neurons for all seasons: human neuronal drive across photoperiods**
Presented by: Sarah Laxhmi Chellappa

C. Meyer[1], G. Gaggioni[1], J. Ly[1], M. Rosanova[2], S. Sarasso[2], S. Archer[3], D.-J. Dijk[3], M. Massimini[2], P. Maquet[1], C. Phillips[1], R. Moran[4], G. Vandewalle[1], S.L. Chellappa[1]
[1]University of Liège (Ulg), Liège, Belgium, [2]Università degli Studi di Milano, Milan, Italy, [3]University of Surrey, Guildford, United Kingdom, [4]Virginia Tech Carilion Research Institute, Roanoke, VA, United States

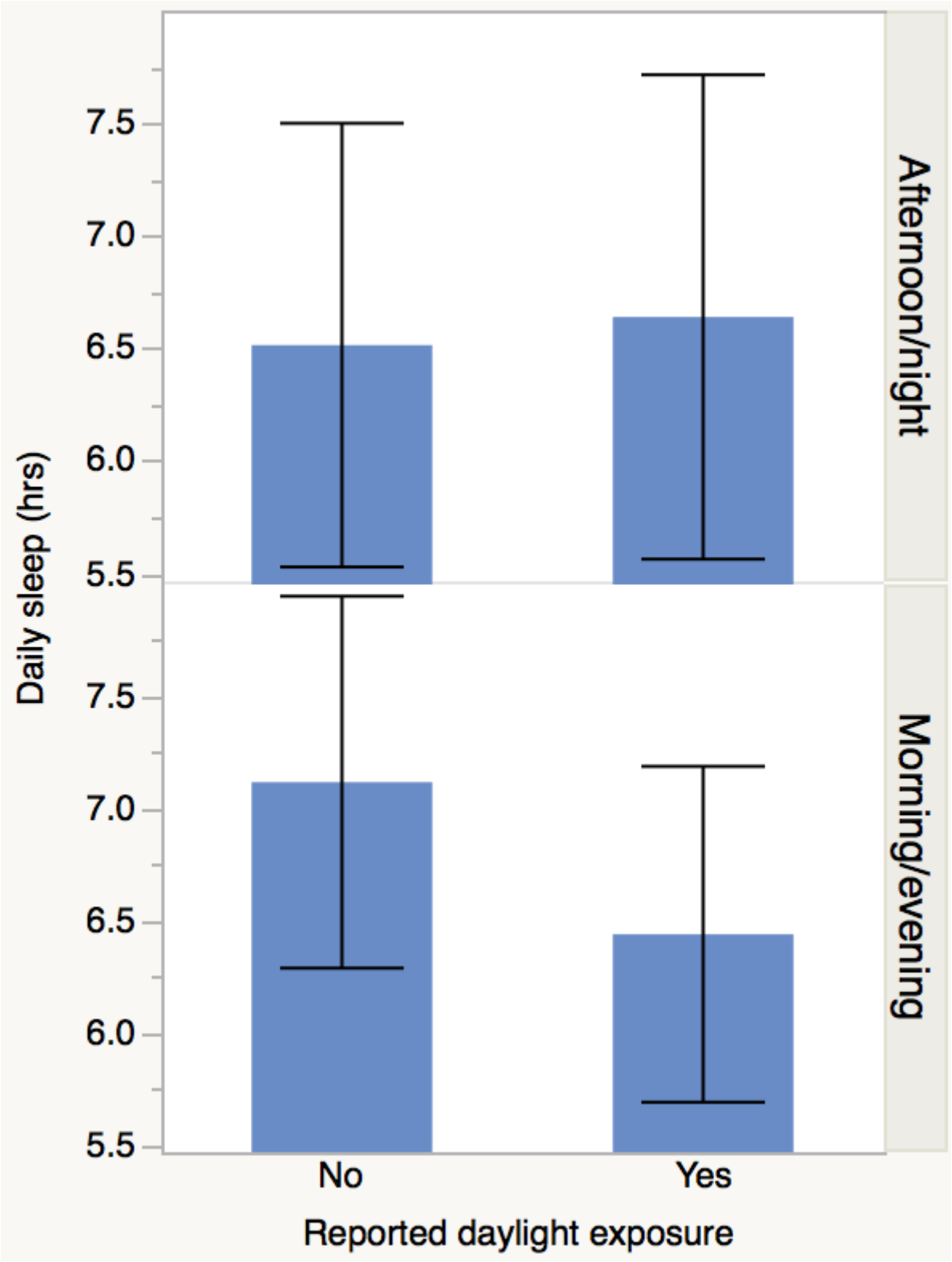
Objectives: The balance between inhibition and excitation ensures optimal functioning of neuronal networks in the brain. Recently, animal data point to a key role for the neurotransmitter γ-aminobutyric acid (GABA) to the network dynamics within the suprachiasmatic nucleus (SCN), which is involved in seasonal encoding. Thus, changes in the environment, such as day length, may impact on neuronal inhibition/excitation balance, and potentially contribute to seasonal adjustments within neuronal

networks. However, it remains completely unknown how brain dynamics in humans are orchestrated by this putative modulatory process.
Methods: Twenty-two healthy young men (18-30 years) underwent 8 sessions of Transcranial Magnetic Stimulation combined to high-density electroencephalography (TMS-hdEEG), during 28h of sustained wakefulness, under stringent constant routine conditions. Two groups of eleven participants underwent this experimental paradigm during, respectively, a short and a long-day photoperiod. To investigate changes in human neuronal inhibition/excitation drive across seasons, we applied a computational framework for inferences on *in vivo* neuronal architectures (Dynamic Causal Modeling) to the EEG responses evoked by TMS over the frontal cortex.
Results: The time course of human inhibition/excitation balance, as indexed by GABA/Glutamate receptor density ratio, within neuronal subpopulations of the frontal cortex displayed a significantly earlier peak of activity ($p< 0.05$) by nearly 3-hours during a short-day photoperiod relative to a long-day. Furthermore, frontal cortical excitability, as indexed by the amplitude of the TMS-EEG evoked responses, showed a similar temporal effect, with a significantly earlier peak of activity ($p< 0.05$) by nearly 3-hours during a short as compared to a long-day photoperiod.
Conclusions: Our data provide a proof-of-principle for a complex temporal processing on human brain dynamics that may be exquisitely sensitive to critical changes in day length across seasons. Ultimately, the data provide a non-invasive window to the hidden neuronal milieu that sets the temporal organization of the human brain.
Funding: AXA-FNRS-ULg-FMRE-ARC-WELBIO-FEDER-Fondation Simone et Pierre Clerdent.

111 - **Environmental daylight exposure interferes with the sleep patterns of sailors working the 3hrs-on/9hrs-off watchstanding schedule at sea**
Presented by: Panagiotis Matsangas

P. Matsangas, N.L. Shattuck
Naval Postgraduate School, Monterey, CA, United States

Objectives: This operational study assessed the effect of environmental daylight exposure on the daily sleep duration of a sample of USS Nimitz (CVN-68) crewmembers working belowdecks (i.e., in the absence of sunlight) on the 3hrs-on/9hrs-off watchstanding schedule during a 2-week underway.
Methods and materials: Participants (N=91, 24.8±4.24 years old) stood two 3-hour watches each day. Crewmembers were assigned to one of four watch sections (WS): WS 1 stood watch from 0300-0600 and 1500-1800; WS 2: 0600-0900 and 1800-2100; WS 3: 0900-1200 and 2100-0000; WS 4: 0000-0300 and1200-1500. Each sailor wore an actigraph and completed an activity log. Participants in the “morning/evening” group stood watch within the time periods 0600-1200 and 1800-2400 (WS 2 and 3). Participants in the “afternoon/night” group stood watch in the time periods 1200-1800 and 0000-0600 (WS 1 and 4).
Results: Crewmembers slept an average of 6.64±0.95 hours per day. Over 61% of participants reported experiencing some daylight exposure (median=0.13 hours daily). Preliminary results (Figure 1) indicated that daylight exposure affected the sleep of the “morning/evening” group (participants not exposed to daylight: 7.12±0.83 hours of sleep; participants exposed to daylight: 6.44±0.80 hours, $Z=2.19$, $p=0.029$). This same pattern was not evident in the “afternoon/night” group ($p>0.50$).



[Daily sleep duration]

Figure 1: Daily sleep duration
Given that our participants performed their work activities belowdecks, the only period in which they could be exposed to daylight was during their personal/free time. Crewmembers on the "morning/evening" shifts reported free time predominantly between 1500 and 2000 with bedtime after 2200. However, it is known that photic exposure in the late biological day results in a phase delay of biological night (Czeisler et al.,1989). We postulate that the daylight exposure effect was not evident in crewmembers working at night because it was masked by other problems in their sleep patterns (less opportunity for sleep).

Conclusion: Our preliminary results suggest that late afternoon sunlight exposure interferes with the sleep patterns of crewmembers when working at sea. From an organizational perspective, the fact that crewmembers' sleep was affected by environment light highlights the challenges of optimizing shift schedules in the maritime operational environment. Daylight exposure is an important factor to consider when optimizing watchstanding schedules at sea.

445 - **The direct non-circadian effects of light in a diurnal grass rat, *Arvicanthis ansorgei***
Presented by: Jeffrey Hubbard

J. Hubbard, E. Ruppert, P. Chu Sin Chung, L. Choteau, C.-M. Gropp, L. Calvel, M. Kobayashi Frisk, P. Bourgin
CNRS UPR 3212 and Sleep Disorders Center, Université de Strasbourg, Strasbourg, France

Objectives: Sleep and wake regulation involves two principle mechanisms: a circadian and a homeostatic process, in addition to a third, the non-circadian direct influence of light. To date the majority of laboratory rodent studies on sleep using EEG are performed in nocturnal rodents, such as mice and rats. However this raises a problem when examining the effects of light on sleep and wake, due to different, not yet fully known, neurobiological substrates between nocturnal and diurnal mammals. Recently we phenotyped a diurnal grass rat, Arvicanthis Ansorgei. In the present study we sought to examine the acute and sustained effects of light on sleep and wake.
Methods: 14 Male *Arvicanthis ansorgei* were implanted with EEG, EMG, EOG. Animals were placed under a baseline assessment of the circadian cycle, as well as 24-hours of continuous darkness. Non-circadian conditions were used to observe the direct effects of light: a 1-hour light pulse (LP) at ZT15 during the dark period, a 1-hour dark pulse (DP) at ZT3 during the light period, and an ultradian 1hLP:1hDP cycle over 24 hours. Finally, 6-hour sleep deprivations were performed under both light and dark conditions (starting at ZT0 or ZT12), to determine any changes in sleep homeostasis. Specific EEG rhythms and associated vigilance states were characterized (theta, gamma, and delta).
Results: Under baseline conditions Arvicanthis had an inverted sleep-wake cycle compared to mice. Single 1-hour light/dark pulses induced wake and NREM sleep, respectively. Under the 1hL:1hD cycle, light exerted a wake-promoting effect, as opposed to the dark-induced effect in mice. NREM Delta power during sleep deprivations was also altered depending on when it began, as well as its length.
Conclusion: These results suggests that the non-circadian direct effects of light are inverted as compared to nocturnal rodents, and are similar to certain data seen in human studies, suggesting that Arvicanthis is a valuable diurnal rodent model for sleep study. Our findings also suggest that the direct photic regulation represents a key sleep regulatory mechanism in addition to the homeostatic and circadian processes in diurnal rodent species.

244 - **Changes in objective shift characteristics and subsequent sleep and fatigue among shift working nurses**
Presented by: Mikko Härmä

M. Härmä[1], S. Puttonen[1], A. Ropponen[1], A. Koskinen[1], J. Pentti[1], M. Kivimäki[1,2]
[1]Finnish Institute of Occupational Health, [2]Clinicum, Faculty of Medicine, University of Helsinki, Helsinki, Finland

Objectives: Shift work is known to be associated with sleep and fatigue but most evidence is based on cross-sectional and self-reported information on working hours. We used employers' pay-roll data on objective working hours of nurses to examine the association of changes in working hour patterns in relation to simultaneous changes in sleep and fatigue.
Methods and materials: Participants were 1997 nurses in one hospital district (the Finnish Public Sectors study). We measured insomnia symptoms with the Jenkins Sleep Problem Scale and different scales for self-reported fatigue during work and free-time. We analyzed the association of changes from 2008 to 2011 in 29 objective working hour characteristics[1] with simultaneous changes in sleep and fatigue using linear stepwise regression analysis controlling for various covariates (age, gender, number of children, occupation, health, work ability and anxiety at baseline and changes from 2008 to 2011 in sleep length, work load, job strain and number of children).
Results: In 2008, shift workers (≥ 25% of all work shifts being evening or night shifts, n=761) reported more often fatigue during work (28%) and free-time (19%) than day workers (n=1236, 22% and 10%, accordingly) but no difference in insomnia was observed (prevalence 20% in both groups). Among shift workers, changes in shift characteristics explained 4-5% of the variation in the change of fatigue,

and 2% of the variation in the change of insomnia. In the full model with covariates, the increase in fatigue at work from 2008 to 2011 was associated to decreases in the % of annual evening shifts ($p< 0.03$), long work shifts ($p< 0.03$) and free week-ends ($p< 0.02$). The increase of fatigue during free-time was related to decreases in the % of morning shifts ($p< 0.001$) and long work shifts ($p< 0.04$). The increase from 2008 to 2011 of reporting higher day-time fatigue was related to increases in the use of shift changes ($p< 0.006$), increase in the proportion of single free days ($p< 0.006$), increase of long spells of night shifts ($p< 0.04$), and decrease in the variation of shift length ($p< 0.03$).
Conclusions: Changes in the length and timing of work shifts are associated to subsequent fatigue but no associations with insomnia symptoms were observed.
[1] Härmä et al. Developing register-based measures for assessment of working time patterns for epidemiologic studies. Scand J Work Environ & Health, 2015;39:57-65.

417 - **The role of sleep and circadian rhythm disturbance in the formation of psychotic-like experiences**
Presented by: Jan Cosgrave

J. Cosgrave, D. van Heugten, K. Porcheret, R.G. Foster, K. Wulff
Sleep and Circadian Neuroscience Institute, University of Oxford, Oxford, United Kingdom

Objectives: There is recent evidence to suggest that sleep and circadian rhythm disturbance (SCRD) occurs before the onset of mental illness. This research aims to investigate whether screening on sleep quality can identify an individual's risk of experiencing psychotic like experiences (PLEs).
Methods and Materials: 46 University of Oxford students took part in a three-week in-depth sleep and circadian phenotyping study. Students were screened on the quality and perception of their sleep using the Pittsburgh Sleep Quality Index (PSQI) and the Insomnia Severity Index (ISI). Participants wore a CamNTech actigraphy device for three weeks to assess their rest-activity pattern. Sub-clinical PLEs were assessed using the Prodromal Questionnaire-16.
Results: From the sample of 46 subjects (23 good and 23 bad sleepers), a Mann-Whitney test indicated that PLEs were significantly greater for the poor sleeping group (Median = 3) compared to the good sleeping group (Median = 1), ($W = 64$, $p < 0.001$). However, no differences were found in sleep fragmentation, sleep onset, sleep offset and sleep onset latency between groups. A multivariate Poisson regression model was fit to the data to assess the relation between sleep and PLEs. The model of best fit included the main effects of PSQI score and total sleep time (sleep time after deducting wake after sleep onset) as well as the interaction between PSQI and total sleep time (Figure 1). The model suggests that both a perception of poor sleep quality combined with shorter sleep is what puts an individual at the highest risk of experiencing PLEs.
Conclusions: This is the first study to assess whether SCRD can increase an individual's risk for PLEs at a sub-clinical level. Our data suggests that perceived poor sleep quality combined with shorter sleep confers the highest risk for an individual to experience PLEs. These individuals have also completed two nights of polysomnography, 48 hours of melatonin sampling, two days of cortisol sampling, and three weeks of daily experience sampling for psychotic symptoms and mood, allowing for further in-depth analyses and profiling of their sleep and circadian rhythms.

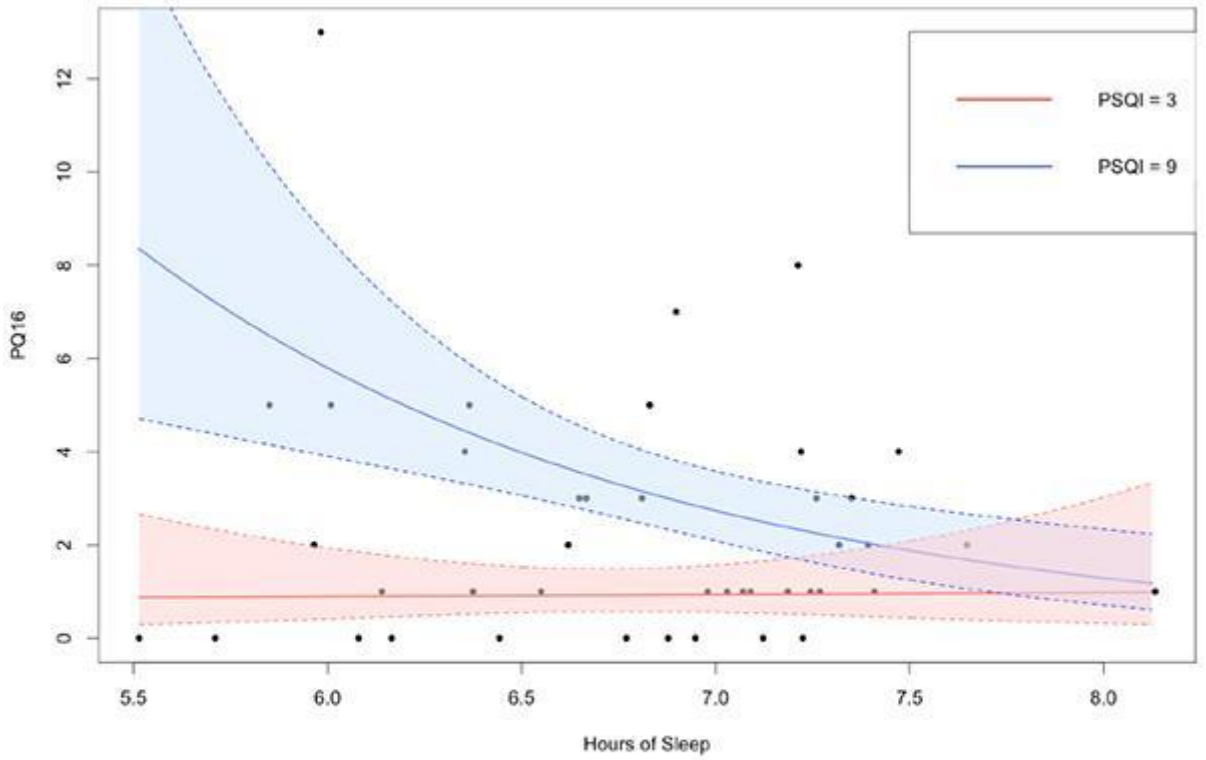


Figure 1: The interaction between hours of sleep, perceived sleep quality (PSQI) and psychotic like experiences (PQ16).
The dotted lines represent 95% confidence intervals. Block lines represent predictions of PQ16 score based on a PSQI score of 3 (red) and 9 (blue). The Pittsburgh Sleep Quality Index (PSQI) score is a measure of sleep quality, a higher score denotes poorer sleep quality. Individuals with a PSQI score of 3, show little effect of hours of sleep on the predicted PQ16 score. Individuals with a PSQI score of 9 are predicted to have a similar PQ16 score to those with a PSQI score of 3 when hours of sleep are within normal range, with the lines converging at around 8 hours. However, with a PSQI score of 9, decreasing sleep progressively increases the risk of PLEs. This suggests that a combination of both a perception of poor sleep quality and fewer hours of sleep are what puts an individual at the highest risk of experiencing PLEs.

[Figure 1]

80 - **Assessment of tasimelteon efficacy in totally blind individuals with non-24-hour sleep-wake disorder in the SET study**
Presented by: Marlene Dressman

M. Dressman[1], L. Licamele[1], S. Lockley[2], C. Xiao[1], M. Polymeropoulos[1], R. Torres[1]
[1]Vanda Pharmaceuticals, Washington, DC, [2]Harvard Medical School, Boston, MA, United States

Objective: To assess the Safety and Efficacy of Tasimelteon (SET) in Non-24-Hour Sleep-Wake Disorder (Non-24). Tasimelteon, a circadian regulator, has specific and potent affinity for the MT_1 and MT_2 melatonin receptors. Tasimelteon is being developed to treat Non-24 in the totally blind, a serious circadian rhythm disorder with no EMA-approved treatment.
Methods: In the SET study (n=84) patients were treated with either tasimelteon (20mg) or placebo. Circadian period was assessed from urinary 6-sulfatoxymelatonin (aMT6s) and cortisol rhythms. Clinical endpoints included nighttime and daytime sleep measures and Clinical Global Impression of Change (CGI-C).
Results: Tasimelteon entrained the circadian clock more than placebo at month 1 (aMT6s: 20.0 vs. 2.6%; cortisol: 17.5 vs. 2.6%). Entrainment rate in a subset of patients who received ~7 months of tasimelteon treatment was 59% (10/17). Tasimelteon induced a greater clinical response (entrainment plus improvement on a Non-24 Clinical Response Scale) (23.7 vs. 0%), improved CGI-C (2.6 vs. 3.4), increased sleep in the worst quartile of nights (LQ-nTST) (57 vs. 17 mins), decreased daytime sleep in the worst quartile of days (UQ-dTSD) (46 vs. 18 mins), and corrected the midpoint of sleep timing (MoST) by 21 mins/day compared to placebo. Tasimelteon was safe and well-tolerated.
Conclusion: Tasimelteon entrained the circadian pacemaker in totally blind patients with Non-24 and improved multiple measures of sleep, wake, and global functioning. While SET was not designed to address the time to response, adequate treatment duration is likely to be important in clinical practice.

Sponsored by Vanda Pharmaceuticals.

502 - **Clinical assessment of drug-drug interactions of tasimelteon, novel dual melatonin receptor agonist**
Presented by: Rosarelis Torres

R. Torres[1], M. Dressman[1], P. Baroldi[1], B. Ogilvie[2], W. Kramer[3]
[1]Vanda Pharmaceuticals, Inc., Washington, DC, [2]XenoTech, LLC, Lenexa, KS, [3]Kramer Consulting, LLC, North Potomac, MD, United States

Objective: Tasimelteon (Hetlioz™) demonstrates a high affinity for both MT_1 and MT_2 melatonin receptors. Tasimelteon is the first and only treatment approved by the US Food and Drug Administration for Non-24-Hour Sleep-Wake Disorder (Non-24), a serious, chronic circadian rhythm disorder which is more common in totally blind individuals. Individuals who suffer with Non-24 are unable to entrain (synchronise) their endogenous master body clock to the 24-hour day-night-cycle leading to sleeplessness at night and sleepiness during the day. The studies presented here were conducted to evaluate the pharmacokinetics of tasimelteon, alone and in combination with inducers and inhibitors of CYP1A2 and CYP3A4/5 which are enzymes identified to play a role in the metabolism of tasimelteon. The secondary objective was to study tasimelteon's safety and tolerability.
Methods and materials: The data from three phase 1, open-label, single-sequence, parallel-group studies in healthy volunteers 18 to 55 years of age, inclusive, is presented. The 20-mg dose was used for the studies, except when co-administering with fluvoxamine in which a 5-mg dose was used. Blood samples for the measurement of plasma concentrations of tasimelteon alone and in combination with the inducer/inhibitor were collected for 24 hours after dosing. Safety measures were also assessed.
Results: Tasimelteon is rapidly absorbed, with a mean absolute bioavailability of approximately 38%. The effects of strong inhibitors and moderate or strong inducers of CYP1A2 and CYP3A4/5 on the pharmacokinetics of tasimelteon were evaluated in humans. Co-administration with fluvoxamine resulted in approximately a 6.5-fold increase in tasimelteon's area under the curve (AUC), whereas cigarette smoking decreased tasimelteon's exposure by approximately 40%. Co-administration with ketoconazole resulted in approximately a 54% increase in tasimelteon's AUC, whereas rifampin pre-treatment resulted in a decrease in tasimelteon's exposure of approximately 89%.
Conclusion: Tasimelteon should not be used in combination with fluvoxamine because of greater risk of adverse reactions. Similarly, use of tasimelteon should be avoided in combination with rifampin or other CYP3A4/5 strong inducers, because there is potential for a large decrease in exposure of tasimelteon which can lead to reduced efficacy. These results provide additional context for clinicians seeking to treat Non-24 patients with tasimelteon.

02.11.2015 - 11:00-13:00
Joint Symposium (IPSA): Restless Legs Syndrome (RLS) in childhood, periodic syndromes and migraine: new advances on pathophysiology and treatment

715 - **Paediatric restless legs syndrome with or without growing pains: a twin family study**
Presented by: David Champion

D. Champion
Anaesthesia and Pain Medicine, Sydney Children's Hospital, .Randwick, NSW, Australia

Objectives: Paediatric restless legs syndrome (RLS) and growing pains (GP) have clinical similarities and are associated in individuals and in families. We have conducted a twin family case-control study, considering three outcomes based on RLS with and without GP.
Methods: Questionnaires (validated or widely used)were mailed to 3,909 twin families (twins aged 3 to 18 years, parents and siblings) through the Australian Twin Registry to assess lifetime prevalence of the common primary pain disorders of childhood and associated conditions (RLS, parent-reported doctor confirmed iron deficiency (ID), anxious depression (ASEBA Behavioural Checklist). Familial and other associations were estimated as odds ratios (ORs) to allow comparisons.
Results: There were 1,017 evaluable responses from twin families. The RLS and the GP results for twin individuals were analysed according to whether participants met criteria for three mutually exclusive and independent traits: GP Only, RLS Only, and both RLS and GP. For RLS Only, the OR within MZ pairs was 10.5 ($p < 0.001$), and was 8.1 for DZ pairs ($p < 0.001$). The strongest (ORs > 3) multivariate associations (statistical predictors) for RLS Only were ID, chronic pain, and family history

(mother with RLS and GP or with RLS Only, mother with ID, and first sibling with RLS Only or with RLS and GP). For RLS and GP, the OR within MZ twin pairs was 38.9 (p< 0.001) and 6.5 for DZ twins (p=0.001). The strongest multivariate associations with RLS and GP were family history (father, mother and first sibling having RLS and GP). For GP Only, the OR within MZ twin pairs was 13.7 (p< 0.001) and 6.0 for DZ pairs (p< 0.001). The strongest multivariate associations with GP Only were headache, and family history (mother, father and first sibling having GP Only).
Conclusions: For RLS Only, genetic factors were associated with little increase in risk, and there was a strong association with ID. For RLS and GP, genetic factors might be associated with substantial increase in risk and there was only a weak association with ID. For GP Only, genetic factors were associated with small to moderate increase in risk, and there were no associations with ID or with pain disorders other than headaches. Our data were consistent with these three independent traits having different aetiological influences. A limiting factor was inadequacies in phenotypic differentiation between RLS and GP.

02.11.2015 - 11:00-13:00
Symposium: Sleep: a view from the deep

684 - **Local oscillations of sleep and sleepiness in humans**
Presented by: Yuval Nir

Y. Nir
Sagol School of Neuroscience & Department of Physiology and Pharmacology, Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel

Objectives: Sleep, sleepiness and the underlying electrophysiological oscillations have been traditionally studied with scalp electroencephalography (EEG), or within a few brain regions in animals. Here we set out to better characterize neuronal activity during sleep and sleepiness by examining intracerebral recordings in humans.
Methods and materials: We obtained full night continuous sleep recordings, as well as sessions during sleep deprivation and wakefulness, in 19 individuals undergoing presurgical clinical testing. Electrooculogram (EOG), electromyogram (EMG), scalp EEG, and video were used to determine sleep-wake stages. Depth intracranial electrodes monitored activity in frontal/parietal cortices and multiple Medial Temporal Lobe (MTL) structures (n=172 locations). Microelectrodes recorded neuronal spiking activity from 600 units (sleep) and 1457 units (sleep deprivation).
Results: During sleep, we found changes in spindle occurrence, frequency, and timing between regions and across sleep. We further show that both slow waves (and the underlying active and silent neuronal states) as well as sleep spindles occur mostly locally. We replicated these results in freely behaving rats to rule out the contribution of epileptogenic factors.
Next, we studied neuronal activity underlying the cognitive effects of sleepiness using a Psychomotor Vigilance Task (PVT) before/after full-night sleep deprivation. During lapses that became more frequent with sleepiness, single-unit responses in the MTL decreased 200-300ms after image onset, and low-frequency power in local fields was significantly increased locally.
Finally, around rapid eye movements (REMs) in both sleep and wakefulness, individual MTL neurons show reduced firing rates prior to REMs and transient increases in firing rate immediately after, similar to activity evoked by image presentation. Response latency, selectivity, and theta phase reset are likewise similar around REMs in sleep and wakefulness.
Conclusions: Most slow waves and sleep spindles occur locally, suggesting that constrained intracerebral communication is an important feature of sleep. In humans, “local sleep” during wakefulness may underlie the cognitive effects of sleepiness. Finally, REMs during sleep rearrange discrete epochs of visual-like processing as during wakefulness.

619 - **Thalamo-cortical activity in sleep-wake transitional states: coming in is different from getting out!**
Presented by: Helene Bastuji

H. Bastuji[1,2]
[1]Lyon Neuroscience Research Center, Central Integration of Pain Lab, [2]Hospices Civils de Lyon, Unité d’Hypnologie, Hôpital Neurologique, Lyon, France

Thalamic and cortical activities are assumed to be time-locked throughout all vigilance states.

However, simultaneous recordings of the cortex and the thalamus showed a decoupling of their activities at sleep onset. Thalamic deactivation most often precedes that of the cortex by several minutes. Delays between thalamus and cortex deactivations can vary from one subject to another when a similar cortical region is considered and heterogeneity in activity levels throughout the cortical mantle is larger than previously thought during the descent into sleep.
The arousing activity is a more synchronous process in thalamus and cortex. However, while thalamic activity is stereotyped with a spectral composition in-between wakefulness and sleep, that of cortical activity is heterogeneous. This heterogeneity of cortical patterns of activation is related to different factors such as sleep stages, cortical areas, arousal modality and homeostasis. Furthermore the spectral composition of the electrophysiological signal during arousal and wakefulness differ from each other. Thus, stereotyped arousals at the thalamic level seem to be associated with different patterns of cortical arousals due to various factors of regulation.
Asynchronous thalamocortical deactivation while falling asleep probably explains the production of hypnagogic hallucinations by a still-activated cortex and the common self-overestimation of the time needed to fall asleep. Furthermore, the cortex does not shift from sleep to wake in an abrupt binary way and arousal may be considered more as a specific state of the brain than as a short awakening. This state may reflect the mechanisms involved in the negotiation between two main contradictory functional necessities, preserving the continuity of sleep and maintaining the possibility to react.

02.11.2015 - 11:00-12:00
Methodological Approaches to Assess Sleep in Normal and Pathological Conditions

386 - **Sleep-wake detection using bed movement sensor**
Presented by: Jussi Virkkala

J. Virkkala[1], H. Mikola[2], K. Müller[3,4], M. Härmä[4]
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Objectives: Long term sleep monitoring using unobtrusive bed movement sensors seems promising. Usually sleep-wake detection is based on detected movements, respiration, and heart rate. Type of bed, placement of sensor can disturb the quality of respiration and heart rate signal. There are also various medications, medical conditions which affect respiration and especially heart rate. These reasons could limit practical applicability of respiration and heart rate based sleep-wake detection. In this study we studied how the use of only movement information of bed sensor could be used for sleep-wake detection possibly making bed movement systems less susceptible for mentioned factors.
Methods: Subset of 167 subjects of previous study (Virkkala et al., Automatic sleep stage classification using two-channel electro-oculography, J Neurosci Methods. 2007) were analyzed for previously unpublished static charge sensitive bed (SCSB) signal. Maximum absolute value of raw 200 Hz SCSB was calculated for each second. Number of seconds above threshold was then calculated for each visually scored sleep-wake epochs. Leave-one-out cross-validation (LOOCV) was used to determine these two parameters for maximal Cohen's Kappa.
Results: Due to poor SCSB signal 7 subjects were excluded. Average sleep efficiency for remaining 160 subjects was 84%. Epoch by epoch agreement and Cohen's Kappa for sleep-wake detection using bed movement sensor were 85% and 0.34.
Conclusions: Using only movement signal of bed sensor resulted in reasonable accuracy of sleep-wake detection. In addition to various bed sensors same detection algorithm could be applied to other e.g. doppler or depth video based sensors capturing body movements.

118 - **Comparison of sleep architecture and continuity measures obtained from polysomnography manual scoring versus heart rate and wrist movements automatic scoring**
Presented by: Alain Muzet

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Objectives: To evaluate the reliability of the new methodology Somno-Art (SA) for assessing sleep architecture parameters based on heart rate and body movement recordings, as compare to data

obtained from the simultaneously recorded polysomnography (PSG).
Methods and materials: Twelve healthy subjects (6 males and 6 females), 18 to 40 years old, participated in this study. Subjects stayed in a clinical research unit for 5 consecutive days and nights. Holter-ECG and actimeter data were recorded continuously during the whole experiment while PSGs were performed every night. All PSG recorded data were scored by two independent scorers and sleep stages were assigned to every 30-s epoch according to the AASM rules. The primary data used by the SA software were instantaneous heart rate and wrist actimetry, and sleep stage scoring was also performed for every 30-sec epoch.
To demonstrate consistency among the polysomnography manual scoring method and the SA methodology, a two-way mixed interclass correlation coefficient (ICC) model to assess the inter-rating reliability (IRR) was utilized. An ICC estimate of 1 indicates perfect agreement and 0 indicates only random agreement.
Results: The results have been obtained on a subgroup of 48 artefact-free nights. The ICC was calculated based on the two rating methods used in the study. Among the 12 parameters considered in these analyses, 10 showed an “excellent” IRR (ICC > .74): *sleep latency*, *REM sleep latency*, *Wake after Sleep Onset*, *amount of stage N3*, *amount of REM sleep*, *Total Sleep Time*, *Sleep Efficiency*, *Number of awakenings*, *number of sleep cycles* and the *Sleep Instability Index*. The two remaining parameters: *amount of stage N1* and *amount of stage N2*, showed a “good” IRR (ICC values between 0.60 and 0.74).
Conclusions: The results of this study stress the consistency between the sleep architecture and continuity measures associated with manual scoring of PSGs and the automatic SA system. The latter presents no problem of inter-scorer reliability and performs a full evaluation of the night in less than a minute. Under the circumstances where sleep is used as a biomarker, the key advantages of the SA system are the simplicity and ease of the recording system which allow long term monitoring to obtain data which are recorded nightly and under any condition.

398 - **Efficient automated sleep staging system with frontal electroencephalography and chin electromyography**
Presented by: Pei-Lin Lee

Y.-H. Huang[1], P.-L. Lee[2,3], Y.-A. Chiao[1], H.-W. Liu[3], T.-D. Chiueh[1]
[1]Graduate Institute of Electronics Engineering, National Taiwan University, [2]Center of Sleep Disorder, [3]Division of Pulmonary and Critical Care Medicine, Department of Internal Medicine, National Taiwan University Hospital, Taipei, Taiwan

Objectives: Polysomnography (PSG) is the gold standard for determining sleep efficiency and diagnosis of sleep disorder. PSG-based sleep staging requires experienced technologists to score the several physiologic signals, which is labor intensive and time consuming. Many studies tried to develop the automatic algorithms for sleep staging with the fewer physiologic signals. However, most proposed algorithms had accuracy less than 80% validated in one brand of PSG and not tested in patients with sleep disorders causing sleep fragmentation. In this study, we proposed an automated sleep staging system based on two EEG and one EMG which was validated in the subjects from control to obstructive sleep apnea (OSA) of different severity and in two brands of PSG.
Methods and materials: 107 subjects, 82 men and 29 women, consecutively referred for possible sleep apnea from Sep. 2012 to June 2013 were recruited for the study. The mean age was 46.4 year-old and body mass index was 26.2 kg/m^2. The distributions of OSA severity included no to mild OSA in 51.1%, moderate OSA in 25.1%, and severe OSA in 28.0%. Those subjects were grouped into Cohort A (Compumedics Siesta) and Cohort B (Embla N7000) according to the PSG devices. The neural-network-based decision tree system and Markov chain were applied to analyze the PSG parameters for development of algorithm (figure). The accuracy was crossly validated between two cohorts and hybrid classifier, which averaged the probability of two cohorts. Moreover, the accuracy was tested according to the OSA severity.
Results: Finally, PSG parameters from 52 subjects in Cohort A and 59 subjects in Cohort B were analyzed. There was no difference in age, BMI, gender, and OSA severity between two groups. In Cohort A, the classification accuracy of all stages, awake, light sleep, slow wave sleep, and rapid eye movement (REM) are 83.1%, 77.5%, 84.1%, 85.4%, and 84.4%, respectively. In Cohort B, they are 82.2%, 80.8%, 81.5%, 88.0%, and 86.0%, respectively. The overall accuracy of Hybrid classifier was 82.5%. The overall accuracy in patients with no to mild, moderate, and severe OSA was 81.6%, 82.3%, and 84.0%, respectively.
Conclusions: Our automated sleep staging system based on three signals could bring accuracy higher than 82% in overall and 80% in any stage. The algorithm worked well across the different

severity of OSA and in two brands of PSG.
Grant: IMERC; MOST 103-2314-B-002-139-MY3

336 - **Suprasternal pressure - a new method for the noninvasive evaluation of respiratory effort**
Presented by: Thomas Penzel

T. Penzel, K. Jelavic, M. Glos, C. Schöbel, C. Garcia, I. Fietze
Sleep Medicine Center, Charité-Universitätsmedizin Berlin, Berlin, Germany

Objective: The esophageal pressure is considered as the gold standard for respiratory effort measurements in the diagnostic of obstructive sleep apnea syndrome. However, it is difficult to assess in daily routine, as it requires the intervention of a specialist for the installation, and sensor is not well tolerated by patients. Therefore, alternative sensors are needed to inform about respiratory efforts. This study aimed to evaluate a new technology PneaVoX for the assessment of respiratory efforts (Cidelec, France). This technology measures Suprasternal Pressure (SPR) which depends on respiratory efforts. In this study, SPR was used for apnea classification and compared to esophageal pressure as well as thoracic and abdominal belts.
Methods and materials: 33 patients suffering from SDB (Sleep Disordered Breathing) have been investigated. PneaVoX measurements and cardiorespiratory PSG were performed simultaneously in diagnosis nights in our sleep center. 9 patients were recorded with esophageal pressure sensor. Analysis was based on 4103 apneas detected from thermistor and nasal cannula, classified as obstructive in 2043 cases, mixed in 1644 cases, and central in 416.
Results*:* Mean age was 52.8±10.2 years and BMI was 30.1±5.1 kg/m^2. Characterization with suprasternal pressure correlate significantly to the reference (esophageal pressure, belts and SPR) for apneas with respiratory efforts ($r=0.99$, $p< 0.0001$), and for central apneas ($r=0.96$, $p< 0.0001$). Apnea characterization sensitivity and specificity for SPR were good comparatively to the ones for respiratory belt. Sensitivities are (98.3%/98.8% for SPR/BELTS respectively) for the detection of respiratory efforts in apneas and specificities are (79.8%/66.8% for SPR/BELTS).
Conclusions: Results show that suprasternal pressure is a reliable signal for the classification of apneas in clinical practice. It is a promising feature to highlight obstructive apneas shown central on belts (Boudewins, Sleep 1997, Luo, Chest 2009).

02.11.2015 - 11:00-13:00
Neurological Disorders and Sleep

206 - **Sleep disorders in motor neuron diseases**
Presented by: Gulcin Benbir Senel

A. Reyhani, G. Benbir Senel, D. Karadeniz
Istanbul Universitiy Cerrahpasa Faculty of Medicine, Istanbul, Turkey

Objective: Obstructive sleep apnea syndrome (OSAS) is known to co-exist frequently in patients with motor neuron diseases (MND). The association of other sleep disorders in these patients, however, is not well explored. Here is investigated the patients with MND clinically, and polysomnographic recordings were reviewed to explore sleep disorders.
Methods: The files of 73 patients with MND having polysomnographic recordings in our sleep disorders unit were retrospectively analyzed.
Results: Thirty-six patients were females (49.3%), and 37 of them were males (50.6%). The mean age of study population was 58±9.8 years, and mean body mass index was 25.71± 4.89 kg/m^2. OSAS was detected in 49 patients (67.1%), the mean apnea-hypopnea index was calculated as 28.0±16.3 per hour of sleep. Thirteen patients (17.8%) had sleep related hypoxemia-hypoventilation syndrome, four patients (5.4%) had central sleep apnea syndrome. Fifty patients (68.4%) had at least one sleep disorder other than sleep related breathing disorder. Of these, 19 patients (26.0%) had restless legs syndrome, 34 patients (46.5%) had periodic leg movements in sleep (PLMS). The mean PLMS index was calculated as 34.0±19.6 per hour of sleep. Ten patients (14.2%) had fragmentary myoclonus, 8 patients (10.9%) had REM without atonia, and four of them had REM sleep behavior disease.
Conclusion: We demonstrated that not only obstructive sleep apnea syndrome but also other sleep related breathing disorders are commonly seen in patients with motor neuron disease. Moreover, other sleep disorders especially sleep related movement disorders exist more commonly in patients with motor neuron disorders in compared to general population.

101 - **Patients with narcolepsy stratified by the presence of cataplexy: retrospective subgroup analysis of treatment with sodium oxybate in a randomised clinical trial**
Presented by: Claudio Bassetti

C. Bassetti[1], J. Black[2,3], R.K. Bogan[4], C. Lai[2], T.J. Swick[5]
[1]Department of Neurology, University of Bern, Bern, Switzerland, [2]Jazz Pharmaceuticals, Inc., Palo Alto, [3]Stanford Sleep Medicine Center, Redwood City, CA, [4]University of South Carolina School of Medicine, Columbia, SC, [5]Neurology and Sleep Medicine Consultants of Houston, Houston, TX, United States

Introduction: Clinical trials have not evaluated the effects of sodium oxybate (SXB) on patients with narcolepsy without cataplexy.
Methods: This retrospective analysis evaluated data from a phase 3, randomised, placebo-controlled trial of SXB+modafinil in adult patients with narcolepsy with cataplexy (NC; n=95) or without cataplexy (NWOC; n=127). Cataplexy patients were identified based on medical history, concomitant medications, and sleep-onset rapid eye movement periods on the nocturnal polysomnogram. Patients were randomised to receive 8 weeks of placebo, SXB (6 g/nightly for 4 weeks increased to 9 g/nightly for 4 weeks), 200 to 600 mg/day modafinil, or SXB+modafinil. Outcomes included the change from baseline at 8 weeks on the Epworth Sleepiness Scale (ESS), Maintenance of Wakefulness Test sleep latency, and percentage of patients with improvement on the Clinical Global Impression of Change (CGI-C).
Results: In the NC group, ESS improvement was significantly greater with SXB (-2.9; *P*=0.011) and SXB+modafinil (-3.8; *P*=0.002) vs placebo (0.8). Similarly, ESS improvement was significantly greater in the NWOC group with SXB (-3.0; *P*=0.021) and SXB+modafinil (-2.8; *P*=0.015) vs placebo (0.8). MWT sleep latency in the NC group significantly increased with SXB+modafinil (3.34 minutes; *P*< 0.001), and tended to be increased with SXB (0.90 minutes; *P*=0.096) vs placebo (-2.58 minutes). In the NWOC group, sleep latency was significantly increased for both subgroups vs placebo (*P*< 0.05). On the CGI-C, significantly more NC patients treated with SXB (69.2%; *P*=0.004) and SXB+modafinil (59.1%; *P*=0.001) achieved “very much improved” or “much improved” vs placebo (18.8%). Although more NWOC patients treated with SXB (44.1%) and SXB+modafinil (41.4%) achieved “very much improved” or “much improved” on the CGI-C vs placebo (28.6%), these differences were not statistically significant. Adverse events were consistent with the drug profiles.
Conclusion: SXB alone or in combination with modafinil decreased excessive sleepiness and improved ability to remain awake similarly in NC and NWOC patients.

99 - **Definition of a responder to narcolepsy treatment with JZP-110 based on the results of a phase 2b clinical trial**
Presented by: Jed Black

L. Scrima[1], H. Emsellem[2], P. Becker[3], C. Ruoff[4], D.A. Lankford[5], G. Bream[6], M. Khayrallah[6], J. Black[4,7]
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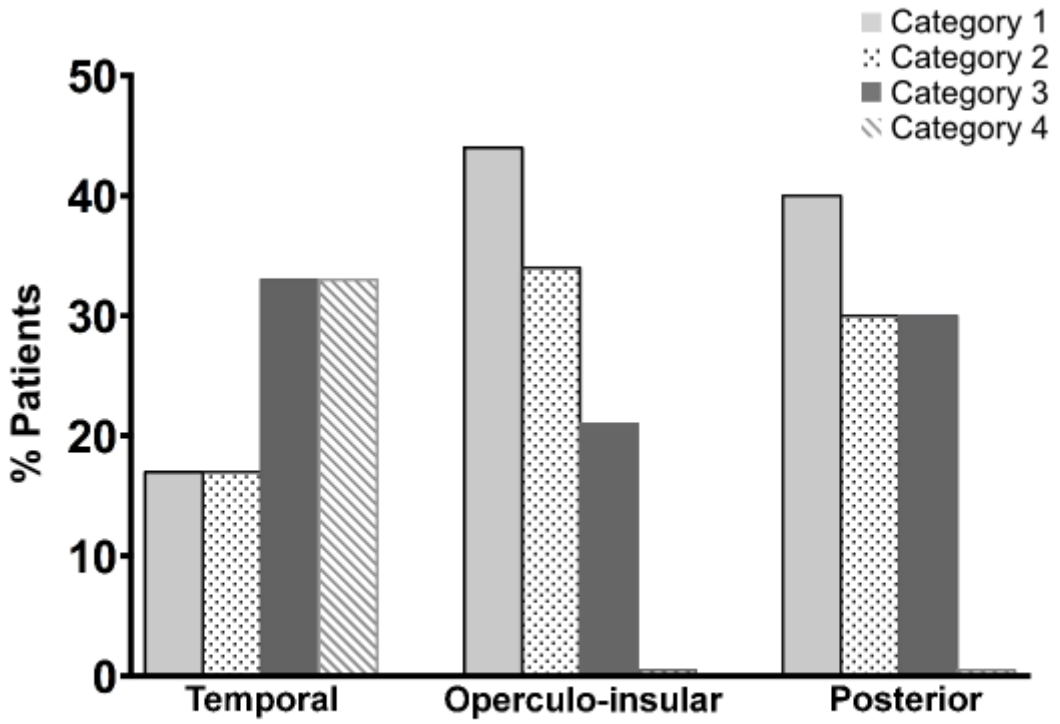
Introduction: Responder analyses are important to assess meaningful changes to patients in clinical trials. This post hoc analysis evaluated two patient-reported outcomes, the Patient Global Impression of Change (PGI-C) and the Epworth Sleepiness Scale (ESS), to establish a preliminary estimate of an optimal ESS change cut-off criterion for defining responders to treatment with JZP-110, a wake-promoting agent that appears to have a distinct mechanism of action.
Methods: Adults with a diagnosis of narcolepsy were enrolled in a phase 2b, double-blind, placebo-controlled, parallel-group study and randomised to receive 12 weeks of once-daily placebo (n=49) or JZP-110 (n=44) 150 mg/day (weeks 1-4) and 300 mg/day (weeks 5-12). Descriptive statistics and receiver operating characteristic (ROC) analysis compared the anchor measure, PGI-C, to the percent change from baseline in the ESS to establish the change in ESS that corresponds to PGI-C ratings of “much improved” or “very much improved.”
Results: Patients were predominantly female (64.5%), white (74.2%), with a mean (standard deviation [SD]) age of 38.7 years (12.1 years) and a baseline mean (SD) ESS of 17.3 (3.3). At week 12, patients

(n=10) who reported that they were “very much improved” on the PGI-C had a mean reduction in their ESS score of 76.7% and patients (n=33) who reported that they were “much improved” on the PGI-C had a mean reduction in their ESS score of 49.1%. ROC analysis of the PGI-C ratings “much improved” or “very much improved” revealed an area-under-the-curve of 0.9 and determined that a 25% reduction in ESS (sensitivity, 81.4%; specificity, 80.9%) may be an appropriate cut-off criterion to use for defining a meaningful patient response to JZP-110.
Conclusion: A ≥25% reduction from baseline in ESS score, as demonstrated by ROC analysis, may be used as a cut-off criterion to identify patients with narcolepsy who respond to treatment with JZP-110.

597 - **Sleep-related hypermotor seizures arising outside the frontal lobe: a review of 45 surgically treated patients**
Presented by: Steve A. Gibbs

S.A. Gibbs[1,2], P. Proserpio[1], A. Losurdo[1], S. Francione[3], M. Cossu[3], L. Tassi[3], G. Lo Russo[3], L. Nobili[1]
[1]Centre of Sleep Medicine, Centre for Epilepsy Surgery 'C. Munari', Milan, Italy, [2]Center for Advanced Research in Sleep Medicine, Université de Montréal, Montreal, QC, Canada, [3]Centre for Epilepsy Surgery 'C. Munari', Ospedale Niguarda, Milan, Italy

Objectives: Sleep-related epilepsy (SRE) is diagnosed when seizures occur exclusively or predominantly during sleep. Although a heterogeneous disease, many SRE cases have a focal seizure onset zone (SOZ), often amenable to surgical treatment if they become drug-resistant. While the majority of SOZs are located in the frontal lobe, producing the classic hypermotor semiology, some SRE with hypermotor seizures have an extra-frontal SOZ. To better characterize this population, we reviewed the anatomo-electro-clinical features, SOZ location, histopathological substrate and postoperative outcome of patients with drug-resistant SRE in our centre from October 1997 to March 2015.
Methods: Patients with SRE were classified according to the location of the SOZ: frontal, temporal, operculo-insular or posterior cortex. Seizure semiology was categorised according to earliest ictal features[1]:
1) elementary motor signs (e.g. clonic jerks, tonic-dystonic posturing);
2) unnatural gestural motor behaviours;
3) integrated behaviours with distal stereotypies (e.g. pedalling) and
4) gestural behaviours with high emotional content.
The histopathological substrate and the two-year postoperative Engel outcome, when available, were also assessed.
Results: From a database of 1516 patients, we identified 161 patients with SRE (10.6%), of which 139 had an early hypermotor semiology. The SOZ was located in the frontal lobe in 94 patients and was extra-frontal in 45 (32.4%): temporal (n=12), operculo-insular (n=23) and posterior (n=10). Figure 1 illustrates how early hypermotor semiology was expressed according to the extra-frontal SOZ location. The most common histopathological substrate was focal cortical dysplasia (FCD) type II (60%), regardless of the SOZ location. Finally, a two-year postoperative outcome was available in 41/45 patients. Of these, 24 (59%) had an Engel Class I, with temporal lobe onset having the highest rate of seizure freedom (80%).



[Figure 1]

Conclusion: SRE with a focal onset are found in approximately 10% of patients undergoing epilepsy surgery. Although the SOZ is mainly frontal, a third of patients with hypermotor seizures have an extra-frontal onset. SOZs located in the operculo-insular and posterior regions tend to produce more elementary and unnatural hypermotor behaviours while temporal SOZ produce more integrated behaviours with high emotional content. Finally, postoperative outcome is satisfactory in most.
[1]Bonini et al. *Epilepsia* 55(2), 2014

523 - **Sleep in the acute and subacute phase after ischemic stroke (SAS-CARE study)**
Presented by: Silvia Miano

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[1]Neurocentre of Southern Switzerland, Lugano, [2]Neurology Department, Inselspital, Bern University Hospital, [3]Pneumology Department, Inselspital, Bern University Hospital, Bern, Switzerland, [4]Department of Neurology, Ospedale Niguarda, Milano, Italy, [5]Department of Neurology, University Hospital Münster, Münster, Germany, [6]Ospedale San Giovanni, Bellinzona, Switzerland

Background and aims: Stroke is known to cause sleep disturbances. Only very limited data are however available on sleep EEG changes in acute and subacute stroke.
Patients and methods: In the context of the SAS-CARE study consecutive patients with ischemic stroke and transient ischemic attack (TIA) from 5 centers were assessed within 7 days (BL) of the acute event and at 3 month (M3) by conventional polysomnography (PSG). Sleep was scored centrally according to international criteria.
The analysis of all evaluable patients used descriptive statistics, the Wilcoxon rank-sum test to study sleep parameters, their evolution, and their relationship with clinical variables.
Results: A total of 258 patients were assessed: 105 at BL and M3, 63 only at BL, and 90 only at M3. The characteristics of the entire population are the following: mean age 61 (s.d. 9.4, range 29.8-78.6)

years, 74.4%males, 84% ischemic stroke, admission National Institute Health Stroke Scale (NIHSS) 4.2 (s.d. 5, range 0-25). In the 85 stroke patients studied at both BL and M3 the sleep evolution was characterized by an improvement of sleep efficiency, total sleep time; and an overall stability of sleep stage N2-N3, REM sleep, PLMI and AHI (see table).

Total sleep time, h, mean (s.d.), at baseline vs month 3	5.35 (1.6) vs 5.8 (1.4), p<0.005
Wake after sleep onset % SPT (sleep period time), mean (s.d.), at baseline vs month 3	35.3 (17.3) vs 25.7 (16.6), p<0.0001
Sleep efficiency, mean (s.d.), at baseline vs month 3	59.1 (18.4) vs 66.7 (18.2), p<0.0001
Stage N1 % SPT, mean (s.d.), at baseline vs month 3	6.7 (3.5) vs 7.5 (4.1)
Stage N2 % SPT, mean (s.d.), at baseline vs month 3	35.5 (10) vs 38.3 (10.8)
Stage N3 % SPT, mean (s.d.), at baseline vs month 3	16.7 (7) vs 18.1 (7.2)
REM sleep of total sleep time, mean (s.d.), at baseline vs month 3(s.d.); N=167	12.2 (5.8) vs 13 (5.6)
Periodic Limb Movement Index (PLMI), mean (s.d.), at baseline vs month 3(s.d.); N=194	12.5 (20.5) vs 13 (20.4)
PLMI≥10Index, mean (s.d.); N=132	10% vs 20%
Apnea hypopnea index, n/h mean (s.d.), at baseline vs month 3	20.8 (16.8) vs 17.9 (16.5)

[Main baseline characteristics and outcomes (only)]

Conclusions: In this large polysomnographic study we found an overall improvement of sleep quality from the acute to the subacute phase of stroke, but an unexpected/unreported stability of PLMI and REM sleep, and of AHI. These observations have clinical implications for the care of stroke patients but also for our understanding of the mechanisms controlling PLM and REM.

291 - **Evaluation of sleep disorders in patients with severe traumatic brain injury during rehabilitation**

Presented by: Maria Gardani

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[1]School of Psychology, [2]Mental Health & Wellbeing, University of Glasgow, [3]Graham Anderson House, Brain Injury Rehabililtation Trust, [4]University of Glasgow, Glasgow, United Kingdom

Objectives: To explore the presence and types of sleep disorders in chronic patients with severe traumatic brain injury (TBI) undergoing inpatient rehabilitation using formal diagnostic criteria based on the International Classification of Sleep Disorders (2nd edition).
Methods and materials: In a cross sectional design, thirty (n=30) chronic inpatients with severe TBI responded to a semi-structured clinical interview about their sleep-wake patterns. The patients wore an actiwatch for seven days and completed self-report measures on sleep, mood, fatigue, pain and daytime sleepiness.
Results: Twenty participants (67%) had sleep-wake cycle disturbances (SWCD), of which fifteen (50%) met diagnostic criteria for a sleep disorder. Diagnosed sleep disorders in the sample were insomnia (26.7%), post-traumatic hypersomnia (6.7%), delayed sleep phase syndrome (10%), irregular sleep-wake pattern disorder (3.3%) and periodic limb movement disorder (3.3%). Sleep quality was estimated by senior clinical staff as interfering with rehabilitation in 36.6% of the sample. Poor sleep quality was associated with greater anxiety, fatigue, and daytime sleepiness.
Conclusions: Consistent with previous studies, the present investigation showed high levels of disturbed sleep-wake cycle disturbances in rehabilitation patients with severe TBI and this was associated with anxiety, fatigue, and daytime sleepiness. These findings highlight the importance of

assessing and treating sleep problems in TBI patients undergoing rehabilitation.

480 - **Sleep and mood and risk of dementia - a prospective study of the National FINRISK study cohorts**
Presented by: Sonja Sulkava

S. Sulkava[1,2], E. Kronholm[3], T. Laatikainen[1], T. Paunio[1,2]
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Objectives: Sleep difficulties as well as depression and psychological stress are proposed as risk factors for dementia. However, data from large representative samples of the general population are needed to further validate and explore the connections. To our knowledge, there are no prior studies reporting connection of job-related exhaustion or nightmares and risk of dementia.
Methods and materials: The analyses were performed in the National FINRISK Study samples representative of the general adult population collected every 5 years starting from 1972. The questionnaires included questions e.g. on insomnia, use of sleep medicine, nightmares, job-related exhaustion and depressive symptoms. In the initial analyses we were able to use the cohorts from years 1992, 1997, 2002 and 2007 comprising altogether 10 000 individuals over 65 years in year 2011. Dementia and Alzheimer's disease (AD) were assessed from the national registers (Care Register for Health Care, Drug Treatment Information System, Register of Cause of Death) years 1992-2011 resulting in 700 cases of dementia which included 500 cases specified to be AD. Logistic regression models were used to analyse the data. Sex and age at the time of diagnosis or at the end of the follow-up (>65 years) were included in all the models. Prevalent cases of dementia were excluded from the analyses.
Results: Questions of depression and nightmares predicted significantly the risk of dementia after adjusting for age and sex ($P < 0.05$). Association of nightmares remained significant after adding depression to the model. Self-reported insomnia (during the current month, dichotomized) or use of sleep medicine (during the current month, dichotomized) as well as job-related exhaustion (frequency of symptoms) showed non-significant tendency of association with the risk of dementia.
Conclusions: We were able to replicate the association of depressive symptoms with the risk of dementia and AD. There was also significant association of nightmares with the risk of dementia which seemed to be partly independent on the reported symptoms of depression. Non-significant tendencies of association for insomnia or job-related exhaustion symptoms and dementia will be reanalysed with bigger data set in the next stage of our study. Analysis of a larger data set with > 40 000 individuals, with follow-up period up to 39 years, will make possible to separate the effect of sleep and mood on incidence of dementia at different ages.

473 - **Alterations of sleep slow waves in pre-manifest and manifest Huntington's disease**
Presented by: Alpar S. Lazar

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Objective: Slow waves (SWs) (0.5-4.0 Hz) in field potentials during sleep reflect synchronized alternations between bursts of action potentials and periods of membrane hyperpolarization of cortical neurons. The individual characteristics particularly the slope of the SWs are thought to reflect homeostatic sleep pressure and synaptic strength in cortical networks and recently have shown to be modulated by circadian phase as well. Huntington´s disease (HD) is a fatal autosomal dominant, neurodegenerative condition characterized by progressively worsening motor and non-motor problems including, synaptic cognitive and neuropsychiatric disturbances, along with increasing disturbances of general sleep quality from pre-manifest stage to manifest stage. Evidence shows that subtle alterations in synaptic function could underlie the early symptoms in HD. It is of particular interest to understand the nature of this neuronal dysfunction using the sleep EEG dependent markers of synaptic strength.
Methods: We analysed the negative half waves of all detected SWs (>37.5 µV) in the entire night NREM sleep of 25 healthy controls (13 females, age: 44.8±15), 31 pre-manifest (PreHD) (20 females, age: 44.8±10.6) and 8 early manifest (eHD) (4 females, age: 56.3±7.2) patients according to published

methodology. We controlled our analyses for age and sex.
Results: The studied groups were different in the incidence (p< 0.006), amplitude (p< 0.0001), frequency (P< 0.0001), and the mean (p < 0.0001) and maximum slope (p < 0.003) of the SWs. The manifest HD group had a decreased SW incidence, amplitude, frequency and duration compared to both control and PreHD groups (P< 0.005 in all cases). PreHD patients were comparable to controls except that male PreHD patients had a higher amplitude of the SWs as compared to male controls (P< 0.003) and eHD patients (P< 0.0001). Disease burden score showed negative association with the amplitude (P< 0.014) mean slope (P = 0.02), maximum slope (p=0.04) within the combined PreHD and eHD patient group independent of sex.
Conclusion: The results show that sleep pressure and synaptic strength associated with SWs are decreased at the manifest stage of the disease but also associated with disease burden in the entire gene carrier group. The increased SW amplitude in preHD and decreased amplitude in eHD is in conformity with our recently reported results indicating disease burden dependent decrease in daytime sleepiness in HD gene carriers.

528 - **Paroxysmal agitated sleep-related episodes in adolescents and adults: atypical NREM parasomnias or sleep-related seizures? A clinical and video-polysomnographic study**
Presented by: Giuseppe Didato

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Objectives: Differential diagnosis between parasomnias and sleep-related epileptic seizures may be based on anamnestic clinical criteria, but also on neurophysiological data, particularly when history is not reliable.
We present twelve patients with paroxysmal sleep-related episodes, characterized by agitated behaviour, whose diagnosis was difficult because of ambiguous anamnestic and neurophysiologic results. Some of them were previously diagnosed as affected by sleep epilepsy.
Methods and materials: Twelve patients (mean age 28 years, range 13-48, four males and eight females) presented high frequency nocturnal episodes with onset during late childhood/adolescence or adulthood. The episodes were characterized by sudden onset usually followed by sitting on the bed, screaming, pedalling, sometimes standing up or running away, terrified facial expression, no recall of the event. The frequency was high, almost every night, in some patients increasing while growing up. They occurred mainly during the first half of the night. Menstrual cycle could facilitate the episodes in two women. Family history was positive in three cases.
Results: Video-polysomnographic recordings (VPSG) documented several nocturnal episodes in each patient. Electro-clinical features of the episodes were not univocal, duration ranged from a few seconds to a few minutes, but the great majority occurred during slow wave sleep. Interestingly, some aspects of the documented episodes resulted different from what was previously reported by the patients or their relatives. Neither epileptic ictal activity nor interictal epileptiform discharges were observed. Sleep structure showed a mild to moderate fragmentation. Brain MRI was uninformative. We interpreted that these patients were affected by NREM parasomnias with atypical features. Therefore, they were treated with drugs aimed at stabilizing sleep (Melatonin or 5 Hydroxytryptophan) and the majority of them showed a good response, with disappearance or significative reduction of the paroxysmal episodes.
Conclusions: The neurophysiological characterization of the paroxysmal sleep-related episodes by VPSG allowed us to identify some important electro-clinical features that resulted essential for the diagnostic conclusion and for the effective treatment of this group of patients, who showed difficult to classify sleep-related episodes.

479 - **Multifactorial secondary periodic leg movements and restless legs syndrome in an infant. A case report**
Presented by: Carmen Soria

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Objectives: To report a case of Periodic leg movements (PLM) and Restless legs syndrome (RLS) in

an infant, secondary to multiple etiologic factors.
Methods: 2-year old infant who 3 months after suffering from Acute Disseminated Encephalomyelitis (ADEM) started to present movements during sleep. ADEM lesions shown in previous MRI were extense in cortex and specially in brainstem. He was sent to our service with suspect of epileptic origin. We performed daytime and night time video-polysomnogram (video-PSG), as well as complete repeated blood analyses and brain+brainstem MRI.
Results: The daytime video-PSG showed an extremely high PLM index/hour (105), even though it was not a completely accurate index due to a short sleep time. The most striking finding was also a high PLM index/hour (90) during quiet wakefulness. A subsequent night-time video-PSG confirmed these findings during sleep and wakefulness (indexes of 75 and 50). No epileptic or cortical discharges were observed.
Analyses showed low ferritin without anemia. MRI studies showed remaining lesions in brainstem 6 months after the ADEM process.
After being treated with oral iron, ferritin levels got higher -almost normal nowadays-. Clinical outcome improved parallel to this raise, although leg movements mostly during sleep are still reported by patient's parents.
Conclusions: This case is an example of clear relationship between causal factors and development of PLM / RLS disorder in an infant. We here remark the importance of considering sleep disturbances and disorders in childhood and infancy after many intercurrent processes, and not only paying attention to epilepsy and most often considered disorders.
This case shows also a strong correlation between some of the causal factors and the clinical outcome, highliting the underlying physiopathology.

02.11.2015 - 12:00-13:00
Sleep Apnea in Medical and Neurological Disorders

150 - **The interaction between sleep apnoea and metabolic syndrome on TNFα levels and sleepiness: a population-based study**
Presented by: Camila Hirotsu

C. Hirotsu, S.M. Togeiro, L.O. Silva, L. Bittencourt, M.L. Andersen, S. Tufik
Psychobiology, Universidade Federal de São Paulo, São Paulo, Brazil

Objective: Fatigue and somnolence are quite common complaints in obstructive sleep apnoea (OSA). Metabolic syndrome (MetS) may be related to OSA in association with inflammation in a bidirectional relationship. Therefore, these abnormalities could help to explain the clinical spectrum of OSA. Our aim was to evaluate the interaction between OSA and MetS on inflammation and OSA symptoms.
Methods and materials: This is a cross-sectional population-based study. A total of 1,042 volunteers were selected using a probabilistic 3-stage cluster sampling technique according to gender, age and socioeconomic regions of the São Paulo's city (Brazil). The diagnosis of OSA was performed by full night polysomnography. Subjects were interviewed for fatigue by Chalder scale, depression and anxiety by Beck inventory and for sleep characteristics by questionnaires. MetS was assessed according to American Heart Association criteria and inflammatory parameters such as tumour necrosis factor (TNF)-α, interleukin (IL)-6, C-reactive protein (CRP), homocysteine and uric acid were quantified in blood samples.
Results: The results showed an interaction effect between MetS and OSA showing that within those participants with MetS, the presence of OSA led to an increase of the TNF-α levels as well as in the sleepiness scale, independently from gender, medication, depressive symptoms, hypoxia, sleep fragmentation and duration, age, BMI, and socioeconomic factors. OSA-related parameters were highly correlated with metabolic factors, and desaturation index was associated as possible predictor of homeostasis model assessment of insulin resistance (HOMA-IR).
Conclusion: MetS is related to sleepiness and inflammation in OSA population. These data could help to understand the clinical spectrum of OSA and should be considered to properly manage these subjects.
Financial Support: AFIP, CNPq, CAPES and FAPESP.

251 - **Impact of sleep disturbances on glomerular filtration functioning in the elderly**
Presented by: Isabelle Jaussent

I. Jaussent[1,2], J.-P. Cristol[3,4], B. Stengel[5,6], A.-M. Dupuy[1,2,3], A. Besset[1,2], C. Helmer[7,8], K. Ritchie[1,2,9],

C. Berr[1,2], Y. Dauvilliers[1,2,10]
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Objectives: To examine the association between insomnia complaints, sleep apnea syndrome, restless legs syndrome (RLS), excessive daytime sleepiness (EDS) and glomerular filtration decline in community dwelling elderly subjects.
Methods: Analyses were carried out on 1105 subjects aged 65 years or older randomly recruited from two French cities. For each subject, the glomerular filtration rate (eGFR) was estimated at baseline and at 11-year follow-up. An eGFR decline over the follow-up was defined as a percentage decline greater than the cut-off value of the highest tertile of kidney function decline in our cohort (21.94%). Insomnia complaints (difficulty in initiating sleep (DIS), difficulty in maintaining sleep (DMS), and early morning awakening (EMA)), EDS, and medication use were self-rated at baseline. RLS and its age at onset were assessed at study endpoint.
Ambulatory polysomnography was performed during the follow-up in a subsample (n=277) to evaluate apnea hypopnea index (AHI), periodic leg movements during sleep (PLMS) and total sleep time (TST) . Logistic regression models controlling for socio-demographic, lifestyle and clinical variables were implemented to determine whether sleep disturbances were associated with renal alteration.
Results: EDS increased the risk of eGFR decline (OR=1.67 95%CI=1.18-2.34) after adjustment for a large range of potential confounders including cardiovascular risk factors. RLS was also found to be associated with eGFR decline independently of cardiovascular diseases and EDS (OR=1.90 95%CI=1.13-3.18). However, the number of insomnia complaints, DIS and DMS were not significantly related to eGFR decline; a borderline significant association was found for EMA. In the subsample population, high AHI (≥ 30/hour) and short TST (< 6 hours) but not PLMS were linked to eGFR decline in crude associations; only AHI remained significantly associated after several adjustments.
Conclusions: Our results of this large 11-year prospective study in the elderly showed that EDS, RLS and AHI constitute key warning sleep markers of increased risk of renal function alteration in a very early stage of decline

12 - **Obstructive sleep apnoea in adults with Down syndrome: a cross-sectional prevalence study**
Presented by: Elisabeth Hill

E.A. Hill[1], S. Van Putten[2], S.-A. Cooper[3], L.J. Williams[4], R.L. Riha[1]
[1]Sleep Research Unit, The University of Edinburgh, [2]Down's Syndrome Scotland, Edinburgh, [3]Department of Health and Wellbeing, The University of Glasgow, Glasgow, [4]Division of Community Health Sciences, The University of Edinburgh, Edinburgh, United Kingdom

Objectives: Individuals with Down syndrome (DS) are predisposed to obstructive sleep apnoea (OSA) due to overlap between the DS phenotype and OSA risk factors. Around 55% of children with DS have OSA (de Miguel-Díez et al, SLEEP 2003) but, to date, no large-scale study has assessed OSA prevalence in DS adults. This study aimed to assess prevalence of OSA in an adult DS population.
Methods: Standard questionnaires including pictorial Epworth Sleepiness Scale (pESS; Ghiassi et al, Thorax 2010) and subscales of the Developmental Behaviour Checklist for Adults (DBC-A; Einfeld & Tonge, J. Autism Dev. Disord. 1995) were sent to adults aged ≥16 years with DS and their caregivers living in the UK. Symptoms highly suggestive of probable OSA were defined using algorithms described in a recent study of OSA in the general population (Fuhrman et al, Sleep Medicine 2012).
Results: Of 5266 questionnaires sent, 1093 valid responses were received (21%). Eighty-one responders (7%) reported a prior diagnosis of OSA (53 males, 28 females); 38 (4%) were on continuous positive airway pressure treatment and were excluded from further analysis. Responders (54% males, 45% females) were mainly young adults (mean age 28±9 years) who were overweight/obese (mean BMI 29.0±6.9kg/m^2). Females had a higher BMI than males (males 28.2±6.7kg/m^2, females 30.1±7.0kg/m^2; p< 0.001), although collar size was greater in males than females (males 41.4±4.7cm, females 38.3±4.7cm; p< 0.001). Males were sleepier than females (p=0.02). Mean pESS scores were within the normal range for the general population (7±5/24), with 23% reporting excessive daytime sleepiness (pESS >10/24). Snoring was reported by 78%, occurring

frequently (≥3 nights per week) in 41%. Twenty-nine percent reported witnessed apnoeas, 14% frequently. No significant gender differences in OSA symptoms were noted. When assessed for probable OSA, prevalence was estimated at 19-21 (males 21-22%; females 18-20%). Individuals with probable OSA scored significantly higher on all three DBC-A subscales.
Conclusions: In this first large, cross-sectional study of SDB in adults with DS, OSA prevalence was estimated at 20% - around 4 times higher than that of the general adult population. Objective prevalence data are currently in preparation.
Acknowledgements: Chief Scientist Office, Scotland; Fondation Jérôme Lejeune; Baily Thomas Trust; Down's Syndrome Scotland; Down's Heart Group; Down's Syndrome Association; Sleep Scotland

235 - **Differential associations between quantitative electroencephalogram markers and memory performance in mild cognitive impairment: influence of obstructive sleep apnea**
Presented by: Nathan Cross

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Background: Evidence supports quantitative electroencephalography (qEEG) measures obtained during sleep as biomarkers for cognitive function in healthy subjects and those with obstructive sleep apnea (OSA). Both OSA and mild cognitive impairment (MCI) are considered risk factors for dementia in older adults, however not all experience further cognitive decline. qEEG analysis may help elucidate the relationship between OSA and cognitive decline in this group of older adults and critically predict those at risk of transitioning from MCI to dementia.
Objectives: To compare the relationships between qEEG markers and cognitive performance in MCI patients with and without moderate OSA and controls. Based on previous research, we hypothesised that cortical slowing (a dominance of slow EEG frequency) and qEEG measures associated with sleep spindles would correlate with memory performance differently depending on OSA severity.
Methods and materials: 15 older adults (>50years) with both moderate OSA (AHI≥15) and MCI (MCI+), 21 older adults with MCI only (MCI-), and 19 aged-matched controls completed neuropsychological and medical assessments, and overnight polysomnography. Power spectral analysis (PSA) of the EEG (C3 derivation) was performed after previously validated automatic artefact removal. Absolute and relative power was calculated in 30-second epochs for delta (0.5-4.5 Hz), theta (4.5-8.0 Hz), alpha (8.0-12.0 Hz), sigma (12.0-15.0 Hz; a surrogate measure of spindle activity) and beta (15.0-32.0 Hz) frequency bands.
Results: There were no significant differences in PSA variables across the three groups. There were differences in memory performance between MCI- and controls, and MCI+ and controls, but not between MCI- and MCI+ groups. Spectral power in the theta, alpha and sigma bands was significantly correlated with tests of verbal memory in the MCI+ group (r range -0.52 to -0.59, all $p < 0.05$), but not in the MCI- or control groups.
Conclusions: These preliminary findings illustrate that while there were no differences in qEEG measures or memory function between MCI patients with or without OSA, there were differential associations between these measures in MCI patients depending on the presence of OSA. This suggests that OSA may be involved in altered brain activity that could directly relate to memory decline in older adults. Further studies looking at longitudinal qEEG and neuropsychometry should help to further characterise any relationships.

497 - **Sleep-disordered breathing in patients with acute stroke and transient ischemic attack: evolution and impact on outcome at 3 months (SAS-CARE study)**
Presented by: Silvia Miano

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Age [years], mean (s.d.); N=177	61.3 (9.5), range: 29.8-78.6
Gender, %; N=168	Male: 72%
Ischemic stroke/transient ischemic attack, %	89%, 11%
Body mass index [kg/m2], mean (s.d.)	27.7 (4.9)
Admission National Institute Health Stroke Scale, mean (s.d.)	4.3 (5.1), range:0-25
Stroke etiology, %	Large artery: 11% Cardioembolic: 20% Small artery: 13% Only patent foramen ovale: 14%
Stroke location, %	Infratentorial: 23%
Risk factors, %	Hypertension: 57% Current smoker: 33% Diabetes: 15% Atrial fibrillation: 11%
Apnea hyponea indexes (AHI, n/h), mean (s.d.), %	21 (18), range: 0-73, AHI≥10: 57%, AHI≥20: 40%, Obstructive apnea index: 6.1±9.3, Central apnea index: 2.7±8.3
Cheyne-Stokes respiration, %	Cheyne-Stokes respiration: 22%

[Key background and baseline data, N=168]

Background and aims: Sleep disordered breathing (SDB) is common after stroke. Its evolution after the acute phase and impact on clinical outcome are poorly known.
Patients and methods: In the context of the SAS-CARE study consecutive patients with ischemic stroke and TIA from 4 centers were assessed by conventional polysomnography within 7 days of the acute event (baseline, BL) and whenever possible also at 3 months (M3). Sleep was scored centrally according to international criteria. Stroke severity and clinical outcome were estimated by the National Institute Health Stroke Scale (NIHSS) and the modified Rankin Scale (mRS), respectively. Descriptive statistics and multiple regression methods with backwards variable selection to study predictors and impact of SDB were used.
Results: Of 168 patients at BL, 105 could be tested again at M3. Most patients had stroke (89%), 72% were male, mean age was 61 years and mean admission NIHSS 5.1 (Table).
The mean apnea hypopnea index (AHI, n/h) was 20.4 at baseline and 19.1 at M3. An AHI>=10 was found in 57% of patients at BL and in 45% at M3. A Cheyne-Stokes Respiration (CSR) was found in 22% at BL and in 11% at M3. At M3, obstructive apnea index but not central AI decreased significantly (6.1±9.3 vs 4.7±8.5, p< 0.01). The time spent in the supine position was similar at BL and M3 (33.2±28 vs 35.9±29.5 %).
Significant (p< 0.05) predictors of AHI at BL were age (coefficient: 0.43/year) and body mass index (1.04 m2/kg). Significant (p< 0.05) predictors of CSR at BL were age and NIHSS.
In stroke patients, a significant association between mRS at M3 (mean:1.1; 3-6, 9% ≥3) and baseline NHISS (0.11), age (0.025) and AHI (0.014) was found.
Conclusions: The main results of this large polysomnographic study confirm only partially the literature:
1) SDB is common in the acute phase of stroke;
2) obstructive but not central SDB improves in a minority of patients at 3 months,
3) SDB appears to have a modest but significant influence on stroke outcome at 3 months.

02.11.2015 - 14:00-15:00
Cerebral States during Normal and Pathological Conditions

655 - **Thalamic and neocortical differences in the relationship between delta and sigma time courses of human sleep EEG**
Presented by: Simone Sarasso

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Objectives: Capitalizing on basic neurophysiological observations regarding the spindle (sigma; 12-16

Hz) and delta (1-4 Hz) electroencephalographic (EEG) oscillations, particular attention has been paid to these rhythms and their relationship during sleep. Several studies reported an overall reciprocal relationship between sigma and delta power time courses as measured by a single correlation coefficient over NREM episodes. Here, by exploiting sleep intracerebral EEG (Stereo-EEG, SEEG) recordings we aimed at investigating this relationship across distant cortical and subcortical regions including thalamic nuclei.
Methods: Nine patients (5 M, 4 F) diagnosed with drug-resistant focal epilepsy underwent SEEG for the presurgical assessment of the epileptogenic zone. Inclusion criteria encompassed the presence of at least one bipolar SEEG lead investigating the thalamus. SEEG leads containing epileptiform activity were discarded. All the remaining contacts were analyzed (spectral analysis; 6-seconds epochs) and the time-course of sigma and delta activity was calculated for all the recording contacts. Cross-correlation analysis (lag-zero) was performed across all contacts between sigma and delta time-course activity across all sleep stages.
Results: In agreement with previous studies, for all patients, cross-correlation analysis between the time-course of sigma and delta activity performed both within and across neocortical contacts showed an overall reciprocal relationship (range -0.5 /-0.8). Intriguingly, when calculated for the thalamus, the correlation coefficient was found positive, both within thalamic contacts as well as between thalamic and neocortical contacts (range 0.7 / 0.9).
Conclusions: Our findings, although preliminary, suggest the coexistence of overnight patterns of distinct oscillatory activity between thalamic and neocortical regions. The occurrence of local slow waves at the neocortical level may prevent the emergence of synchronized spindle activity of thalamic origin, and therefore partially explain the observed dissociation. Further analysis should imply the detection of individual slow waves and spindles both in neocortical and thalamic regions, also including deep-seated cortical (e.g. hippocampus) as well as subcortical (e.g. limbic system) structures.

579 - **Functional networks involved during sleep spindles recorded in MEG**
Presented by: Jean-Marc Lina

J.-M. Lina[1,2,3], *Y. Zerouali*[4], *J. Dubé*[5], *J. Carrier*[2,5]
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Objectives: During NREM sleep, spindles result from a widespread thalamo-cortical loop and involve synchronous cortical networks that are still poorly understood. We investigated whether brain activity during sleep spindles can be characterized in terms of specific patterns of functional connectivity networks among cortical generators.
Methods and materials: Using simultaneous MEG-EEG sleep recordings, we developed a wavelet-based methodology aimed at identifying synchronous epochs during spindles and imaging the oscillatory cortical networks associated with. Spindles were detected on the Cz channel and analyzed using the MEG recordings. Around each spindle onset, we first extracted the frequency-locked MEG activity from the instantaneous frequencies of the MEG signals (analytic wavelet analysis). Secondly, we performed source reconstruction of the corresponding wavelet signals, yielding a robust estimate of the cortical generators of the observed synchronous oscillations. Finally, we quantified functional connectivity among cortical regions using phase-locking values in the source space. The main innovations of this approach are
1) to propose a new sampling of the sleep spindle with respect to the synchrony involved,
2) to reveal the dynamic behavior of functional networks resolved in the time-frequency plane and
3) to characterize functional connectivity among MEG sources through phase interactions during sleep spindles.
Brain activity of 5 young healthy subjects was recorded (90 minutes), following a period of 26 hours of sleep deprivation.
Results: For most of the sleep spindles (>92% in average), we observed a switch of connectivity from early fast (13-16 Hz) to late slow (9-13Hz) oscillatory modes. We also showed that earlier synchrony was associated with mainly intra-hemispheric connectivity whereas later synchrony was associated with global long-range connectivity.
Conclusion: We propose that such a methodology can be a valuable analysis tool for studying the functional connectivity underlying neural processes involving sleep spindles, such as memory consolidation, plasticity or aging. (Research supported by FRQ-NT(Quebec) and NSERC grants, Canada)

442 - **The impact of sleep on cognitive functioning**
Presented by: Bogdan Voinescu

B. Voinescu
Clinical Psychology and Psychotherapy, Babes-Bolyai University, Cluj-Napoca, Romania

Objective: The impact of several sleep related variables, such as subjective sleep quality, total sleep duration, stress-induced sleep reactivity and daytime fatigue on inattention, impulsiveness and cognitive failures was evaluated.It was expected that short or long sleep duration, as well as poor sleep quality, higher stress reactivity and fatigue were associated with more inattention, impulsiveness and cognitive failures.
Methods and materials: Two hundred twelve adults (81.9% women), aged between 18 and 58 (mean age±SD: 26.0±8.18) were recruited via a website and completed an online questionnaire that evaluated sleep related parameters, such as sleep quality (Pittsburgh Sleep Quality Index - PSQI), stress-induced sleep reactivity (Ford Insomnia Response to Stress Test - FIRST), daytime fatigue (Fatigue Severity Scale - FSS) and the core symptoms of ADHD in adults (Adult ADHD Self Report Scale - ASRS), impulsivity (Barratt Impulsiveness Scale - BIS) and cognitive failures (Cognitive Failures Questionnaire - CFQ). Participation was voluntary and confidential. The study was approved by the Ethics Committee of Babes-Bolyai University. Partial correlation with controlling for age and gender was used to measure the link between the aforementioned variables. Then the participants were divided based on sleep duration (cut-offs: 5.7, 7.2 and 8.7), sleep quality (cut-off: 7), sleep reactivity (cut-off: 19) and fatigue (cut-off: 36). Using ANOVA in SPSS 22.0, the significance of the difference between means was calculated.
Results: ASRS and CFQ correlated moderately, positively and significantly with FIRST, FSS and PSQI (rhos ranged from 0.314 to 0.421), while with BARAT only weakly (0.160 to 0.229). Those reporting poor sleep, higher stress-induced sleep reactivity and more severe fatigue scored significantly higher in ASRS, BARAT and CFQ. Total sleep duration was not found to have any significant impact on the measured variables.
Conclusions: These data suggest that the quality of sleep and not its duration has significant impacts on inattention, impulsiveness and cognitive failures. More specifically, the poorer the sleep, the higher the stress induced sleep reactivity and the more severe the daytime fatigue, the more negative the impact on the measured cognitive processes.

02.11.2015 - 14:00-15:00
Video Session: Sleep, epilepsy and neurological diseases

707 - **Epileptic seizures during sleep**
Presented by: Steve A. Gibbs

S.A. Gibbs
Centre for Advanced Research in Sleep Medicine, Hôpital du Sacré-Coeur de Montréal, Université de Montreal, Montreal, QC, Canada

Sleep-related epilepsy, defined as an epilepsy where “seizures occur exclusively or predominantly during sleep” represents around 10% of all epilepsies. Most cases originate from the frontal lobe and are of focal onset. Patients with almost exclusively sleep-related hypermotor seizures are said to be affected by nocturnal frontal lobe epilepsy (NFLE), a heterogenous syndrome regrouping genetic, cryptogenic and symptomatic cases. Classically, NFLE is associated with asymmetric tonic/dystonic postures or complex hypermotor movements occurring during sleep. In the space of a single night, patients may exhibit different sleep-related motor events of increasing complexity ranging from short minor motor events and paroxysmal arousals to the longer lasting major attacks. Although seizure semiology of the frontal lobe can be difficult to precisely localize, studies using invasive intra-cerebral EEG recordings (stereo-EEG) have mapped of these semiological features to specific cortical regions and categorized the ictal behaviours of the frontal lobe as a rostro-caudal continuum. The most highly integrated ictal behaviours arise from the rostral prefrontal regions, while the more elementary motor signs are associated to caudally located discharges. Furthermore, it is now known that one third of sleep-related seizures with frontal lobe semiology are of extra-frontal onset arising either from the temporal, insular or parieto-occipital regions. In these cases, the extra-frontal ictal discharge propagates to the frontal lobe after a certain delay. Consequently, extra-frontal clinical manifestations

and auras are often associated to the classic NFLE semiology and should be sought out: epigastric rising, fear, acoustic sensations, and/or déjà vu in temporal lobe onset; laryngeal and throat sensations, dysarthria, hypersalivation, diffuse or bilateral cutaneous paraesthesia of unpleasant character in insular onset; and focal paraesthesia, vertigo or a falling sensation in parietal lobe onset seizures.
In this session, classic videos of frontal lobe seizures will be briefly presented followed by examples of extra-frontal seizures propagating to the frontal lobe. Finally, a case of an 18-year old man with a seven-year history of sleep-related paroxysmal episodes will be briefly discussed, focusing on key clinical, anatomical and histopathological features of sleep-related seizures.

688 - **Unusual NREM parasomnias in adults**
Presented by: Sofia Eriksson

S.H. Eriksson
Dept of Clinical and Experimental Epilepsy, University College London, London, United Kingdom

NREM parasomnias are disorders arising from deep NREM sleep. NREM parasomnias usually start in childhood and the majority “grow out of” parasomnias in their teens. However, up to 2-3% of patients continue to have events in adulthood. In more unusual cases, events may also start later in life.
The most common types of NREM parasomnias are night terrors, sleep walking and confusional arousal. There are less frequently reported symptoms such as sleep eating and sleep sex where the latter may have forensic implications.
Recently we described a case with more unusual symptoms of NREM parasomnia with pain and screaming episodes from deep sleep. Events consisted of sudden arousal, screaming and flapping of left or right arm. She would complain of intense pain affecting the fingers of either hand or arm and occasionally her legs. Episodes would last < 30 seconds with some recollection. Polysomnography captured episodes from slow wave sleep and investigations excluded other causes for pain such as neuropathy or radiculopathy.
NREM parasomnias are thought to be incomplete arousals from slow wave sleep and blood flow study during sleep walking events has shown reduced blood flow in frontal and parietal association cortices but increased blood flow in cerebellum and posterior cingulate cortex supporting a hypothesis of dissociation between mental and motor arousal. During NREM parasomnia events, people may hence misinterpret internal or external stimuli and episodes may be confabulated during arousal in response to a more primitive fight or fright stimulus from subcortical brain regions.
In NREM parasomnia with pain symptoms, the sensory cortex may be activated during events instead of the more commonly affected visual cortex. It is possible that physical discomfort in the limbs could trigger arousals and act as a cue for the sensory hallucination.
For the majority of patients with NREM parasomnias the diagnosis is based on typical history such as age of onset of events, frequency of events and potential triggers and in particular a characteristic semiology reported by patients and bed partners. Differential diagnoses are in particular epilepsy and REM sleep behaviour disorder. Polysomnography is often used to support the diagnosis and may sometimes reveal less common diagnoses and the video session will include a case with a history strongly suggestive of NREM parasomnia where the overnight polysomnography revealed an unusual diagnosis of psychogenic parasomnia.

02.11.2015 - 14:00-15:00
CPAP Treatment of Sleep Disordered Breathings

503 - **Impact of CPAP on diastolic function in patients with coronary artery disease and obstructive sleep apnea: a randomized controlled trial**
Presented by: Yüksel Peker

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Background: We recently demonstrated that obstructive sleep apnea (OSA) was associated with worse diastolic function in patients with coronary artery disease (CAD) at baseline within the Randomized Intervention with Continuous Positive Airway Pressure (CPAP) in CAD and OSA (RICCADSA) trial. In the current study, we addressed if CPAP treatment would improve diastolic function in this CAD cohort with preserved left ventricular ejection fraction (LVEF≥50%).
Methods: Between December 2005 and November 2010, 244 revascularized CAD patients with non-sleepy OSA (apnea-hypopnea index (AHI)≥15 h^{-1}, and Epworth Sleepiness Scale [ESS] score < 10) were randomly assigned to CPAP or non-CPAP. CAD patients with sleepy OSA (ESS ≥10), receiving CPAP (N=155) and 112 nonOSA (AHI< 5 h^{-1}) patients were included as controls. Echocardiographic measurements were obtained at baseline, and after 3 months and 1 year, respectively.
Results: In the whole population, 381 patients had a preserved LVEF, and were free of atrial fibrillation and severe valve abnormalities at baseline. In the intention-to-treat (ITT) population, there were no significant differences regarding the changes in echocardiographic parameters of diastolic function after CPAP treatment. On treatment analyses revealed significant improvement in diastolic relaxation velocity (é tissue velocity) at 1 year follow-up in OSA patients who were using CPAP at least 4 h/night. In the multivariate regression analysis, the CPAP use ≥4 h/night was associated with an almost 3-fold increase in probability of improvement of the é tissue velocity after adjustment for hypertension, enlarged left atrium and increased left ventricular mass index. An even stronger association was observed in the OSA group using CPAP at least 5 h/night (Odds Ratio 4.3; 95% Confidence Interval 1.9-9.9).
Conclusion: Our findings did not show reversal of the worse diastolic function in the ITT population in the RICCADSA cohort with preserved LVEF. However, further adjustment for confounding factors as well as for CPAP adherence revealed an improvement in diastolic relaxation velocity after 1 year, which may have important implications for long-term outcomes.
Funding: *The study was supported by grants from the Swedish Research Council, the Swedish Heart and Lung Foundation, the Research Fund at Skaraborg Hospital, Heart Foundation of Kärnsjukhuset, ResMed Foundation, and Resmed Ltd.*

638 - **A randomised controlled trial of CPAP vs non-invasive ventilation for initial treatment of obesity hypoventilation syndrome**
Presented by: Eli Dabscheck

M. Howard[1,2], A. Piper[3], B. Stevens[1], A.E. Holland[1,4,5], B. Yee[3], E. Dabscheck[4,6], D. Mortimer[6], A.T. Burge[4], D. Flunt[3], C. Buchan[4], L. Rautela[1,2], N. Sheers[1,2], D. Hillman[7], D.J. Berlowitz[1,2]
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Objectives: Obesity hypoventilation syndrome (OHS) has become the most common indication for domiciliary Non-Invasive Ventilation (NIV). This project evaluated whether CPAP and NIV provide similar clinical outcomes in OHS.
Methods: 3 month randomised controlled trial of NIV (spontaneous-timed mode bi-level positive airway pressure - Bi-level PAP) vs CPAP for initial treatment of OHS, evaluating the impact on treatment failure (hospital admission, persistent ventilatory failure or non-compliance), quality of life and control of ventilatory failure.
Results: 60 participants were randomised (29 Bi-level PAP, 31 CPAP, age 53 (10) y, BMI 55 (12) kg/m^2, $PaCO_2$ 60 (14) mmHg). There was no difference between groups in treatment failure at 3 months (Bi-level PAP, 17.2% vs CPAP, 12.9%, p=0.65). Sleepiness (Epworth Sleepiness Scale (ESS)), quality of life (SF36 and Severe Respiratory Insufficiency questionnaire (SRI)), obesity and ventilatory failure (PaCO2) improved in both groups (p< 0.01 for all), however there was no difference between groups.
Conclusion: CPAP and Bi-level PAP provided similar improvements in symptoms, quality of life and ventilatory failure for OHS after 3 months with no difference in treatment failure.
Grant Support: The ResMed Foundation

41 - **Does CPAP treat depressive symptoms in OSA patients?**
Presented by: Yingjuan Mok

Y. Mok[1,2], C. Hoyos[2], C. Miller[2], K. Melehan[1], B. Yee[1,2], R. Grunstein[1,2], D. Bartlett[2], P. Liu[2], K. Wong[1,2]

[1]Respiratory and Sleep Medicine, Royal Prince Alfred Hospital, [2]Woolcock Institute of Medical Research, Sydney, NSW, Australia

Objectives: Depression is common in patients with obstructive sleep apnea (OSA). While continuous positive airway pressure (CPAP) improves several aspects of OSA, its efficacy in improving depressive symptoms remains controversial. This study was conducted to evaluate the impact of CPAP on depressive symptoms in OSA patients.
Methods: Pooled data from 2 randomized placebo-controlled trials with therapeutic and sham CPAP arms were reviewed. Depressive symptoms were measured using the Depression, Anxiety and Stress Scale (DASS) at baseline and 3 months. The primary outcome is the change in the depression score of the DASS (DASSD) after 3 months of intervention. Depression was defined as DASSD >9 (out of a maximum 42). Adherence to CPAP/sham was defined as average use >= 4 hours/day over the study period.
Results: 126 male OSA patients with a mean age of 51 (SD=11) were included in the analysis. Baseline BMI was 32.0 kg/m2 (SD=5.1) and AHI was 42.4 events/hour(SD =22.6). 12 patients were on antidepressants and there were no changes to medication during the study. 38.5% of CPAP users and 23.0% of SHAM users demonstrated adherence to treatment. The change in DASSD scores between baseline and 3 months did not differ in OSA patients given CPAP treatment versus sham CPAP (p=0.80). There was no significant difference between those who were adherent in either the CPAP or sham intervention groups (p=0.754), or when examining only those with depression at baseline (p=0.628). In a secondary analysis, those patients with baseline depression randomised to therapeutic CPAP experienced a greater reduction in DASSD scores at 3 months if they were adherent to therapy compared to those who were not (-10.0, 95% CI -18.3 to -1.8, p=0.019).
Conclusions: Overall, CPAP treatment did not significantly improve depression scores in OSA patients. However, a secondary analysis of the group with baseline depression suggests that CPAP adherence may play a role in treatment outcomes. The interaction between OSA and depressive symptoms is complex and treating both the OSA and depression appears crucial along with more intensive CPAP support in the early stages of treatment for patients with baseline depression.

429 - **Effects of CPAP on metabolic alterations in adipose tissue associated with OSA**
Presented by: Georgia Trakada

G. Trakada[1,2], D. Sakkas[3], S. Sakellariou[3], A. Konsta[1,2], E. Patsouris[3], A. Mitrakou[3]
[1]Pulmonary Laboratory of Alexandra Hospital University of Athens, [2]Sleep Study Unit, First Department of Psychiatry, University of Athens Medical School, Eginition Hospital, [3]Department of Clinical Therapeutics University of Athens Medical School, Athens, Greece

Objectives: Obesity is closely associated with OSA and is characterized by an overgrowth of adipose tissue that leads to the formation of hypoxic areas within the tissue. Hypoxic status within the adipose tissue could contribute to the development of insulin resistance in adipocytes. CPAP is the treatment of choice in moderate to severe O.S.A. We hypothesized that correction of profound hypoxia of OSA by CPAP may ameliorate the dysfunction of adipose tissue independently of weight loss.
Methods and materials: Eight recently diagnosed subjects with OSA by full polysomnography were studied before and after 6 months with CPAP therapy. Diabetes and prediabetes ,cardiovascular disease and current smoking were excluded. All subjects underwent anthropometric measurements an OGTT the day after PSG and 6 months after CPAP treatment. Fat biopsies were obtained at the same time periods and adipose tissue samples of 300mg were obtained from abdominal fat. Fat cell size, extent of fibrosis, vascularity, inflammatory infiltration and tissue macrophages accumulation were microscopically evaluated on Eosin-hematoxylin and Masson Trichrome histochemical and CD34, LCA and PGM-1 immunohistochemical stains respectively.
Results: Mean Age of the group was 48±3 years,mean BMI 37±3 kg/m^2. At the end of the 6 months BMI was not changed, waist circumference was decreased by 1.09±0.08cm, fat mass was statistically decreased from 45,17 to 31,16 kg (p< 0.002) Fat free mass increase did not reach statistical significance. A marked decrease in LCA was observed followed by an increase in CD34. A positive correlation was observed between LCA and decrease in fat mass.
Conclusions: In conclusion restoration of hypoxia by CPAP treatment for 6 months led to an improvement of adipose tissue function.

553 - **Wireless telemonitoring at the commencement of CPAP therapy does not affect long-term efficacy or adherence to the treatment**

Presented by: Tarja Saaresranta

U. Anttalainen[1,2], S. Melkko[1], S. Hakko[1], T. Laitinen[1], T. Saaresranta[1,2]
[1]Pulmonary Diseases, Turku University Hospital, [2]Sleep Research Centre, University of Turku, Turku, Finland

	Telemonitored Group (n=50)	Usual Care Group (n=61)	P-value
ESS	5.4±3.5	5.4±3.4	0.935
DEPS	1.8±3.4	1.5±2.8	0.839
GHQ-12	5.1±6.1	4.9±5.8	0.890
Change of PAP mode (%)	8.0	4.9	0.699
Discontinuation (%)	20.0	16.4	0.663
CPAP usage (mean hours/d)	6.4±2.1	6.1±1.7	0.625
CPAP pressure (cmH_2O)	10.3±1.3	10.8±1.6	0.172
Mask leak (L/min)	17.4±14.2	19.4±22.7	0.674
Residual AHI	1.3±1.0	3.2±3.8	0.035

[Table. Patient characteristics and technical data]

Objectives: Adequate support at the initiation of continuous positive airway pressure (CPAP) therapy is known to predict long-term adherence to treatment. Increasing number of sleep apnoea (OSA) patients challenges health care resources and novel solutions are urgently needed. Wireless telemonitoring during the CPAP trial might save nursing time. However, its impact on long-term adherence or efficacy of CPAP therapy is not known. We therefore wished to compare long-term CPAP adherence and efficacy of treatment between the groups who commenced their CPAP therapy according to our regular nursing procedure or with the help of the wireless telemonitoring used during the habituation phase of the CPAP therapy.
Methods and materials: Consecutive adult OSA patients were randomly allocated to the telemonitored (TM, n=50) or usual care (UC, n=61) groups. Gender distribution, mean age, body mass index, subjective sleepiness, or severity of sleep apnoea did not differ between the groups at baseline. Telemonitoring was started after CPAP titration and used in the beginning of the habituation phase of fixed pressure CPAP treatment until the treatment-related problems were adequately solved.
Results: After a one year from the start with the fixed pressure CPAP treatment, the residual AHI was 1.3±1.0/h vs. 3.2±3.8/h (p=0.035) in the TM and the UC groups, respectively. The groups did not differ in terms of weight, subjective sleepiness, depressive symptoms, psychological distress, change of CPAP mode to other PAP modes, discontinuation rate, adherence to CPAP treatment, therapeutic CPAP pressure, or mask leak (Table).
Conclusions: Using wireless telemonitoring at the commencement of CPAP therapy does not compromise long-term efficacy or adherence to CPAP therapy. It may help sleep nurses to provide adequate patient support for the increasing number of OSA patients.

02.11.2015 - 14:00-15:00
Sleep Habits and Disorders from Infancy to Adolescence

228 - **Parental and child sleep at two years of age - results from the Ulm SPATZ health study**
Presented by: Jon Genuneit

J. Genuneit[1], S. Braig[1], M.S. Urschitz[2], D. Rothenbacher[1]
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Background: Disturbed and insufficient sleep has been associated with various health outcomes in children and adults. Infant sleep and parental sleepiness are major sources of parental concern and stress. However, studies investigating the impact of child sleep on parental sleep in a family context in the general population are scarce.
Methods: In the Ulm SPATZ Health Study, 934 singleton newborns and their mothers were recruited following delivery in the University Medical Center Ulm, Southern Germany, between 04/2012 and 05/2013. A total of 568 fathers also opted into the study. Parental and child sleep were assessed in 218 triads during the ongoing 2-year follow-up with the Pittsburgh Sleep Quality Index (PSQI) and the Children's Sleep Habits Questionnaire (CSHQ), respectively, using separate self-administered questionnaires.
Results: Poor sleep quality (PSQI>5) was detected for 34% of the mothers and 26% of the fathers with both parents affected in 10% of the families. Use of sleeping medication was rare; fathers tended to score lower in all scales but sleep duration. For infants, CSHQ scores ranged from 34 to 61 with a mean (SD) of 45 (6.1). An increase in CSHQ score by two standard deviations of its distribution was associated with a 1-point increase in maternal PSQI (p=0.0025) but no significant increase in paternal PSQI.
Conclusion: Poor sleep quality is prevalent among parents of infants, even when breastfeeding has ceased and children have developed more stable sleeping patterns. Further investigation of the full SPATZ cohort will aid to determine subgroups with larger impact of the child's sleep quality on parental sleep.

516 - **Sleep habits among middle and high school students in the Greek population**
Presented by: Anastasios Bonakis

A. Bonakis[1], P. Alatzas[2], A. Konsta[2], S. Fragiadaki[2], C. Giavasi[2], D. Dikaios[2]
[1]Neurology, Athens, [2]University of Athens, Athens, Greece

Objectives: To promote sleep knowledge and record the sleep habits of teenage students in Greece.
Methods and materials: A theatre play («Are we getting some sleep tonight or what?» http://www.dana.org/About/EDAB/Publications/) was created and performed aiming to raise awareness of middle-high school students regarding the importance of sleep for psychosomatic wellbeing. A structured questionnaire was administered a month later aiming to record
1. teenagers´ sleep habits on weekdays-weekends
2. the use of electronic devices around their sleeping environment
3. teenagers´ sleep disorders
and to depict the educational purpose of art on health issues.
Results: More than 3000 students attended the play during 2013-2014. 1370 questionnaires were collected (628 males, mean age 15±1,5 years). The total responses and the male/female subgroups were analysed. Complains: bad sleep quality (Total 33,28%, 40,6% Girls, 25,3% Boys, p≤0,001), waking up tired (26,9%), daytime sleepiness during morning classes (Total 49,5%, Girls 56,4%, Boys p≤0,001), difficulties falling asleep (11%), sleep fragmentation(7,2%), early awakening (5,4%), fear of sleeping alone (3%), restless legs with difficulties in sleep initiation (2,4%) and noisy sleeping environment (1,09%). Girls outnumbered boys in almost every complaint. 96% of students have at least one electronic device in their bedroom. 54% still using it after lights-out. 84% keep their mobile phones switched on.
During weekdays 80% of students wake up between 7-8am, only 14,9% sleep before 23:00 and 19% sleep after 1:00 (Mean total sleep time (MTST)7,2 h). During weekends 40% wake up between 12-3:00 and 48,3% (55,7% of girls) sleep after 1:00 (MTST 9,1 h). 955 of the students said that the play promoted their understanding of sleep. 55% of boys and 66,6% of girls admitted that they should alter their sleep behavior, despite not having done so.
Conclusion: This study highlights teenagers´ weekday sleep deprivation in Greece, the common use of electronic devices in their sleep environment and the high prevalence of sleep disturbances particularly in girls.Finally it underlines the educational role of art in raising awareness around important health issues.

405 - **Sleep patterns in children from obese and non-obese families and in relation to parental obesity, sleep and stress**
Presented by: Lijuan Xiu

L. Xiu[1], *V. Svensson*[1], *E. Johansson*[1], *A. Ek*[1], *K. Ekbom*[1], *C. Marcus*[1], *M. Ekstedt*[1,2]
[1]Division of Pediatrics, Department of Clinical Science, Intervention and Technology, Karolinska Institutet, [2]School of Technology and Health, Royal Institute of Techology, KTH, Stockholm, Sweden

Objectives: Short sleep duration has consistently been associated with unhealthy weight development. Parental obesity is a major risk factor for childhood obesity. However, less is known about sleep patterns in young children of obese parents. This study was to describe children's sleep, parental sleep and stress in families with overweight/obese or normal weight parents, as well as to evaluate associations of children's sleep with parental obesity, sleep and stress.
Methods and materials: We used baseline data of 167 one-year-old children and their parents, participating in the longitudinal Stockholm obesity prevention project (Early-STOPP), with 121 children from overweight/obese families (at least 1 obese or 2 overweight parents) and 46 children from normal weight families. Sleep patterns of children were assessed using 7-day sleep dairies. Parental habitual sleep and stress were assessed using the Karolinska Sleep Questionnaire and the Swedish Parental Stress Questionnaire.
Results: Children from overweight/obese families had later bedtime and wake-up time, as well as longer sleep onset latency (SOL) and lower sleep efficiency (SE) than children from normal weight families. Although differences did not reach statistical significance, more children in overweight/obese families had < 10h night-time sleep and < 12h 24-hour total sleep. Parents in overweight/obese families had shorter total sleep duration than parents in normal weight families, and mothers in overweight/obese families experienced more sleep disorders and parental stress. In multivariate regression analyses, children's SOL was positively associated with parental overweight/obese (β=0.19, $p< 0.05$) and maternal 'social isolation stress' (β=0.17, $p< 0.05$). Children's SE was positively associated with maternal sleep quality
(β=0.24, $p< 0.01$) and 'sense of incompetence' (β=0.17 $p< 0.05$). Children's night-time sleep duration was negatively associated with their BMI (β=-0.20 $p< 0.05$) and maternal 'relationship with spouse' (β=-0.16, $p< 0.05$), and positively associated with paternal sleep quality (β=0.14, $p< 0.05$), while 24-hour sleep duration was only associated with gender.
Conclusions: This study suggests that beyond sleep duration, delayed sleep patterns and poor sleep quality in children from overweight/obese families identified already at one year of age may also contribute to the strong but poorly defined association between parental and childhood obesity.

		Normal weight families (n=46)	Overweight/obese families (n=121)	P-value
Sleep measures	BT (h:min)	19:36 (42)	19:54 (50)	0.03
	WT (h:min)	06:46 (44)	07:02 (43)	0.03
	nTST (h)	10.6 (0.77)	10.5 (0.77)	0.21
	24-TST (h)	12.6 (0.73)	12.4 (0.80)	0.06
	SOL (min)	10 (6,21)	18 (12,28)	0.00
	SE (%)	94 (91,97)	92 (89,95)	0.02
Categories of sleep duration	nTST<10h	7 (16.7)	35 (28.9)	0.07
	24h-TST<12h	9 (19.6)	40 (33.1)	0.09
Note: BT, bedtime; WT, wake-up time; nTST, night-time total sleep time; SOL, sleep onset latency; SE, sleep efficiency; 24h-TST, 24 hours total sleep time; h, hour; min, minute.The mean (SD), median (q1, q3) and number (%) are presented for normally distributed (BT,WT,nTST,24-TST), non-normally distributed (SOL,SE) and categorical data (nTST<10h,24h-TST<12h), respectively.				

[Children's sleep patterns in different families]

163 - **The long and short of adolescent sleep: the unique impact of day length**
Presented by: Kate Bartel

K. Bartel[1], *M. Gradisar*[1], *A. van Maanen*[2], *J. Cassoff*[3], *P. Williamson*[1], *A. Meijer*[2], *O. Friborg*[4], *F. Oort*[2], *R. Gruber*[3], *B. Knauper*[3]

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Objectives: Variation in day length has been proposed to impact adolescent sleep, yet it is unclear whether the influence of day length exists after taking into account known behavioural influences such as sleep hygiene (i.e., strategies to obtain good sleep) and parent-set bedtime.
This study aimed to determine the effects of day length on adolescents' weekday bedtime (BT), sleep onset latency (i.e., the time it takes to fall asleep; SOL) and total sleep time (TST) after controlling for age, parent-set BT and sleep hygiene and to determine which variables have the greatest impact on adolescent sleep.
Methods and materials: Data were collected from an online survey administered in Australia, the Netherlands, Canada and Norway (*N* = 711, *M* age = 16.3 years ± 1.64, 34% m). Information on weekday sleep patterns (BT, SOL, TST), age, sleep hygiene (Adolescent Sleep Hygiene Scale-revised; Storfer-Isser, Lebourgeois, Harsh, Tompsett & Redline, 2013), parent set BT (0=no, 1=yes) was gathered. Survey completion date and residence were used to calculate day length (range = 0.50-16.02 hours) using an online sunrise and sunset calculator.
Day length was categorised into three groups, and dummy coded for analyses, so that the mid length (7.5-13.00 hours) was the reference group.
Results: Hierarchical regression analyses determined that day length predicted a significant 2.0%, 3.2% and 2.0% variance in weekday BT, SOL and TST, respectively, after controlling for age, parent-set BT and sleep hygiene ($p < .001$). A shorter day length (0.5 hours), compared to a mid-length day predicted a later BT, and decreased SOL and TST ($p < .01$). A longer day length (13.01-16.50 hours) did not predict significant differences in adolescent sleep, compared to mid length day. Good sleep hygiene consistently had the largest beneficial influence on sleep parameters.
Conclusions: The effect of day length alone on BT, SOL and TST was small. Only a shorter day length produced significant differences in sleep parameters. Moreover, behavioural strategies to improve sleep (sleep hygiene) appeared more important in influencing adolescent sleep than day length.
References:
Storfer-Isser, A., Lebourgeois, M. K., Harsh, J., Tompsett, C. J., & Redline, S. (2013). Psychometric properties of the adolescent sleep hygiene scale. *Journal of sleep research*, *22*(6), 707-716.

02.11.2015 - 16:30-18:30
The Effects of Short Sleep or Sleep Deprivation on Quality of Life

554 - **Effects of lifestyle interventions on quality of sleep in breast cancer patients**
Presented by: Haleh Ghavami

H. Ghavami[1], N. Akyolcu[2]
[1]Medical Surgical Nursing, Urmiya Medical Sciences University, Nursing and Midwifery Faculty, Urmiyeh, Islamic Republic of Iran, [2]Surgical Nursing, Istanbul University, Florence Nightingale Nursing Faculty, Istanbul, Turkey

Objectives: To compare a 24-week lifestyle intervention program (doing aerobic exercises 45-60 minutes three times per week, for 24 weeks with dietary energy restriction training) to usual care on quality of sleep in women with breast cancer.
Methods and materials: This is a randomized clinical trial study. The Study samples were 80 women with stage I, II, or III breast cancer, that operated for breast cancer and their chemotherapy or radiation therapy completed 3-18 months ago. They are divided randomly into two groups; control group and lifestyle interventions group. Those in the lifestyle intervention group were instructed to practice aerobic exercises 45-60 minutes three times per week, for 24 weeks with dietary energy restriction training. Those in the control group were instructed to continue normal activities and their routine health care. Data were obtained from the patient information form and Pittsburgh Sleep Quality Index (PSQI) that completed before and after the lifestyle intervention in both groups.
Results: No baseline differences existed between the two groups for the mean of PSQI score (p = 0.594) before the study; but the mean of PSQI score in the lifestyle intervention group after the application decreased to 2.4 ± 1.39, while in the control group it decreased to 9.45 ± 3.95. The difference between the mean of PSQI score between the two groups after the application was statistically high (p = < 0.001) (Table 5).

Comparison before and after lifestyle intervention by Pitsburgh Sleep Quality Index (PSQI) (n=80)

Before intervention	Group	n	Mean	SD	z[a]	p
PSQI	Intervention	40	9,83	3,90	-0,533	0,594
	Control	40	10,20	3,69		
After intervention	**Group**	**n**	**Mean**	**SD**	**z[a]**	**p**
PSQI	Intervention	40	2,40	1,39	-7,335	**<0,001**
	Control	40	9,45	3,95		

[a]= Mann Whitney U test
***=p<0,001**

[Table 5]

Conclusions: Patients with breast cancer characterize a group worthy of attention and oncology nurses are in a unique position to offer suggestions to help manage physical and psychological problems, and lifestyle intervention could be considered as part of a cancer survivorship program. For women with breast cancer, lifestyle intervention can improve sleep quality. Additional research in lifestyle intervention along with cognitive behavioral therapy also may be beneficial.

365 - **Individual vulnerability of cognitive performance impairment after alcohol consumption predicts vulnerability to sleep loss**
Presented by: Eva-Maria Elmenhorst

E.-M. Elmenhorst, S. Benderoth, M. Vejvoda, J. Wenzel, D. Aeschbach
German Aerospace Center, Insitute of Aerospace Medicine, Cologne, Germany

Objectives: The vulnerability of cognitive performance to sleep loss varies largely among individuals. It has been proposed that these interindividual differences are related to the effects of adenosine in the brain which is known to increase sleepiness and sleep propensity. The performance impairing effects of alcohol have been suggested to be mediated in part by the inhibitory actions of cerebral adenosine. In the rat brain it has been reported that ethanol increases extracellular adenosine. Therefore, we investigated whether vulnerability to sleep loss can be predicted by the vulnerability of performance after alcohol intake.
Methods and materials: Individual susceptibilities to sleep loss and alcohol consumption were examined in 47 volunteers (mean age 27 ± 5 (SD) years, 21 female). Performance was tested using a 10-min Psychomotor Vigilance Task (PVT) every 3 hours during wake time. Participants were exposed once to 38 hours of total sleep deprivation and once to acute alcohol administration aimed at yielding a blood alcohol concentration (BAC) of 0.08%. After alcohol intake at 4 pm 35 participants had reached a BAC of more than 0.06% immediately prior to the PVT session at 6 pm (mean BAC 0.074%, SD 0.009%, min. 0.063%, max. 0.095%). Two nights of recovery were scheduled between conditions. Baseline performance was recorded at the beginning of the investigation following an 8-hour sleep period. Results from the 6 pm PVT sessions are reported.
Results: PVT performance impairments after 35 hours of sustained wakefulness and after acute alcohol intake, assessed both as deviations from baseline performance, correlated highly (i.e. 10% slowest reaction times: Pearson's $r=0.73$, $p< 0.0001$; standard deviation of reaction times: $r=0.75$, $p< 0.0001$; response speed: $r=0.47$, $p=0.0043$).
Conclusions: Individuals who showed good performance under sleep deprivation proved more resistant to the effects of alcohol consumption while persons who suffered strong performance impairments due to sleep loss did likewise after alcohol intake. This pattern suggests that sleep deprivation and alcohol effects on performance may share - at least in part - common pathways, possibly involving the adenosinergic system.

560 - **Nitric oxide modulation: a possible mechanistic approach to neuroprotective effect of *Centella asiatica* in sleep deprivation induced anxiety like behaviour and oxidative stress**
Presented by: Priyanka Chanana

P. Chanana, A. Kumar
University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh, India

Introduction: Anxiety and oxidative stress are established classic effects of Sleep deprivation. Therefore, the present study was designed with the aim to evaluate the possible neuroprotective effect of *Centella asiatica* and an effort was made in deciphering the plausible mechanism of its effects in sleep deprivation induced anxiety.
Materials and methods: Male laca mice were sleep deprived for a period of 72 hours using grid suspended over water method. Two doses of C. asiatica viz 150, 300 mg/kg per oral were used. Also NO modulators like antagonist L-name and precursor like L-arginine were given, in combination with C. asiatica to elucidate the NO modulating potential of the drug. All the drugs were administered for a total of 8 days starting 5days prior to sleep deprivation exposure. The animals were tested behaviourally for evaluation of anxiety, change in motor activity and for their brain samples were biochemically tested for the evaluation of oxidative stress markers.
Results: 72-hour sleep deprivation caused significant anxiety-like behaviour, impaired locomotor activity and produced oxidative damage to the neurons as compared with naive (without sleep deprivation) animals. C.asiatica treatment brings about an improvement in sleep deprivation induced motor dysfunction, anxiety like behaviour and oxidative stress parameters. Also while the neuroprotective effect of C. asiatica was increased by NO antagonists, it was diminished by NO agonists.
Conclusion: Results of the present study suggests that NO modulation is involved in the protective action of C.asiatica against sleep deprivation-induced anxiety-like behaviour and associated oxidative damage.

280 - **Sleep deprivation affects global brain reactivity but not global cortical connectivity**
Presented by: Giulia Gaggioni

G. Gaggioni[1], S. Chellappa[1], J. Ly[1], D. Coppieters 't Wallant[1], S. Sarasso[2], M. Rosanova[2], S. Archer[3], P. Maquet[1], D.-J. Dijk[3], M. Massimini[2], G. Vandewalle[1], C. Phillips[1]
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Objective: We recently found that local cortical reactivity and connectivity, inferred based on transcranial magnetic stimulation (TMS) coupled to EEG, were affected by time awake and the circadian timing system (Ly et al. in prep, Chellappa et al. in prep). Whether these observations can be generalized over the entire brain is unknown. We therefore investigated global brain responsiveness during a sleep deprivation protocol.
Methods: 22 healthy young men (18-30 years) underwent 8 TMS-EEG sessions during 29h of sleep deprivation under constant routine. TMS pulses were delivered over the frontal cortex, a brain region highly sensitive to sleep deprivation. After EEG pre-processing and source reconstruction ("multiple sparse prior" constraint), we determined spatio-temporal distribution of the statistically significant sources (> 4 SD signal variation post- relative to pre- TMS pulse, i.e. $p < 0.001$). We then computed a global cortical reactivity index [significant current density (SCD)], and a global cortical connectivity index [significant current scattering (SCS)] for each session (Casali et al., NeuroImage, 2010). SCD is highly sensitive to the amplitude of the response generated by TMS, SCS instead to its spatial extension. Both these synthetic indices were realigned according to circadian phase inferred from melatonin secretion profiles.
Results: Mixed effects analyses revealed a significant change in SCD with time in the protocol ($p = .02$), but no changes in SCS ($p = .3$). SCD showed a non-linear profile, relatively stable during the first 16h of the protocol - i.e. a normal waking day - and followed by a steep overnight increase up to the next morning.
Conclusions: These data suggest that the global brain reactivity mirrors local brain reactivity, pointing towards a magnification of local changes over the entire brain. However, global cortical connectivity does not appear to reflect the changes in local connectivity during sleep deprivation.
Fundings: WBI-AXA-FNRS-Ulg-FMRE-ARC-FEDER-WELBIO.

195 - **Neurofeedback training of the sensorimotor rhythm in insomnia does not change sleep-EEG parameters or sleep quality in the long term**
Presented by: Maria-Teresa Gnjezda

M.-T. Gnjezda, D. Koerner, D. Heib, K. Hoedlmoser, M. Schabus
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Consciousness Research', University Salzburg, Salzburg, Austria

There is only little evidence supporting the efficacy of neurofeedback training (NFT) as a non-pharmacological therapeutic tool to enhance sleep quality in insomnia. In the present study we used NFT with the aim to modulate the sensorimotor rhythm (SMR). The SMR frequency band between 12-15 Hz is known to be dominant during quiet but alert wakefulness and is prevalent in light NREM sleep in the form of sleep spindles. The question of the present study was whether patients suffering from insomnia could increase their SMR-rhythm and sleep quality on the long term in a double-blind design. 20 subjects with clinical symptoms of primary insomnia, 10 mispercept insomniacs and 12 healthy control subjects were tested. A counterbalanced within-subjects design (12 NFT sessions) was adopted. Each patient participated in SMR-NFT as well as sham-Pseudofeedback (PFT) training blocks (12 each). EEG baseline recordings were scheduled before and after each training session. Data revealed that participants could increase their SMR rhythm during NFT. If beta oscillations were trained during PFT these also increased, suggesting that various EEG-parameters can be modulate within 12 NFT sessions. The healthier the subject the better was the response to the “treatment”. However, no significant long-term effect could be shown in EEG baseline-measurements directly following training. Preliminary results could also not reveal any reliable effects on sleep onset, sleep duration or sleep maintenance. Subjective sleep quality finally showed a tendency to slightly increase after both NFT and PFT conditions. In summary, the findings do not support significant NFT benefits on insomnia if (elderly) patients are suffering from chronic insomnia. Possibly, patients suffering from chronic insomnia need more than 12 NFT sessions to show significant effects on subsequent sleep episodes.

393 - **Quality of life among untreated sleep apnea patients compared to the general population and changes after treatment with positive airway pressure**
Presented by: Erla Björnsdóttir

E. Björnsdóttir[1,2], B. Keenan[3], B. Eysteinsdottir[2], E.S. Arnardottir[1,2], C. Janson[4], T. Gislason[1,2], J.F. Sigurdsson[1,5], S.T. Kuna[3,6], A.I. Pack[3], B. Benediktsdóttir[1,2]
[1]University of Iceland, [2]Department of Respiratory Medicine and Sleep, Landspitali Landspitali - The National University Hospital of Iceland, Reykjavik, Iceland, [3]University of Pennsylvania Perelman School of Medicine, Philadelphia, PA, United States, [4]Uppsala University, Uppsala, Sweden, [5]University of Reykjavis, Reykjavik, Iceland, [6]Philadelphia Veterans Affairs Medical Center, Philadelphia, PA, United States

Objectives: Obstructive sleep apnea (OSA) leads to recurrent arousals from sleep, oxygen desaturations, daytime sleepiness and fatigue. This can have an adverse impact on quality of life. The aims of this study were to compare:
1) quality of life between the general population and untreated OSA patients; and
2) changes of quality of life among OSA patients after two years of positive airway pressure (PAP) treatment between adherent patients and non-users.
Propensity score methodologies were used in order to minimize selection bias and strengthen causal inferences.
Methods and materials: The enrolled OSA subjects (n=822) were newly diagnosed with moderate to severe OSA who were starting PAP treatment and the general population subjects (n=742) were randomly selected Icelanders. The Short Form 12 was used to measure quality of life.
Results: Untreated OSA patients had worse quality of life when compared to the general population. This effect remained significant after using propensity scores to select samples, balanced with regard to age, body mass index, gender, smoking, diabetes, hypertension and cardiovascular disease. We did not find significant overall differences between full and non-users of PAP in improvement of quality of life from baseline to follow up. However, there was a trend towards more improvement in physical quality of life for PAP adherent patients and the most obese subjects improved their physical quality of life more.
Concusions: The results suggest that co-morbidities of OSA such as obesity, insomnia and daytime sleepiness have a great effect on life qualities and need to be taken into account and addressed with additional interventions.

102 - **Trajectories and stability of self-reported short sleep duration from adolescence to adulthood**
Presented by: Amie C. Hayley

A.C. Hayley[1,2], J.C. Skogen[3,4], S. Øverland[3,5], B. Wold[6], L.J. Williams[2], G.A. Kennedy[7], B. Sivertsen[3,8,9]
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Objective: To examine the trajectories and stability of short sleep duration at ages 13, 15 and 23 years on short sleep duration at age 30 years among 1105 students who participated in the Norwegian Longitudinal Health and Behaviour Study.
Methods and materials: Questionnaire data were used to obtain sleep variables. Dichotomised short sleep duration was based on normative values and set as ≤ 8.5 hours (age 13 years), ≤8 hours (age 15 years) and ≤ 7 hours (ages 23 and 30 years).
Results: A significant overall reduction in total sleep duration (hrs/night) across age groups was noted. Sleep duration at age 15 and 23 years (whole group) was moderately but positively correlated with short sleep at age 30 years ($p< 0.01$). When split by sex, at age 15 years, this association was present among females only (all $p< 0.01$), and at age 23 years, this association, whilst present in both sexes, was stronger among males ($p< 0.001$). Categorical short sleep at age 23 years was associated with short sleep at age 30 years (unadjusted OR = 3.67, 95% CI 2.36-5.69). Following sex stratification, this effect was significant for both males (unadjusted OR= 3.77, 95% CI: 2.22-6.42) and females (unadjusted OR= 2.71, 95% CI: 1.46-5.04). No associations were noted for categorical short sleep at ages 13 or 15 years and subsequent short sleep at 30 years.
Conclusions: Habitual short sleep duration during middle adulthood is not sustained from the time of early adolescence. Rather, these trends appear to be formed during early adulthood.

488 - **10 year exposure to short sleep, insomnia symptoms and salivary cortisol**
Presented by: Jessica G. Abell

J.G. Abell[1], J.E. Ferrie[1,2], M.J. Shipley[1], M. Kivimäki[1], M. Kumari[1,3]
[1]Department of Epidemiology and Public Health, University College London, London, [2]School of Social and Community Medicine, University of Bristol, Bristol, [3]Institute for Social and Economic Research, University of Essex, Essex, United Kingdom

Objectives: The short term impact of restricted sleep duration or poor sleep quality has been found to have a negative impact on health. Chronic stress, measured by cortisol has been suggested as a possible pathway between sleep and health. Although a cross-sectional association between diurnal cortisol and both sleep duration and disturbance has been described, the impact on cortisol patterns of experiencing short sleep duration or insomnia symptoms in the long term has not been examined.
Methods and materials: We used longitudinal data from N=3,314 participants of the Whitehall II study, an occupational cohort of British civil servants. Self-reported short sleep duration and insomnia symptoms were measured at phases 5 (1997-1999), 7 (2003-2004) and 9 (2007-2009). Salivary cortisol was measured at phase 9. Six saliva samples were taken on waking, waking + 0.5, 2.5, 8, and 12 h and bedtime for the assessment of the cortisol awakening response and the slope in cortisol secretion across the day, calculated using multi-level models (MLM).
Results: Recurrent short sleep was associated with flatter slopes in diurnal cortisol patterns. An association with diurnal slope of cortisol was not, however, observed for those who reported persistently high levels of insomnia symptoms. Recurrent short sleep duration and sustained sleep disturbance were both independently associated with an increased cortisol awakening response; although this pattern was only significantly higher for those reporting two occurrences of short sleep. These patterns were independent of the other sleep exposure examined and a range of covariates.
Conclusions: We conclude that long term sleep problems are associated with adverse salivary cortisol patterns throughout the day. However, the pattern of the association is different for chronic insomnia symptoms and recurrent sleep duration.

435 - **Sleep loss negatively affects employability and perceived leadership skills**
Presented by: Tina Sundelin

T. Sundelin[1,2], *J. Axelsson*[2]
[1]Stockholm University, [2]Karolinska Institutet, Stockholm, Sweden

Objective: Previous research shows that sleep-deprived people are perceived as less attractive and more tired than their well-rested selves. Attractive people are more often ascribed qualities such as social competence, potency, and intellectual competence. These qualities are especially desirable for leaders, but also for employees. The objective of this study was to find out whether sleep loss and perceived tiredness might affect employability and perceived leadership skills, as well as perceived intelligence and trustworthiness.
Method: 24 people were photographed on two separate occasions, at least one week apart. In one photograph they had slept no more than 4h/night for two consecutive nights and in the other they had spent at least 8h/night in bed for two consecutive nights. The photographs were rated by 61 observers on leadership ability, employability, trustworthiness, and intelligence. The observers also rated participants´ attractiveness and tiredness.
Results: When participants were sleep deprived, they were rated as less good leaders ($p < 0.001$), less employable ($p = 0.001$), and less trustworthy ($p = 0.01$) compared to when they had slept. Sleep-deprived participants were also rated as less attractive ($p = 0.006$) and more tired ($p = 0.011$). There was no difference in ratings of intelligence ($p = 0.105$). Looking more tired was strongly related to being perceived as a poorer leader, less employable, less trustworthy, and less intelligent (p's< 0.001).
Conclusions: The study confirmed previous findings of sleep deprivation affecting attractiveness and perceived tiredness, and showed that sleep-deprived people are judged as being worse leaders, as well as being less employable and less trustworthy.

508 - **Sleep-wake pattern changes throughout 24-h from adolescence to early adulthood in former iron-deficiency anemic infants**
Presented by: Patricio Peirano

S. Reyes[1], *C. Algarín*[1], *B. Lozoff*[2], *P. Peirano*[1]
[1]Sleep Laboratory, University of Chile, Santiago, Chile, [2]Center for Human Growth & Development, University of Michigan, Ann Arbor, MI, United States

Objective: To examine longitudinal changes in sleep-wake patterns (SWP) from adolescence to early adulthood in former iron-deficient anemic infants (former IDA).
Methods and materials: The 51 participants were part of an infancy iron deficiency anemia preventive trial and follow-up study (47% former IDA and 49% female). Motor activity was recorded continuously for a week with actigraphs (Actiwatch-16/64) worn in the nondominant wrist. Recordings were performed both in adolescence (15.3 ± 0.2 y) and adulthood (21.1 ± 0.1 y). Sleep and wake episodes were identified through actigraphic data by means of an automated method (Actiware®). The following SWP were calculated: (a) daytime patterns: wake-up time (WT) total sleep time (DTST) and number of naps (NN); and (b) nighttime patterns: sleep onset time (SOT), total sleep time (NTST), and number of awakenings (NA).
Results: Compared to adolescents, adults showed a delayed WT (9:25 vs. 7:40, $p < 0.05$) and SOT (00:54 vs. 23:23, $p < 0.05$), higher DTST (1.4 vs. 0.9 h, $p < 0.05$), and lower NA (1.0 vs 1.6, $p < 0.05$) and NTST (7.6 vs 7.7 h). A significant interaction was found between ages and IDA condition for NTST ($p = 0.02$). Compared to former IDA adolescents, former IDA adults showed lower NTST (7.4 vs. 8.0 h, $p < 0.05$. These results were adjusted by gender.
Conclusion: Our results show changes in nighttime and daytime SWP between adolescence and adulthood. Compared to adolescents, adults SWP were characterized by delayed SOT and WT, higher DTST, and reduced NTST. These changes and especially NTST reduction were more marked in former IDA. (Support: NIH R01 HD33487 grant).

02.11.2015 - 16:30-18:30
Symposium: Mood disorders, sleep-wake regulation and neurotransmitter receptor plasticity

693 - **Neurotransmitter receptor plasticity related to sleep-wake regulation: the effect of sleep deprivation on human neurotransmitter receptors**
Presented by: David Elmenhorst

D. Elmenhorst

Institute of Neuroscience and Medicine INM-2, Forschungszentrum Jülich, Jülich, Germany

Neurotransmitter receptor plasticity can be cause or consequence of altered sleep-wake rhythms. This symposium presents recent advances in the search for molecular changes in the brain following acute and chronic sleep deprivation in rodents and humans together with behavioral, genetic and biochemical assessments to identify distinct receptor molecules conveying sensitivity to sleep loss. Over the last decades several receptor ligands, agonists as well as antagonists, have been developed suitable for non-invasive in vivo imaging of neuro receptors with positron emission tomography (PET). The imaging technique has been used for example to investigate physiological mechanisms of the sleep wake regulation like circadian variation and the effects of sleep deprivation. Pharmacokinetic analysis of PET experiments additionally allows investigating sleep relevant drug action in the human brain, like for example the impact of caffeine or ethanol on adenosine receptor availability. PET is so far the only possibility to assess neuroreceptor changes quantitatively in living humans. Despite the advantages it has nevertheless its pitfalls in sleep research settings that have to be considered like relatively long scanning times or the fact that most experiments are performed with antagonist ligands. Few classes of receptors have been investigated related to sleep in humans so far. The talk will review findings on A1 adenosine, 5-HT2A serotonin and D2/3 dopamine receptor changes in humans due to sleep deprivation. It focuses on recent data on different durations of sleep deprivation and recovery sleep on adenosine receptors and its association with reduced alertness and increased sleepiness. Previously we have found that 28h of sleep deprivation increases the distribution volume of the highly selective A1 adenosine receptor radioligand 18F CPFPX in a region-specific pattern in several brain regions (maximum: orbitofrontal cortex 15.3%). Whereas there were no significant changes (1.5%) in a control group with regular sleep between both scans. In a recent study we observed that 58 hours of sustained wakefulness increased the receptor availability further but 14h of recovery sleep returns the availability back to the level of normal sleeping controls.

697 - **The neurobehavioral consequences of chronic sleep restriction in rats**
Presented by: Radhika Basheer

R. Basheer
VA Boston Healthcare System and Harvard Medical School, West Roxbury, MA, United States

Sleep is an essential behavioral state and its importance is almost always realized due to the negative consequences resulting from insufficient sleep or prolonged sleep loss. Neurochemical changes resulting from sleep deprivation and the brain areas harboring such changes are the subject of intense investigation in an effort to understand the mechanisms that lead to the deleterious effects of sleep deprivation such as extensive sleepiness and cognitive impairments.
The basal forebrain is an important brain region serving as a ventral extrathalamic relay center of the ascending reticular activating system. The basal forebrain not only receives various neurotransmitter inputs but is also a complex structure containing three closely intermingling neurotransmitters, acetylcholine, GABA and glutamate utilizing neuronal subtypes. The intermingled presence of these neurons is suggestive of their concerted role in the regulation of sleep-wakefulness and sleep homeostasis.
Others and we have examined the role of purinergic molecule adenosine both in sleep-wake-regulation and sleep homeostasis in basal forebrain and cortex. Prolonged wake-induced increase in adenosine leads to receptor plasticity and alterations in subsequent response to extracellular adenosine. The intriguing selectivity of basal forebrain as a region showing the rapid increase in extracellular adenosine has led us to investigate the underlying mechanisms both at the cellular as well as neurochemical levels. We have identified two potential pathways that contribute to wakefulness-associated increase in adenosine- one is dependent on the induction of inducible nitric oxide synthase-mediated release of nitric oxide and the other is dependent on the rapid breakdown of the adenosine triphosphate (ATP) that is released from astrocytes and as a co-transmitter from neurons. There is extensive evidence in support of the homeostatic role of adenosine in basal forebrain and cortex. There is also emerging evidence on the local interactions of acetylcholine with non-cholinergic neurons that are important in the regulation of wakefulness response. Thus, a complex interplay of neurotransmitters and neuromodulators within basal forebrain regulate both spontaneous sleep-wakefulness and sleep homeostasis. Restricting or depriving sleep in rodents allows investigations of neurochemical mechanisms leading to neuronal plasticity that underlie the effects of sleep deprivation.

702 - **Genetic underpinnings of the relationship between sleep disturbances and depression**
Presented by: Tiina Paunio

T. Paunio[1,2], *K. Kantojärvi*[2], *J. Alasaari*[2]
[1]University of Helsinki, [2]Department of Health, National Institute for Health and Welfare, Helsinki, Finland

Objectives: Both genetic and environmental factors contribute to variance of depressive disorder and characteristics of sleep with a modest additive heritability of 30-50%. Their shared genetic component is fairly low, suggesting that most of the longitudinal association between poor sleep and depressed mood is likely to be due to neurophysiologic effects of disturbed sleep on regulation of emotions. We hypothesized that this effect would take place via epigenetic modifications affecting gene expression in a dynamic manner. The hypothesis was tested by combining data from analysis of direct genetic correlations and epigenetic modifications, with a focus on established candidate genes for mood disorders and regulation of sleep.
Methods: The population-based Health2000 cohort, applied for analysis of direct genetic correlations, included data from 2117 individuals (51% females, age 30-75) genotyped by Illumina 610K and imputed to the 1000 Genomes. Previously identified risk variants for mood disorders *(CACNA1C)* and sleep duration (SD) *(PAX8, KLF6 and PTPRU)* were selected for linear or logistic regression analysis by SPSS using age and gender as covariates. For analysis of differentially methylated genomic positions (DMPs) related to insufficient sleep, we examined a FINRISK subsample of 473 individuals (53% females, age 25-74) using Illumina HumanMethylation 450 array and statistical analysis with MINFI, LUMI and LIMMA packages of software R.
Results: There was association of CACNA1C variants to normal regulation of sleep (SD, P< .05), as well as to disturbances in sleep (nightly awakenings and early morning awakenings, P< .05). There was also suggestive evidence for association of variants for SD in general population to disturbed sleep (KLF6 to early morning awakenings, P< .005, and PTPRU to nightly awakenings, P=0.05). Analysis of DNA methylation levels for insufficient sleep showed association of >950 DMPs at P< .001 including genes previously associated to mood disorders and sleep regulation.
Conclusions: Several risk variants from CACNA1C associated to sleep traits and some of the variants for SD associated also to symptoms of disturbed sleep. Finding of deviated levels of methylation on genes related to regulation of sleep and emotions among individuals suffering from sleep insufficiency supports the hypothesis that epigenetic regulation is involved in the pathological cascade for disturbed sleep and depression.
Acknowledgments: Academy of Finland

02.11.2015 - 16:30-18:30
Symposium: Non-CPAP Therapies for OSA

695 - **Weight loss in OSA - strategies and efficacy**
Presented by: Craig L. Phillips

C.L. Phillips[1,2]
[1]Woolcock Institute of Medical Research, University of Sydney, [2]Department of Respiratory & Sleep Medicine, Royal North Shore Hospital, Sydney, NSW, Australia

The prevalence of obesity in the world has increased more than twofold in the past 20 years with up to 50% of men and 30% of women in western countries now defined as being overweight or obese. As obesity is a primary causative factor for OSA, this epidemic has necessarily translated into a higher OSA prevalence. Weight loss remains the primary goal to address the obesity problem and has been well proven to reduce or even cure OSA although there is great inter-individual variability in responses. The long term sustainability of weight loss remains a holy grail of obesity research. This discussion will summarise the effects of weight loss via surgical, pharmacological and lifestyle programmes on OSA severity and its cardio-metabolic complications and introduce the concept of a multidisciplinary approach to maximising the effectiveness of weight loss programmes to improve outcomes.

70 - **Positional therapy**
Presented by: Nico de Vries

N. de Vries[1,2], *L. Benoist*[1], *M. Ravesloot*[1], *P. van Maanen*[1]
[1]Saint Lucas Andreas Hospital, Amsterdam, The Netherlands, [2]University of Antwerp, Antwerp, Belgium

The Wagnerian leitmotif of this presentation is sleep position. The finding is highlighted that mild OSA in the majority of cases positional. With progression of the disease from mild via moderate to eventually severe OSA, positional OSA progresses into non-positional severe OSA. A later observation is that patients with insufficient response to therapy, such as can happen in upper airway or bariatric surgery, severe non-positional OSA can reverse to less severe positional OSA. It has become clear that sleep position deserves a larger role in the management of sleep disordered breathing. In poly(somno)graphy positional sensing should routinely be included. Separate positional measurements for head and trunk during polysomnography should be seriously considered. Next in order, improvement of current drug induced sedated endoscopy methods, by taking sleep position into account. For example, cases with positional OSA undergoing DISE, observations in lateral sleeping position are mandatory. Perhaps, tilting of the head during DISE is sufficient.
Variations on the “tennis ball technique” have become obsolete, since the introduction of smart positional therapy. Positional therapy can be offered as single treatment or supplementary to oral device treatment or surgery. Rare cases of central sleep apnea have been shown to be positional as well; the pathophysiology remains unclear. Guidelines might need to be adapted.
If one tries to define the features of the ideal treatment for OSA (or for that matter, any other disease), they would include effectiveness, patient friendliness, good compliance, wide availability, reversibility, cost-effectiveness, absence of (major) side effects, and the possibility to combine with other treatments. New forms of positional therapy have the potential to fulfill these criteria to a large degree.

02.11.2015 - 16:30-17:30
Case Discussion: Insomnia, sleep timing and depression in adolescents and young adults

92 - **Insomnia, sleep timing and depression in adolescents: a case discussion**
Presented by: Laura Palagini

L. Palagini
Department of Clinical Experimental Medicine, Psychiatric Unit II, University of Pisa, Pisa, Italy

Objective: Depression is a common disorder in adolescence and it has a course marked by frequent recurrence, impairment in school, interpersonal relationships and suicide attempts. The majority of depressed adolescents suffer from sleep disorders, particularly, decreased sleep efficiency and circadian sleep dysregulation which predict recurrences, the risk of suicide attempts and the treatment-resistance of depression. It has been hypothesized that the concurrent treatment of depression and sleep disturbances adolescents would improve both sleep and depression outcomes. The objective was to study the personalized therapeutic intervention for both depression and sleep dysregulation in an adolescent suffering from depression and sleep disorders.
Methods: A male adolescent (age 16 years), suffering from depression (according to the DSM- 5) was evaluated with the Clinical Global Impressions-Improvement scale (CGI-I) and the Children´s Global Assessment Scale (CGI-S). The subject was also complaining difficulty initiating sleep and irregular sleep timing and he completed sleep diaries, the Adolescent Sleep Hygiene Scale (ASHS), and the Adolescent Sleep-Wake Scale (ASWS). He underwent standard pharmacological treatment for depression at a first step; after the treatment period a first evaluation of both depressive symptoms and of the sleep disorders were computed. If symptoms were still present a cognitive-behavioural treatment for insomnia and a chronobiological therapeutic intervention were added to the standard treatment. After the treatment period a second evaluation of both depressive and sleep symptoms were computed.
Results: At the first evaluation CG-I and C-GAS, ASHS and ASWS improved but not significantly. At the second evaluation the improving was significant for CGI-S ($p < .05$), ASHS ($p < .001$) and ASWS ($p < .001$).
Conclusions: At least for depressed adolescents who have clear evidence for disturbed sleep, a personalized cognitive-behavioural therapeutic protocol for insomnia and chronobiological therapeutic intervention aiming at restoring the normal circadian rhythms may be indicated. It may contribute to improve both depressive symptoms and global functioning in adolescence.

02.11.2015 - 18:30-20:00
Poster Session 2

465 - **Overweight children and sleep quality: is there a link?**
Presented by: Helena C. Loureiro

S.R. Pacheco, A.M. Miranda, H.C. Loureiro, R. Coelho, A.C. Monteiro, G. Bragança
Pediatric Department, Hospital Prof.Doutor Fernando Fonseca EPE, Lisbon, Portugal

Introduction: Overweight seam to be related to a higher prevalence of sleep disturbances. Decreased sleep duration and altered sleep quality are also risk factors for obesity, insulinresistance and change in appetite regulator hormones in youth.
Objective: The goal of the study was to compare the sleep pattern of a group of overweight children with a matched control group and to assess a relationship between sleep quality and obesity at different ages.
Material and methods: Retrospective cohort study comparing 41 overweight and obese children and 41 non-overweight children (control group), all submitted to polysomnography (PSG type 1-AASM2012). The sample was matched by age, sex and Apnea- Hypopnea- Index (AHI). Age- and gender-specific body mass index (BMI) z-scores were determined and categorized using OMS growth Charts (non-overweight: z-score < 1 and overweight-obese: z-score ≥1). AHI, sleep duration, sleep efficiency and onset latency, sleep stages and number of arousals were compared. The statistic analysis was performed using SPSS^{R} version 21.
Results: The populations mean age was 10 years ± 3,4 SD (min 5y; max 17y), 56% were girls in both groups. There was no statistical difference (p=0,199) between the study (mean 3 ± 2,30 SD) and control groups (mean 2,85 ± 2,02 SD) regarding AHI. A statistical significant difference was found comparing slow wave sleep in both groups. The N3 % was lower in the study group. (Study group: 18,95 ± 6,18%; control group: 21.61 ± 7,39%; t (40)= 2,156, p=0,037). No statistical differences were found in sleep latency, efficiency, duration, arousals light sleep or REM.
Conclusion: The present study suggests a link between overweight /obesity and altered sleep quality due to compromised NREM sleep. There is a need of more studies, with larger samples, evaluating the sleep pattern of overweight children and youth and possible confounding factors.

381 - **Effect of infant sleep arrangement on sleep pattern, feeding methods and parental sleep quality**
Presented by: Shih-Chi Chung

S.-C. Chung[1], S.-M. Chu[2], P.-L. Chen[1]
[1]College of Medicine, School of Nursing, Chang Gung University, Taiwan, [2]Department of Newborn Medicine, Chang Gung Memorial Hospital, Taoyuan, Taiwan

Introduction: Different sleep arrangements in infancy might affect infant sleep development, feeding pattern, and parental sleep quality; however, the association among these is rarely studied. The aim of this study was to compare infant sleep pattern, feeding methods, and parental sleep quality between bed-sharing and room-sharing infants of 1-month age.
Methods: This is a preliminary study of one longitudinal research that investigates the effect of infant sleep arrangement on infant sleep, body weight development, parental psychological well-being, and parental sleep quality from birth to 2 years. Eighty-six eligible healthy mother-newborn pairs were recruited during 1st week after birth, and they were followed for 1 month. Newborns were match paired for maternal age, family economic status, and gender after they were classified into bed-sharing (n=40) and room-sharing (n=46) groups based on their sleep arrangement reported by the parents. Parents completed a 3-day infant sleep-feeding diary, weighed their infant, and completed the Pittsburgh Sleep Quality Index (PSQI) weekly.
Results: When the infants reached their first month of age, bed-sharers gained more weight (+232gm) than room-sharers. In addition, more bed-sharers were exclusive breastfed (100%) than the room-sharers (92%). Bed-sharers comparing to room-sharers showed longer sleep latency and longer wake time after sleep onset. In addition, bed-shares kept lower sleep efficiency comparing to room-sharers. Parental sleep quality was not associated with infant sleep arrangement.
Conclusion: Bed-sharers had a higher breastfeeding rate and gained more body weight than the room-sharers. However, room-sharers slept better than the bed-sharers. Parental sleep quality was not affected by infant sleep arrangement.
Support: This study was supported by Chang Gung Memorial Hospital, Taiwan (CMRPD1C0481)

78 - **Sickle cell disease: genetics and sleep**
Presented by: Helena C. Loureiro

H. Loureiro, M.I. Mascarenhas, T. Ferreira, A. Dias
Pediatrics, Hospital Prof. Doutor Fernando Fonseca EPE, Amadora, Portugal

Objectives: To describe polysomnographic sleep characteristics in a sample of children and adolescents with sickle cell disease that were previously studied regarding S haplotype, presence of alpha thalassemia and HbF basal level.
Methods and materials: This was a retrospective study that included 54 children and adolescents with SCD, aged 1-18 years previously submitted to a genetic characterization (S haplotype and alpha globin), and Hemoglobin F basal level determination. Subjects were divided in 2 age groups (1-8 and 9-18 years) regarding lymphoid tissue hypertrophy and adenotonsillectomy status. Considering their haplotype, alpha deletion and HbF level, sleep characteristics were studied namely efficiency, latency and REM latency and sleep phases percentage (N1, N2, N3 and REM), AHI index, SpO2 mean and minimum. Descriptive and nonparametric statistics were used.
Results: From a sample of 54 children and adolescents , 55.6% male, aged mean 9.52 years (1-18Y) s.d. 4.1 with SCD, 2 groups were formed: group A, n= 21 (1-8Y), age mean 5.24; s.d. 1.78Y, 57.1% male and group B, n= 33 (9-18Y), age mean 12.24, s.d. 2.48Y, male 54.5%. Regarding haplotype determination, Bantu/Bantu was predominant, 57.4% of subjects (group A-66.7%; group B-51.5%), and 42.5 % had alpha deletion mostly 3.7 deletion. Regarding HbF basal level, 21 individuals (38.9%) had HbF >10%. Presence of alpha deletion showed no influence in sleep characteristics including AHI and SpO2 mean and minimum. Instead, presence of HbF greater than 10% seems to be protective regarding AHI ($p< 0.01$) in group B (older). Regarding respiratory parameters, OSA existed in 92.5 % of subjects with mean AIH 3.5/h, s.d 1.73 (0.4-9.5/h), SpO2 mean was 94.6%, s.d. 3.05 (87-99%) and SpO2 minimum mean was 90.0%, s.d. 5.37 (72-97%); 8 subjects had previously adenotonsillectomy (1 in group A; 7 in group B). Polysomnographic parameters were similar in all the haplotypes, finding no relevance in HbF level or thalassemic status.
Conclusions: Although sleep is disturbed in children and adolescents with SCD compared with controls, haplotype does not seem to influence sleep characteristics. Instead, the presence of high levels of HbF seems to be protective regarding respiratory sleep disturbances, mainly AHI in older subjects with less adenoid and tonsils hypertrophy.

202 - **Heart rate variability during sleep in Duchenne muscular dystrophy and spinal muscular atrophy**
Presented by: Gulcin Benbir Senel

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Objective: Cardiac muscle dysfunction is particularly clinically relevant in children with duchenne muscular dystrophy (DMD) or spinal muscular atrophy (SMA) and may result in the leading causes of death in these patients. We investigated the heart rate variability (HRV) during sleep in these children.
Methods: All participants were prospectively enrolled and full-night video-polysomnography recordings including electrocardiography was performed.
Results: Ten children diagnosed as DMD and 5 children with SMA were included in our study. Age- and gender-match control group consisted of six children. The mean age, gender and body mass index were all similar among three groups. The polysomnographical parameters were all similar but only apnea-hypopnea index was higher in patients with SMA ($p< 0.040$). Average RR difference, RR difference over 50 ms (%RR50), average low frequency heart rate fluctuation (LF), average high frequency heart rate fluctuation (HF), LF/HF ratio (LF/HF), LF/HF in wakefulness, LF/HF in NREM sleep and LF/HF in REM sleep were calculated. All these parameters were significantly higher in children with SMA than controls ($p< 0.010$). Average RR, %50RR, LF/HF and LF/HF in NREM sleep in children with DMD were higher than in controls ($p< 0.030$). Average RR, %50RR, and LF/HF in children with SMA were also higher than in children with DMD ($p< 0.050$), while LF/HF in sleep - either in NREM or REM sleep - were similar.
Conclusion: We demonstrated a reduced HRV and therefore autonomic dysfunction in children with DMD and SMA. These findings are particularly important to attract attention to cardiac myopathy and diastolic heart failure in these patients. Polysomnographic study is therefore recommended as a

screening test for whole night electrocardiographic recordings and heart rate variability analysis for the demonstration of autonomic functioning.

588 - **Remains after tonsillotomy in children with obstructive sleep apnea syndrome residual apnea-hypopnea index?**
Presented by: Martina Ondrová

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Introduction: The prevalence of obstructive sleep apnea syndrome (OSAS) is about 1-3% of the child population. The only objective examination is polysomnography but otorinolaryngology examination is also necessary. Recommended method of treatment for hypertrophy of the palatine tonsils is a both side tonsillectomy. The effectiveness of this method is in a wide range of 70-90%. Tonsillotomy offers the possibility to use a less radical surgical treatment with the same therapeutic effect.
Methods: In the period 2007-2015 the set of 58 children after both side tonsillotomy have been developed to control polysomnography in Brno and polygraphy in Benešov from 2 to 6 months after surgery. All children had only hypertrophy of the palatal tonsils with pharyngeal obstruction grade III and IV by Brodsky and the sugrery was performed in hospital in general anesthesia. Age ranged from 2 to 10 years. Tonsillotomy is shorter than tonsillectomy, the healing is quicker and less paintfull mostly after it too. Treatment effect of tonsillotomy on the incidence of apneas and snoring was already evident during the healing time and after healing those incidents not described by childrens´ parents.
Results: All children improved breathing. No snoring was reported after surgery in first year. The values of AHI were mostly 0, only 1 patient´s was AHI 0,9 and another patient´s 1,2. But this child has a Turner´s syndrome. No more frequent relapses of palatal tonsils hypertrophy after tonsillotomy were reported (only 3,4% on one side during second year after tonsillotomy with snoring during inflammatory desease, no need for reoperation). No recurrent tonsillitis were found.
Conclusion: Tonsillotomy reduces symptoms of obstructive sleep apnea syndrom in childhood. Reduction of radikality does not change significantly the effect of OSAS treatment. The functional part of retained palatine tonsils so important for correct immune system development. Therapeutic effect of tonsillotomy is comparable with tonsillectomy.

256 - **Ineffective task-induced cerebral oxygenation in adolescents during chronic sleep deprivation in real-life condition**
Presented by: Ramin Khatami

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Objectives: Sufficient sleep is important for adolescent mental development. Chronic sleep deprivation (CSD) during school time can lead to low school performance. Psychomotor vigilance task (PVT) has proven to be a sensitive measure of sleep loss. Functional neuroimaging of adolescent brain activities during PVT under real-life school conditions will provide insights into the neuronal basis of how CSD influences cognitive function in adolescents.
Methods and materials: 17 health high school students (female: 9, age: 18-19 years) participated in a 4 nights CSD protocol at home. They were restricted to sleep 5 hours per night from Monday to Thursday controlled by actigraphies and phone calls from experimenters. Daily PVT sessions were performed each day between 4-5 pm from Monday to Friday. Near infrared spectroscopy (NIRS) measurements were conducted over left prefrontal cortex during PVT in 7 volunteers (female: 4). The NIRS device can measure absolute values of oxygen saturation (StO_2) and relative changes of HbO_2, HHb, oxygen index (OI), blood volume (BV). The PVT reaction time (RT) was assessed (one-way repeated ANOVA, $p< 0.05$). The mean values of hemodynamic parameters during PVT and at baseline before PVT between Monday and Friday were compared (paired t-test, $p< 0.05$).
Results: The PVT performances (mean RT, median RT, mean 10% fastest and 10% slowest RT) decrease during sleep deprivation (Table 1). Compared to measurement on Monday, subjective sleepiness (evaluated by Stanford Sleepiness Scale) increasaed and sleep latency decreased,

suggesting CSD paradigm was successful in real-life condition. Significant decrease in mean cerebral HbO_2, OI and StO_2 while an increase in HHb were observed during PVT sessions on Friday. The baseline StO_2 before the start of PVT significantly increased after 4 night CSD (Table 1).

Table 1. Paired t-test of PVT performance, subjective sleepiness and NIRS measurements between Day1 and Day 5

parameters	p-value	mean value of day1 (SE)	mean value of day5 (SE)
meanRT	0.027*	243.27 (4.82)	286.23 (13.15)
medianRT	0.047	234.86 (4.66)	272.14 (12.97)
10% fast RT	0.133	196.48 (4.32)	216.99 (9.76)
10% slow RT	0.02*	331.23 (12.51)	436.55 (28.18)
SSS	0.005*	2.00 (0.44)	5.14 (0.34)
sleep onset latency (min)	0.012*	5.2(1.0)	2.1(0.5)
slow-wave sleep latency (min)	0.015*	12 (3.3)	6.5(2.1)
baseline StO_2 before PVT (%)	0.013*	68.3 (1.9)	72.9 (1.7)
mean StO_2 during PVT (%)	0.009*	1.1 (0.3)	0.1 (0.2)
normalized mean HbO_2 changes (%)	0.019*	2.8 (0.8)	0. 2 (0.5)
normalized mean HHb changes (%)	0.028*	-1.3 (1.1)	1.0 (1.4)
normalized mean BV changes (%)	0.094	1.2 (0.4)	0. 1 (0.4)
normalized mean OI changes (%)	0.008*	7.5 (1.7)	0.2 (0.9)

SSS: Stanford Sleepiness Scale. RT: reaction time. StO_2: cerebral oxygen saturation. BV: blood volume. OI: oxygen index, i.e., HbO2-HHb. The mean changes of HbO2, HHb, BV and OI during PVT are normalized to their baseline values before the tasks. Slow–wave sleep latency is calculated as the time interval from the start of sleep stage 1 to the first epoch of sleep stage 3.

[Table 1]

Conclusions: Our findings show that CSD in adolescents induced a performance decline that was accompanied by a profound decrease of task-induced cortical oxygenation although oxygenation levels at baseline before the task increased, indicating an inefficient relationship between energy supply and consumption induced by CSD. The baseline cortical oxygenation is up-regulated by chronic prolonged wakefulness most probably reflecting higher energy demands due to prolonged neuronal activity. The strong oxygenation decline during the task that parallels performance decline points to a reduced reserve of cortical cerebral oxygenation.

468 - **Validation of the LEOSound®-monitor for standardized detection of cough and wheezing in children**

Presented by: Michael Scholtes

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Children with asthma usually suffer from nocturnal wheezing and coughing. Parents often underestimate these nighttime respiratory symptoms. The LEOSound® cough and wheezing monitor provides the standardized quantification of such symptoms, especially in children. The system works like a 'long-term stethoscope'. Breathing sounds are recorded by three bio-acoustical sensors (trachea and back), analyzed and evaluated with regard to wheezing and cough events.

The aim of this study was to investigate the feasibility of the nocturnal application of the LEOSound®-Monitor in children. A further objective was to determine the accuracy of the software-based analysis compared with the audiovisual assessment by specialists in pediatric pneumology.

We investigated 11,520 epochs (each lasting 30 seconds) from twelve children/adolescents (age 1-16 years).

We achieved high quality recordings of continuous 8-h in-patient measurements. For each 8-h session we recorded cough frequency and wheezing rate.

The comparison between software-based analysis and the manual assessment results in a sensitivity of 0.93 for cough and 0.98 for wheezing detection. The according specificity was 0.99 for cough and 0.96 for wheezing detection.

The automated LEOSound®-Monitor provides a practicable solution for the standardized detection and objective quantification of lung and breath sounds in children. Thus, it is a reasonable expansion of the conventional repertoire of diagnostics and could be a powerful survey instrument for objectively

measure cough and wheezing in clinical studies. These data provide the basis for an age-adapted optimization of the automatic assessment.

120 - **The prevalence of sleep disorders in Thai children underwent polysomnography in tertiary care hospital**
Presented by: Montida Veeravigrom

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Objective: We conducted the study to determine the prevalence of sleep disorders in Thai Children underwent polysomnography in Excellence Center for Sleep Disorders, King Chulalongkorn Memorial Hospital.
Method: Retrospective analysis of pediatric polysomnography studies performed over 4 years, from January 2011 to December 2014.
Results: One hundred sixty six studies were conducted. 142, 7 and 17 studies were diagnostic, split night and PAP titration studies, respectively. 136 diagnostic/split night studies were performed in children with clinical presentation of snoring (92.6%), heavy breathing (0.7%), witnessed apnea (14.7%), restless sleep (11%), enuresis/nocturia (5.9%), abnormal behavior (4.4%), excessive daytime sleepiness (10.3%), hyperactivity (2.2%) and poor weight gain (0.7%). Eleven diagnostic studies and one split night study were performed to follow up obstructive sleep apnea (OSA) after adenoidectomy and/or tonsillectomy. One diagnostic study was conducted to follow up OSA after post mandibular distraction.
OSA was the most common diagnosis with prevalence of 92.7%. Severe OSA was diagnosed in 40.4%. Prevalence of sleep related hypoventilation in OSA patients was 15.4%. Of sleep related hypoventilation, 47.6% associated with severe OSA. The second diagnosis was periodic limb movement disorder with prevalence of 20.6%. Parasomnia, sleep bruxism and narcolepsy were diagnosed in 2.9%, 2.2 % and 0.7% respectively.
Seventeen PAP titration studies were performed. Four CPAP titration studies were conducted for OSA treatment. Twelve BiPAP titration studies were performed in 8 children with hypoventilation. Two patients have central hypoventilation from congenital central hypoventilation syndrome (CCHS) and brainstem glioma. Five patients have OSA and neuromuscular hypoventilation from Pompe disease, Duchene muscular dystrophy, minicore myopathy, lipid storage myopathy and Myotonic dystrophy. One BiPAP AVAPS titration was conducted in the patient with CCHS.
Conclusion: Prevalence of sleep disorders in Thai children underwent polysomnography were very high compared with other countries. Our findings suggested sleep disorders in Thai children has been under recognized.

479 - **Multifactorial secondary periodic leg movements and restless legs syndrome in an infant. A case report**
Presented by: Carmen Soria

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Objectives: To report a case of Periodic leg movements (PLM) and Restless legs syndrome (RLS) in an infant, secondary to multiple etiologic factors.
Methods: 2-year old infant who 3 months after suffering from Acute Disseminated Encephalomyelitis (ADEM) started to present movements during sleep. ADEM lesions shown in previous MRI were extense in cortex and specially in brainstem. He was sent to our service with suspect of epileptic origin. We performed daytime and night time video-polysomnogram (video-PSG), as well as complete repeated blood analyses and brain+brainstem MRI.
Results: The daytime video-PSG showed an extremely high PLM index/hour (105), even though it was not a completely accurate index due to a short sleep time. The most striking finding was also a high PLM index/hour (90) during quiet wakefulness. A subsequent night-time video-PSG confirmed these findings during sleep and wakefulness (indexes of 75 and 50). No epileptic or cortical discharges

were observed.
Analyses showed low ferritin without anemia. MRI studies showed remaining lesions in brainstem 6 months after the ADEM process.
After being treated with oral iron, ferritin levels got higher -almost normal nowadays-. Clinical outcome improved parallel to this raise, although leg movements mostly during sleep are still reported by patient's parents.
Conclusions: This case is an example of clear relationship between causal factors and development of PLM / RLS disorder in an infant. We here remark the importance of considering sleep disturbances and disorders in childhood and infancy after many intercurrent processes, and not only paying attention to epilepsy and most often considered disorders.
This case shows also a strong correlation between some of the causal factors and the clinical outcome, highliting the underlying physiopathology.

190 - **The effect of continuous positive airway pressure treatment in obstructive sleep apnoea patients on obesity and insulin sensitivity parameters**
Presented by: Milada Hobzova

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Objectives: One of the important risk factors for obstructive sleep apnoea (OSA) is obesity. Both OSA and obesity lead to systemic inflammation, increased insulin resistence and higher incidence of cardiovascular diseases (CVD). Continuous positive airway pressure (CPAP) therapy decreases of CVD and metabolic risk.The aim of the study is to investigate the effect of CPAP therapy in OSA patients on obesity parameters, C- reactive protein (CRP) and insulin sensitivity.
Subjects and methods: We included 266 OSA patients, investigated in The University Sleep Center. The CPAP treated group (n =179, 52.9±10.3 yrs) and non treated-control group (n=87, 53.9±10.3 yrs).The following parameters were calculated or measured: OSA parameters - apnoe-hypopnoe index (AHI), oxygen desaturation index (ODI), mean saturation, time in oxygen saturation under 90% SaO2 (t90) using polysomnography; and anthropometric measurements (height and weight, body mass index (BMI), percentage of total body fat (Omron BS 306 bioimpedance analyzer), neck, waist and hip circumference, waist/hip circumference ratio; and blood tests - fasting glucose level, insulin, CRP. HOMA index was calculated. The calculations and measurements were repeated after 1 year. The data were analyzed using the STATISTICA (data analysis software system), version 12 (StatSoft, Inc. (2013).
Results: In OSA treated group, body weight, BMI, % of total body fat, neck, waist and hip circumference, all OSA parameters, serum level of insulin and HOMA index dropped significantly ($p < 0.05$) after a year on CPAP. Only waist/hip ratio (p=0.283), glycaemia (p=0.962) and CRP (p=0.062) showed no signifiant change.In the control group, only hip circumference, glycaemia, serum insulin level showed a signifiant change ($p < 0.05$) after a year. However, weight (p=0.294), BMI (p=0.331), % of total body fat (p=0.736), neck and waist circumference (p=0.385; 0.473), waist/hip ratio (p=0.156), AHI (p=0.167), ODI (p=0.242), mean oxygen saturation (p=0.182), t 90 (p=0.121), CRP (p=0.850), HOMA index (p=0.318) remained unchanged.Interestingly, HOMA index dropped in all patients in both groups who lost weight. A CPAP treated patient was twice more likely to reduce weight than untreated subject from control group (33.0% vs. 16.1%).
Conclusions: In OSA patients, the CPAP therapy leads to significant improvement of OSA and obesity parameters. Insulin sensitivity was improved after CPAP treatment only in patient with weight reduction.

79 - **Assessment of maintenance of effect of tasimelteon in totally blind individuals with non-24-hour sleep-wake disorder - RESET study**
Presented by: Marlene Dressman

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Objective: To assess the safety, efficacy, and maintenance of effect of tasimelteon (20 mg) in Non-24-Hour Sleep-Wake Disorder (Non-24) in the totally blind. Tasimelteon, a novel circadian regulator

with selective agonist activity for MT_1 and MT_2 melatonin receptors, was previously shown to entrain the central pacemaker and improve sleep-wake measures in the SET study. Non-24 is a serious circadian rhythm disorder highly prevalent in the totally blind with no EMA-approved treatment.
Methods: In the Randomized-withdrawal study of the Safety and Efficacy of Tasimelteon (RESET) twenty patients were treated with tasimelteon (20mg) for 8 weeks in an open-label run-in phase and then randomized to placebo or continue tasimelteon treatment for 8 weeks. Circadian period was assessed from urinary 6-sulfatoxymelatonin (aMT6s) and cortisol rhythms. Clinical endpoints included nighttime and daytime sleep measures.
Results: Tasimelteon maintained entrainment compared to placebo (aMT6s: 90 vs. 20%; cortisol: 80 vs. 20%). Total nighttime sleep in the worst quartile of nights was 67.2 minutes longer and total daytime sleep duration was 59.4 minutes shorter in tasimelteon-treated compared to placebo ($p< 0.05$). The midpoint of sleep timing (derived from both nighttime and daytime sleep) increased 36 minutes in tasimelteon-treated patients ($p< 0.05$). Tasimelteon was safe and well-tolerated.
Conclusion: Tasimelteon entrained the circadian pacemaker in totally blind patients with Non-24. Discontinuation of tasimelteon treatment resulted in loss of entrainment and a simultaneous ~60 minute decrease in nighttime sleep and an equivalent increase in daytime sleep. The RESET study demonstrates the necessity for continued tasimelteon treatment to maintain circadian entrainment in Non-24.
Sponsored by Vanda Pharmaceuticals.

157 - **Altered distribution of resting periods of daily locomotor activity in circadian rhythm sleep disorder subjects**
Presented by: Marina Hirose

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Objective: A number of researchers have suggested that circadian rhythm sleep disorder (CRSD) and mood disorders have a close relationship. We recently found that the probability of observing longer resting periods in daily activity in patients with major depressive disorder (MDD) was systematically increased, in the context of the statistical laws of behavioral organization (Nakamura et al. 2007). In this study, we examined whether CRSD had similar characteristics of the altered behavioral organization to that of MDD.
Methods and materials: We evaluated the statistical laws of behavioral organization in 18 CRSD patients (17 delayed sleep phase type, 1 free-running type) without mental disease (e.g. mood disorders) and age- and gender-matched 18 healthy subjects, using locomotor activity data acquired by actigraphy monitoring over seven days. We analyzed the cumulative distributions of resting and active period durations and then compared the distribution parameters between CRSD and healthy subjects. If there was any significant difference in their parameters, we further examined their association with relevant clinical factors (Beck Depression Inventory [BDI], Morningness Eveningness Questionnaire [MEQ], medications etc.) in CRSD group by stepwise regression analysis.
Results: We found the cumulative distributions of resting periods took a power-law form over the range of 2 - 100 minutes with significantly lower parameter values (i.e., scaling exponent)in CRSD patients compared with healthy subjects ($P=0.0231$), whereas the distribution of active periods had no significant difference between the groups. BDI score was slightly but significantly higher in the patients, although they had no apparent clinical depression. There was no significant association between the parameter of resting period and relevant clinical factors in CRSD group.
Conclusion: Our findings showed the systematic and significant increase of resting periods in CRSD patients. This result could suggest some relationship between CRSD and mood disorders, but the interpretation should be cautious because other factors might have influenced.
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160 - **Comparison of sleep parameters and resilience between shift-work and non shift-work nurses**
Presented by: Seung Chul Hong

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Objectives: The aim of this study is to compare the sleep status, resilience and the 5 subcategories of resilience between shift-work nurses and non shift-work nurses who had been working at university hospital.
Methods: The subjects were 338 nurses (265 shift-work nurses and 73 non shift-work nurses) who had been working at St. Vincent´s hospital, College of Medicine, The Catholic University of Korea. Data were collected by self-questionnaires of Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), Korean Connor-Davidson Resilience Scale (K-CD-RISC). We compared the sleep parameters, such as total sleep time, subjective sleep quality, sleep efficiency, daytime sleepiness, general sleep condition, the resilience and it's 5 subcategories (self-efficacy, leadership and trust in one's instincts, positive acceptance of change and secure relationships, a sense of control and tenacity, spiritual influences) between shift-work nurses and non shift-work nurses.
Results: There was no significant difference in total sleep time, but the subjective sleep quality and general sleep condition were significantly lower in shift-work nurses. Also, daytime sleepiness was more severe and sleep efficiency was lower in shift-work nurses compared to non shift-work nurses. However the total score of K-CD-RISC showed no significant difference between two groups.
Conclusion: This study suggest that shift-working nurses have poorer sleep quality and more severe daytime sleepiness than non shift-work nurses. Nevertheless, we could not find significant differences in resilience and its subcategories between two groups. More comprehensive and in-depth studies to find sleep-related problems and the their influences affecting medical service providers will be needed.

491 - **Characterisation of the circadian rhythm and sleep aberrations in Smith-Magenis syndrome patients**
Presented by: Paolo Baroldi

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Objective: To characterise the circadian rhythm and the sleep disorder of individuals with Smith-Magenis syndrome (SMS).
Methods and materials: An observational study in individuals with SMS (ClinicalTrials.gov ID: NCT02180451) included a 4-week evaluation phase. Three inpatient testing segments scheduled 1 to 2 weeks apart involved 36-hour melatonin and cortisol assessments with blood samples taken every hour from an intravenous catheter. Participants were fitted with an actigraphy watch to assess light exposure and monitor activity. Other assessments include daily diaries for sleep, behaviour parameters, and other important events.
Results: Eight participants, aged 7 to 35, with history of severe sleep disturbances and a cytogenetic confirmed SMS diagnosis were evaluated. The timing of the melatonin and cortisol acrophases was consistent during the 4 week assessment, with a circadian period of ~ 24.0 hours. Melatonin secretion occurred mainly during the daytime with a mean acrophase between approximately 2 pm and 5:30 pm and very low levels or no melatonin produced during the nighttime, except for 1 participant for whom the melatonin secretion acrophase occurred around 5 am and 1 participant with an acrophase around 10 am. The mean cortisol acrophase ranged from about 9 am to 11:30 am in all participants. The sleep/wake pattern recorded by actigraphy demonstrated a severely fragmented nighttime sleep period with multiple bouts of activity, and daytime naps or periods of no or little activity. These patterns were variable between participants and between days.
Conclusion: Individuals with SMS showed an abnormal daytime, but stable, secretion pattern of plasma melatonin believed to be responsible for the severe sleep disorder. In contrast, their cortisol rhythm appears to be normal. Individuals with SMS suffer from severe nighttime sleep disturbances characterised in particular by multiple periods of nighttime activity that frequently interrupt the sleep period, resulting in poor sleep efficiency, variable sleep onset and morning awakenings, and unpredictable sleep quality. The sleep disorder, which is believed to be the strongest predictor of maladaptive behaviour in SMS individuals, including aggressive behaviour, temper tantrums, hyperactivity, attention deficits, constitutes a major challenge to the patients and their families. Its detailed characterisation is essential in developing an effective treatment, which is crucially needed.

495 - **Pharmacokinetic characteristics of tasimelteon**
Presented by: Rosarelis Torres

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Objective: Non-24-Hour Sleep-Wake Disorder (Non-24) is a serious chronic circadian rhythm disorder that occurs when individuals are unable to entrain (synchronise) their endogenous master body clock to the 24-hour day-night cycle. Non-24 is most prevalent in totally blind individuals without light perception. In the studies discussed here, we assessed the absolute bioavailability of tasimelteon (HETLIOZ™), a melatonin agonist with selective activity at the MT_1 and MT_2 receptors that is the first and only treatment approved by the US Food and Drug Administration for Non-24. Additionally, we evaluated the pharmacokinetics, safety, and tolerability after single- and multiple- dose of oral and intravenous (IV) tasimelteon in young, healthy, non-smoking subjects across multiple phase studies.
Methods and materials: Data from 115 subjects from five phase 1 studies was analysed to determine the pharmacokinetics of tasimelteon. Additionally, the absolute bioavailability of tasimelteon was determined in an open-label cross-over study. In this study, all 14 volunteers received a 20 mg capsule administered orally or a 2 mg IV dose infused over 30 minutes in a random order. Volunteers were treated with the alternate route after a 5 ± 2 days wash-out period. Blood samples for pharmacokinetic analysis were collected during each administration. Safety measures were also assessed.
Results: The C_{max}, T_{max}, area under the curve ($AUC_{(inf)}$), and $t_{½}$ among the five studies analysed were similar. Tasimelteon is rapidly absorbed with an average (± Standard Deviation; SD) C_{max} of 235 ± 128 ng/mL occurring at a median T_{max} of 0.50 hours. The average AUC (± SD) is 411.4 ± 327.8 h×ng/mL, and the average $t_{½}$ (± SD) is 1.32 ± 0.431 hours. Tasimelteon's absolute bioavailability was 38% and the total clearance from plasma after IV administration was 505 ± 135 mL/min. The mean $t_{½}$ was similar for the oral and IV administration. The oral-to-IV exposure ratios for the most abundant metabolites were higher than 100%, suggesting presystemic or first-pass metabolism. Tasimelteon was safe and well tolerated across all the phase 1 studies.
Conclusion: Low bioavailability could lead to variable therapeutic responses due to systemic exposure's variability. Tasimelteon has a higher absolute bioavailability than other melatonin agonists which combined with its short half-life supports its profile as an effective treatment for Non-24.

574 - **Clinical, neurophysiological and circadian patterns of patients with late/irregular sleep wake schedules**
Presented by: Teresa Paiva

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Objectives: To evaluate the clinical and biological patterns of patients from a Sleep Medicine Center referring for late or irregular sleep/wake schedules.
Methods: Patients of both genders with these complains. Evaluation-It included the clinical history, nocturnal type I PSG, wrist actigraphy for 1 or 2 weeks, and saliva collection for dim light melatonin onset (DLMO) evaluation. Statistics-Descriptive statistics was used.
Results: 170 patients were selected the mean age was 39.7 years from 16 to 92; 54.7% were males; almost 40% of the patients had less than 12 years of school training, 39.1 had a university course. Concerning jobs, 14% were shift workers, 28.2% were students and 10.2% were retired.
Wake up and bed time varied enormously from 5am to 6pm and from 10pm to 6:45am respectively. The prevalence of other complains was high: anxiety 57.7%; insomnia 55.9%; depression 39.3%. Periodic limb movements were present in 20.5%, sleep apnoea and restless legs in 10.8%, 5.4% had traffic accidents.
PSG data showed a reduction in sleep efficiency and increased sleep latency. The average sleep onset timing was 2am±1.56SD. The average DLMO was 1:13am, ranging from 9:23pm to 6:30am.
Conclusions: Patients with irregular schedules (16.6%) were frequently depressed; they had reasonable schedules during weekdays but oversleep during weekends. Patients with late week bedtimes were 28.2% and patients with clear sleep phase delay were the majority (55.2%).
The high rates of anxiety, insomnia and depression were remarkable; in spite of a relatively preserved sleep duration and macrostructure.

139 - **Insomnia and sleep quality in patients suffering from chronic low back pain: a case-control study**

Presented by: Mahnaz Abbasi

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Objectives: Insomnia and poor quality of sleep are the consequences of suffering from other medical disease. Low back pain (LBP) is one of the most common primary diseases that can cause sleep disorders. This study was conducted to assess prevalence of insomnia and poor sleep quality in patients suffering from chronic low back pain and compare with a control people.
Methods: This case control study recruited 70 patients with chronic low back pain between June 2014 and August 2014. All consecutive cases with diagnosis of chronic LBP who had been referred to Rheumatology disease clinic were included. Seventy age- and sex- matched healthy individuals were recruited as a control group in the study. Insomnia Severity index (ISI) and Pittsburg Sleep Quality Index (PSQI) were used to detect insomnia and sleep quality in both groups. Visual Analogue Scale (VAS) was used to assess pain severity of patients.
Results: Seventy patients with chronic LBP (33 males and 39 females) and 70 normal people (30 males and 38 females) responded to questionnaires. Patients and control people were similar in case of age and gender. Poor sleep quality was detected in 26 people of patients (37.1%) and 11 people of control group (15.7%). This difference was statistically significant (P< 0.05). The frequency and severity of insomnia was higher in LBP patients than control group (P< 0.05). There was significant correlation between severity of pain measured by VAS with patients´ insomnia (r=0.41, P< 0.001).
Conclusion: Insomnia and disturbed sleep appear to be common in chronic LBP patients compared to healthy people. It is recommended that more attention paid to sleep problems in patients suffering from chronic LBP during their management.

172 - **Relationship between sleep hygiene practices and sleep quality in professional drivers**
Presented by: Zohreh Yazdi

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Objective: Sleep hygiene practices are a group of behaviors, which have been distinguished to promote normal sleep. The present study was designed to explore different aspects of sleep hygiene practices in professional drivers. Also, we assessed relationship between theses practices and sleep quality in this group.
Methods: 157 professional long-haul truck drivers who had been referred to the Occupational Health Clinic for routine periodic examination were invited. Data were collected using a questionnaire including questions about demographic and job characteristics. Pittsburg Sleep Quality Index was used to assess drivers´ sleep quality. Also, Sleep Hygiene Questionnaire was used to detect different aspects of sleep hygiene like time in bed, smoking near sleep, napping and etc. Data was analyzed with the SPSS software version 19.
Results: Mean age of drivers was 37.2±0.5 years and mean experience of work was 13.7±6.3 years. The mean BMI of drivers was 26.6±4.9 and 100 drivers (63.7%) did not use tobacco. We categorized sleep hygiene behaviors in five aspects including physiologic, cognitive, emotional, sleep environment, and daytime sleep. The physiologic and environmental aspects showed to be the best (76.4% with good sleep hygiene practices) and worst (43.9% with good sleep hygiene practices) aspect for our participants, respectively. Also, 78 (49.7%) of drivers had poor sleep quality. Drivers with better practice in sleep environment aspect had statistically significant better sleep quality (P< 0.05). The significant association was not seen in another aspect.
Conclusion: It can be concluded that poor sleep hygiene practices especially in some aspects may be a reason for poor quality of sleep in professional drivers.

296 - **Circadian assessment of wrist skin temperature in healthy subjects with different chronotypes**
Presented by: Paul Baier

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Objective: Evidence grows that the evening type is a risk factor for affective disorders. However, in current practice the identification of patients' chronotypes is based on questionnaires, hence underlying a bias in psychiatric patients. Existing marker rhythms (e.g. salivary melatonin or core body temperature) require laborious methods. Aim of this study was to evaluate if wrist skin temperature (WST) variations can serve as objective index for the circadian system.
Methods: 60 healthy subjects (n=20 morning, n=20 intermediate, n=20 evening type, according to self assessment with the D-MEQ) followed an early (22:00-6:00) and a late (0:00-8:00) bedtime schedule in a randomized order on each five consecutive nights at home. Behavior was assessed with a diary, WST was recorded continuously.
Results: In all subjects WST increased in association with bedtime and dropped sharply after awakening, thus showing an inverse relationship with published body core temperature. In the early bed time regime there was a statistically highly significant difference in WST variation at lights on between morning type (1.5 ±0.7 °C) and as well intermediate (1.2±0.5 °C; p< 0.001) as evening type (1.1±0.5°C; p< 0.0001).
Conclusions: We could identify objective parameters as index for the chronotype in healthy subjects, assessed with an inexpensive and thus potentially high throughput method. Further studies with psychiatric populations are in preparation.

437 - **The association of morningness-eveningness with anger and impulsivity in the general population**
Presented by: Yu-Jin G. Lee

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Objectives: This study aimed to assess the relationships of morningness-eveningness with anger and impulsivity in the general population. We hypothesized that evening-types would be more impulsive and show higher anger. The moderating effects of anger or impulsivity on the relationships were examined.
Methods: All subjects were sampled randomly through a research agency. The city was divided into 8 administrative districts. The sample size from each district was matched proportionally to the number of population from each area. All subjects from each district were controlled by age and gender. The number of males and females were equal. And the same number of subjects categorized according to age (the 20s, 30s, 40s and over-50s) were sampled evenly from each age group. Participants completed questionnaires including the Morningness-Eveningness Questionnaire (MEQ), the Barratt Impulsiveness Scale (BIS), the State-Trait Anger Expression Inventory (STAXI) and the Center for epidemiologic studies depression scale (CES-D). After excluding those who incompletely filled up the questionnaire, finally 1,000 participants (500 males and 500 females) were analyzed.
Results: Age was positively correlated with the MEQ scores (r=0.395, p< 0.001). BIS scores positively correlated with the STAXI (r=0.424, p< 0.001) and negatively correlated with MEQ scores (r=-0.167, p< 0.001). The STAXI scores had a negative correlation with MEQ scores (r=-0.113, p< 0.001). In the regression analysis with dependent variables of age, gender and CES-D scores, high MEQ scores predicted low STAXI scores (β =-0.062, p=0.029). High MEQ scores significantly low BIS scores
(β =-0.129, p< 0.001). Moderation analysis further revealed BIS scores moderated the relationship between MEQ scores and STAXI scores (t=-4.395, p< 0.001). Only when the BIS scores were high (+1SD), the effect of MEQ on STAXI was significant (B=-0.012, p< 0.001). Moderation effects of STAXI scores on the relationship between MEQ scores and BIS scores were lower than those of BIS scores.
Conclusion: In the current study, morningness-eveningness was associated with impulsivity and anger. Impulsivity moderated the relationship between anger and morningness-eveningness more than anger did. Our results suggest that level of anger and impulsivity may be modified by intervening chronotypes in the general population.

112 - **Self-reported sleep characteristics: data from the cohort population study ESSE-RF (Russia)**
Presented by: Mikhail Bochkarev

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Objectives: To evaluate self-reported sleep characteristics in different regions of the Russian Federation.
Methods and materials: Participants of the cohort study Epidemiology of cardiovascular disease in various regions of the Russian Federation - ESSE-RF (Russian) population aged 25-64 years from 13 regions of the Russian Federation interviewed by questionnaires about average duration of sleep, difficulty falling asleep, and maintaining sleep, sleepiness, snoring and apnea during sleep. Variables related to trouble falling asleep, night awakenings and sleepiness were defined as a “frequent” when answered “≥3 times a week”.
Results: Were obtained for 21,969 participants, mean age 49 (25; 65) years including 8385 males and 13584 females. Average sleep duration was 7h (1; 16) with 23,4% prevalence of short-sleepers (≤ 6h) and 4,5% of long-sleepers (>9h). 3699(17%) of respondents answered frequent difficulties asleep; 2660(20.03%) women and 1039 (12.27%) men ($\chi2 = 511,8$; $p < 0,001$); difficulties maintaining sleep were in 13.45% of respondents; 2188(16.48%) women and 734(8.68%) men ($\chi2 = 755,8$; $p < 0,001$). Complaints about snoring had 10098 (46.5%) of respondents; 4429 men (19.9%) and 5921 women (26.6%); 8770 (39.4%) of respondents not bothered snoring, and 3138 (14.1%) of respondents did not know the answer to this question ($\chi2 = 120,7$; $p < 0.001$). Complaints about sleep apnea presented in 1380 subjects (6.2%), 607 men (2.7%) and 779 women (3.5%), 14690 (66%) respondents had no complaints about apnea, 6188 (27.8%) were unaware of sleep apnea presence ($\chi2 = 11,9$; $p < 0.01$). Self-reported sleepiness was frequent in 1348 (12%) of respondents, 429 (5.08%) men and 919 (6.93%) women ($\chi^2=112,6$; $p< 0,001$).
Conclusions: The prevalence of insomnia symptoms is in line with other foreign epidemiological studies. Women have insomnia symptoms almost two times higher than men. The frequency of complaints of sleep apnea is much lower (6.2%) than in results of previously published epidemiological studies in other countries.
Funding: Study was supported by the Russian Humanitarian Fund grant #14-06-00219.

342 - **Sleep duration and quality in low and middle income countries - a systematic review and meta-analysis**
Presented by: Nick Glozier

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Objective: Sleep research has been dominated by high income countries (HIC). Sleep may be different in low and middle income countries (LIMC) due to cultural, demographic, geographical and other factors. We aimed to review the epidemiology in LIMC.
Methods: We systematically reviewed the literature reporting sleep parameters in the general adult and old age populations in LIMC and meta-analysed the prevalence of subjective poor sleep quality. We identified 34 publications; over 50% of which came from China and Brazil.
Results: The mean self reported sleep duration was between 6.9 and 8.6 hours in the 9 studies that reported this. Although we demonstrated a pooled prevalence of poor sleep quality of 36% (95%CI: 29-42%) in working age adults and 34% (95%CI: 30-38%) in older adults, substantial heterogeneity existed; prevalence rates ranging from 6% to 86%. This enormous variability was not explicable by regional, rurality, age group, study type, or sleep assessment method. There was a suggestion of significant publication bias, with smaller studies reporting worse sleep. There was no evidence either for or against biphasic sleep in LIMC.
Conclusion: This review provides evidence that sleep parameters in LIMC appear similar to those in HIC but the variability and bias found suggests any attempt to extract a universal prevalence estimate from the current data is flawed.

369 - **Bed or hammock for better sleep quality and physical activity**
Presented by: Jesús A. Moo Estrella

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Objectives: This study aimed to compare the sleep quality and physical activity between sleeping in bed or hammock.
Subjects and methods: Participated 69 college students volunteers (53 % female, mean age 21 ± 1.6 years), divided into two groups: 33 usually sleeping in bed and 36 in hammock. Objective sleep data and physical activity were obtained by actigraphy device for 24-hour/day for seven consecutive days to monitor their sleep-wake patterns. Participants also completed a set of questionnaires about sleep habits, insomnia, sleepiness (Epworth scale) and physical activity.
Results: No differences were observed (p> .05) between sleeping in bed and hammock in terms of minutes (418.6 ± 87.4 vs 395 ± 93.3) and percentage of sleep (31.1 ± 6.1 vs 28.9 ± 7.3), sleep efficiency (74.6 ± 10.7 vs 72.9 ± 11.4), wake after sleep onset (213.3 ± 134 vs 220.6 ± 123.6), wake minutes
(941.7 ± 112 vs 977.2 ± 131), however differences were found in activity index (77.7 ± 4.7 vs 81 ± 6.1, t = 2.36, p = .021). Subjective report no differences were found regarding: sleep schedules (p> .05), cases of insomnia (34.4 vs 28.6%) and sleepiness (9.73 ± 4.4 vs 9.71 ± 6.2). However differences were found in terms of physical activity outdoors (26 ± 51 vs 54 ± 54, t = 2.23, p = .30).
Conclusions: Sleep quality is equal between sleeping in bed or hammock. But objectively and subjectively, physical activity, especially outdoors, is greater when sleeping in a hammock.

53 - **Sleep quality and anxiety in patients with chronic illness a qualitative study**
Presented by: Mary Kemple

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This study aimed to explore sleep quality in patients with chronic illness. A qualitative approach was chosen as the most appropriate approach for investigation in this area, enabling exploration of patient's experiences of sleep quality. A purposive sample of 9 participants volunteered from a general practice primary care clinic was used. Semi-structured interviews were recorded, transcribed and analysed using an interpretative approach.
Nine participants consented to interview (7 men and 2 women). The age ranged from 66 years to 94 years. While sleep quality was the primary focus most participants had multiple co-morbidity, these included heart failure, hypertension, rheumatoid arthritis and coronary heart disease in addition the majority of participants were prescribed several medications. A consistent theme that emerged from the data was the pervasive role that anxiety played in initiating and maintaining poor quality sleep. While participants reported themselves as being healthy, they also highlighted the feelings of not being rested or refreshed because of the poor quality of their sleep. Several participants attributed this to the impact of anxiety on their sleep. Included in this were themes related to worrying a lot. Participants worried that they would be unable to fall asleep and when unable to fall asleep they spent the time in bed worrying. Instead of sleeping when in bed they described their thoughts as circling around and around worrying about family and grandchildren. In conclusion anxiety has a powerful impact on patients sleep quality and as such warrants further investigation.

317 - **Relationships between sleep patterns and BMI among older adults ages 70 and above**
Presented by: Galia Sheffer Hilel

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Objectives: Studies in the general population have shown links between nutritional status, especially BMI, and the duration and quality of sleep, however only few have investigated these relationships in older adults. The current study focused on the relationships between BMI and sleep duration and efficiency in older adults ages 70 and above. We hypothesized that increased BMI is associated with shorter sleep duration, that low and high BMI are related to low sleep efficiency, and that these

associations are maintained when controlling for comorbidities, functional status and gender.
Methods and materials: Secondary analysis was performed on a database originally collected to examine hospitalization and functioning in older adults. A prospective cohort of 720 older adults hospitalized in 2009-2011 was recruited by convenience sampling. Exclusion criteria included admission for stroke, being in a coma, mechanically ventilated, completely dependent in basic functions and/or poor cognitive status. Measures were based on self-report questionnaires partially confirmed by medical records, and included sleep duration (hours), estimated sleep efficiency (sleep duration / time in bed), BMI, comorbidities, functional status and gender. Participants were divided into three groups based on standard BMI cutoffs for older adults and defined as follows: underweight (BMI ≤ 23), normal
(23< BMI < 30) and obese (BMI≥30).
Results: An inverse linear correlation was found between BMI and sleep duration, indicating that BMI increases as sleep duration decreases ($r=-0.152$, $p< 0.001$). This association remained significant in the fully adjusted model ($\beta=-0.134$, $p< 0.001$). A significant group difference in sleep efficiency was found only for women ($F=7.115$, $p< 0.001$), with higher sleep efficiency in the normal (0.73±0.02) compared to the high (0.63±0.02) BMI group in the adjusted model ($p< 0.001$).
Conclusions: This study extends previous findings of an inverse relationship between BMI and sleep duration to the older adult population. Findings reveal reduced sleep efficiency in obese compared to normal weight older women, but not men. Associations were maintained when controlling for comorbidity and functional status.

320 - **Advantage of REM sleep imaging in the detection of amnestic mild cognitive impairment**
Presented by: Pauline Brayet

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Objectives: Individuals with amnestic mild cognitive impairment (aMCI, subjects with objective memory loss) are at great risk of developing Alzheimer's disease (AD). Both aMCI and AD subjects show an early impairment of the cholinergic system, a system greatly involved in rapid-eye movement (REM) sleep activation. The aim of this study was to evaluate the value of assessing regional cerebral blood flow (rCBF) during REM sleep in the discrimination between aMCI and controls compared to the same measure during wakefulness.
Methods and materials: 5 amnestic MCI (3 men; 75.4 ± 6.2 years) and 7 controls (2 men; 69.3 ± 3.6 years) underwent a complete neuropsychological assessment, a polysomnographic investigation and two high-resolution 99mTc-HMPAO single-photon emission computed tomography (SPECT) imaging tests (one during REM sleep and one during wakefulness). Using statistical parametrical mapping, between-group differences on rCBF were assessed with independent t-tests for both REM sleep and wakefulness with cluster-level $p< 0.05$.
Results: No differences in age and education were found between groups. Compared to controls, aMCI subjects had decreased rCBF in the bilateral cingulate cortex. While the hypoperfusion was localized to the anterior cingulate cortex during wakefulness (272 voxels, $p< 0.02$), the hypoperfusion during REM sleep was greater (1172 voxels; $p< 0.001$) and extended from the anterior cingulate cortex to the midcingulate area (see Figure 1). An additional region of hypoperfusion in REM sleep was found in the left caudate nucleus in aMCI subjects (253 voxels; $p< 0.02$). Increased rCBF was shown for aMCI in the left precuneus (478 voxels; $p< 0.002$) and the right angular gyrus ($p< 0.05$) in wakefulness. No regions of hyperperfusion were found in aMCI subjects for REM sleep.
Conclusions: These results demonstrate the superiority of REM sleep rCBF (compared to that during wakefulness) in the discrimination between aMCI and control subjects. The region that showed a prominent hypoperfusion in aMCI is heavily innervated by serotoninergic, noradrenergic and cholinergic projections during wakefulness. The serotoninergic and the noradrenergic systems are inactive during REM sleep, unmasking the impaired cholinergic innervation. For this reason, rCBF assessed during REM sleep could be an interesting tool to identify patients at risk of developing AD.

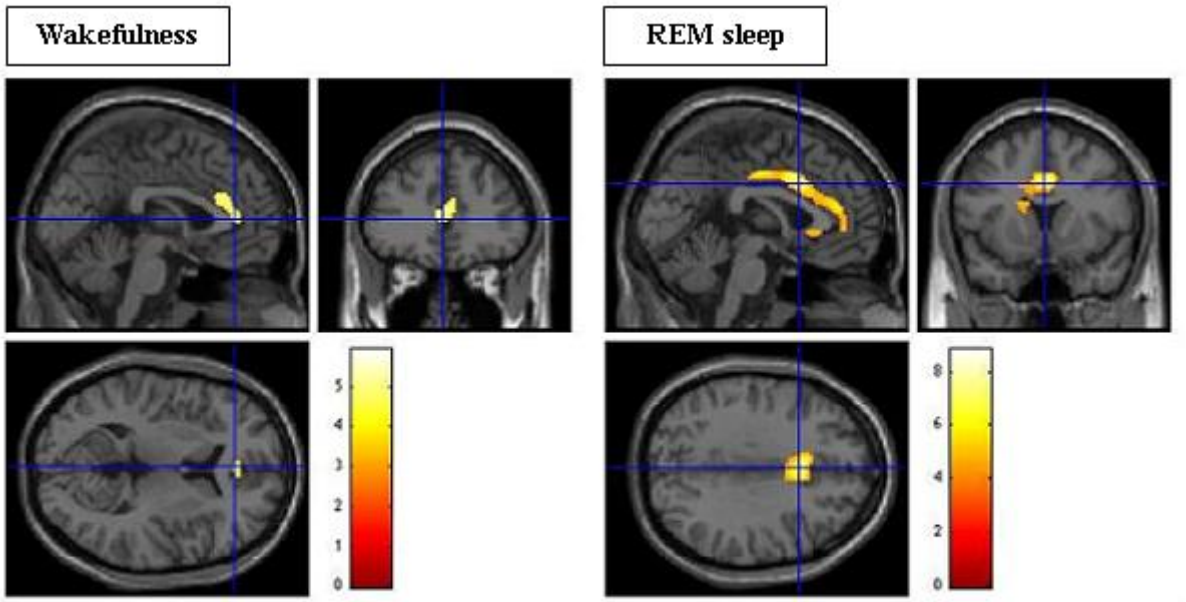

Figure 1. Hypoperfusion of the bilateral cingulate cortex in amnestic MCI subjects compared to controls during wakefulness and REM sleep. The hypoperfusion of the cingulate cortex is greater and more extended in REM sleep (note that the t-value scales are different; it goes higher in REM sleep).

[Figure 1.]

368 - **The sleep of older men and women with chronic leg ulcers: an overlooked health problem?**
Presented by: Amanda Hellström

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Objectives: Leg ulcers (venous, arterial, venous-arterial, other ulcers) are often painful and associated with sleep disturbances. Pain intensity may vary depending on the type of leg ulcer but studies investigating leg ulcer diagnoses in relation to pain and sleep are lacking. The prevalence of sleep disturbances and leg ulcers are affecting a considerable quantity of older people, particularly women. This study aimed to investigate sleep disturbances in older people (≥65 years) with leg ulcers depending on pain intensity, age, gender and leg ulcer diagnosis.
Methods and materials: For this cross-sectional study, data from the Swedish Registry of Ulcer Treatment, collected between May 2009 and December 2013, was used. 1824 people were included of whom 62.9 % were women. Mean age was 83.4 years (SD 8.8). The Numeric Rating Scale (NRS) measured pain intensity, sleep disturbances were assessed with a binary question. For analysis Chi-square and logistic regression backward: LR were used.
Results: Approximately half of the sample experienced pain (51.4%). Sleep disturbances was found in 34.8 % of the total sample and were associated with pain ($p < 0.001$). Of those with concurrent pain, 58.8% had sleep disturbances. No significant difference in sleep disturbances were found between men and women ($p=0.606$), however women more often reported pain and scored higher on the NRS. Mean NRS scores did not differ significantly between ulcer diagnoses, but arterial and venous-arterial ulcers increased the odds of having sleep disturbances, as did a NRS score ≥4.
Conclusions: The majority of the sample was >80 years. Sleep and pain were linked to diagnosis and sleep disturbances increased with higher pain intensity. It is of importance to perform careful anamnesis of the ulcer type, and presence of sleep disturbances in order to capture the individual's specific health needs. Also, the variation in pain, sleep and diagnosis needs to be considered when formulating guidelines for the treatment of older people with leg ulcers.

387 - **Vulnerability of sleep-dependent thalamo-cortical circuits to early stages of neurodegeneration**
Presented by: Jose L. Cantero

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Objectives: Amyloid-beta aggregates are frequently observed in the thalamus of Alzheimer's disease (AD) patients, mainly in the reticular, posterolateral and/or pulvinar nuclei. Most of these thalamic compartments are involved in the generation of the alpha rhythm during wakefulness, accounting for changes in the electrophysiological properties of alpha oscillations in mild cognitive impairment (MCI) and AD patients. However, it remains unknown whether thalamo-cortical dysfunctions are extended to sleep in MCI patients, issue that could be unveiled by sleep spindles, an emergent property of the thalamo-cortical system during sleep. The main goal of this study was to compare electrophysiological features of sleep spindles between MCI patients and healthy older (HO) subjects.
Methods and materials: Overnight polysomnographic (PSG) recordings were performed to 31 MCI patients and 26 healthy older (HO) subjects, and scoring of sleep stages was conducted according to standard guidelines. A sleep technician manually scored sleep spindles in all sleep recordings. Group differences in sleep spindles (number of spindles, spindle density, and spindle duration) were assessed with a multivariate analysis of covariance (MANCOVA) adjusted by age and gender.
Results: MCI patients showed lower spindle density and shorter spindle duration in stage 2 and slow wave sleep stages (3+4) compared to cognitively intact elderly subjects.
Conclusions: These results suggest that dysfunctions of thalamo-cortical circuits are extended to sleep spindle oscillations in MCI patients. Given the role of spindles in sleep preservation, the augmented sleep fragmentation reported in MCI patients might be facilitated by spindle-poor sleep.

403 - **Sleep profiles and cognitive function in adults with mild cognitive impairment in comparison to cognitively healthy adults and moderate Alzheimer's disease patients**
Presented by: Katharina Wulff

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Objectives: The objective of this study was to examine relationships between dimensions of cognitive impairment and sleep profiles in home-dwelling, older adults with amnestic mild cognitive impairment (aMCI), Alzheimer Disease of moderate severity (AD) and cognitively non-impaired controls.
Methods: Exclusion of confounds for all participants included institutionalisation, comorbidities (incl. sleep apnoea), and dementia medication. Cognitive ability was assessed in various attention and memory domains with the Mini-Mental-State-Examination and five computerised tests (CANTABeclipse™). Sleep disorders and sleep quality were assessed with the Jupiter Sleep Questionnaire and Pittsburgh Sleep Quality Index. Participants' daily rest-activity behaviour was monitored for three weeks using wrist-worn actigraphs. Groups were compared according to their diagnostic category and then pooled to correlate sleep data with cognitive performance.
Results: aMCI individuals (N=8) were similar to cognitively healthy controls (N=13) in attention and episodic memory but had reduced ability in domains of verbal and visuospatial memory. The mild visuospatial impairment seemed likely to be of memory origin rather than reduced attentional capacity, because contrast analysis showed preserved attentional task performance in aMCIs, while attentional deficiency was significant in the group of moderate AD patients (N=24). All self-reported and objective measures of sleep quality (i.e. sleep disturbance, sleep efficiency, sleep fragmentation) and sleep quantity of the aMCIs were within the normal range and comparable to those of cognitively healthy controls. Unmedicated moderate AD patients scored significantly lower on all cognitive tests and had distinctively longer sleep periods in both self-reported and actigraphy measures which were not explained by sleep disorders, sleep medication, fragmented sleep or poor sleep efficiency.
Conclusion: This investigation is of clinical importance, because major confounding variables, such as comorbidities, dementia medication and institutionalisation were excluded. The lack of comorbidities (neurological, psychiatric, sleep apnoea) might be responsible for the absence of commonly reported sundown syndrome and sleep disturbances in our AD patients living at home. Sleep duration is not prolonged at the stage of mild cognitive impairment. Whether there is interdependence between progressive decline in cognition and long sleep duration remains elusive.

82 - **Relationship between different chronotype and academic achievement in medical students**
Presented by: Zohreh Yazdi

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Objective: Sleep is an essential element for proper academic performance in medical students, but today's young students are deprived of this. Previous studies in other countries showed high prevalence of sleep disturbances in college students with different chronotype, which affect their academic performance. The aim of this study was to assess the prevalence of different chronotype in medical students of Qazvin University and its relation with their academic performance.
Methods: This cross sectional self-administered questionnaire based survey was conducted at Qazvin University of medical sciences from 1-31 March, 2013. The participants were medical students. The Horne and Ostberg Morningness Eveningness questionnaire was completed to identify different chronotype in our participants. Mean grade point average (GPA) was recorded for academic performance.
Results: Out of 230 medical students, 170 (73.9%) participated in the study. Mean sleep duration of students was 6.1±1.3 hours. Of all participants, 105 (61%) students were intermediate, 22 (12.9%) and 43 (25.3%) of students were eveningness and morningness, respectively. Results showed that GPA was significantly associated with different type of chronotype. Evening type of students had lower academic achievement (GPA) ($P< 0.05$).
Conclusion: These results could be used to help educational consultants to identify vulnerable students. Future research is needed to reveal precise effect of chronotype on academic achievement.

191 - **High rates of polypharmacy in a sleep lab population: a retrospective hospital audit**
Presented by: Vanessa Coe

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Objectives: Patients referred for polysolmnograpy frequently have comorbid medical conditions requiring medication use. Common side effects of these medications include sleepiness, insomnia, and sleep disturbances, which can have substantial implications for sleep quality and the treatment of sleep disorders. The aim of this audit was to: identify types and number of medications used in a sleep laboratory population; identify any relationship between the use of these medications and the severity of patient symptoms; and to assess the incidence of comorbidities.
Methods: A retrospective audit of case notes for patients that underwent polysolmnography at a tertiary teaching hospital in Adelaide, South Australia, between January and December 2014 was conducted. Patient characteristics, number and type of medications, and identification of medication with sleep related side effects was extracted into a standardised template by an experienced sleep technologist.
Results: There were 947 patients who underwent polysomnography during this time with data extraction currently complete for 118. Polypharmacy was common in patients attending our service, with an average of 5.5 medications per patient (range: 0 - 24). Of these, 63% were identified as having 4 or more medications and 43% were taking 6 or more medications. Both a high body mass index and older age were correlated with overall number of medications used, though no correlation was observed between number of medications and Apnoea Hypopnoea Index or Epworth Sleepiness Score. The most common medications were antihypertensives, antidepressants, anticholesteremics, proton pump inhibitors, and bronchodilators.
Conclusions: Over 200 medications have known sleep related side effects and small changes to treatment regimens can produce large improvements in quality of life. This audit has found a substantial proportion of subjects who are already reporting sleep issues requiring investigation, are indeed using multiple medications. This has clinical relevance as previous studies have found an association between polypharmacy and decreased sleep quality. Given this, it is important to take a patient's medication regimen into consideration when assessing a patient for possible sleep disorders. Moreover, psychological factors such as perceived benefit and the presence of sleep maintenance

insomnia play a role in CPAP compliance and these can be affected by a patient's medication regimen.

675 - **Sleep complaints, sleep habits and their association with academic performance among medical students in Armenia**
Presented by: Anush Karamyan

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Objectives: To study the pattern of sleep complaints, sleep habits and their influence on academic performance among medical students in Armenia.
Methods and materials: We conducted a cross-sectional survey among first- to seventh-year medical students at Yerevan State Medical University, Armenia, in October 2014. At the time of the survey students were out of any exam sessions. The questionnaire involved demographics, personal lifestyle habits, sleep habits, sleep complaints and academic performance. We used Spearman correlation and Mann-Whitney test for statistical analyses.
Results: Of the 295 medical students having completed the questionnaire, 87 (29.2%) were male and 208 (69.8%) were female. Median age was 20 years (range 17-28), reported median duration of sleep was 7 hours (range 3.5-11). The most prevalent complaint was daytime sleepiness, reported by 60.1% of the students. Overall 29% of the students reported to have followed sleep hygiene rules, whereas 75.3% of them had a habit of late tea, coffee or energetic drinks intake, and 57.6% of them used their beds for other activities than sleep. There was no significant correlation between academic performance and sleep duration, but students who reported recently occurred concentration and memory disturbances had shorter duration of sleep compared with those without memory complaints (6.5 vs. 7 hours, p=0.01).
Conclusion: This study indicated poor sleep habits among medical students. Complaint of excessive daytime sleepiness turned to be extremely prevalent. Our data demonstrate that medical students have poor knowledge on sleep hygiene. Appropriate health education projects on sleep hygiene could minimize the negative effect of higher academic pressure on medical students' well-being.

537 - **Are pets in the bedroom beneficial or detrimental?**
Presented by: Lois Krahn

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Introduction: Pet ownership in the U.S. is at the highest level in two decades (APPA, 2013). This trend raises questions of where pets sleep and whether they disturb their owners' sleep. A 2015 study (Krahn) reported that 49% of patients seen at a multidisciplinary sleep center had pets. Pet owners who felt that their pet(s) were unobstrusive or beneficial (41%) outnumbered those who described their pets being disruptive (20%).
Method and materials: Between Dec and May 2015, 95 consecutive patients provided information about pets at night as a part of a comprehensive sleep questionnaire. Questions were incorporated into the section about environmental factors influencing sleep asking about the type and number of pets. During the subsequent sleep interview, additional information was collected about where the companion animals slept about how the pet affected the pet owner's sleep.
Results: Slightly more than half of the sample , 49 subjects (51%), had pets. Dog owners (37) outnumbered cat owners (13) and bird owners (1). Having their pet (s) nearby at night was described as beneficial by 29 pet owners (59%) while 9 commented that their pet(s) were disruptive (18%) and 8 were neutral (16%). 18 pet owners (36%) described the pet as close enough to touch their body at times during the night. Qualitative comments included representative examples like "cozy", "comforting", "soothing", and "problems with howling".
Conclusions: The majority of pet owners viewed their pets as being beneficial to sleep with a minority describing them as disruptive in some way. Sleep specialists should inquire about companion animals and help patients problem solve about methods to optimize their sleep. Pet owners can be intensely loyal to their companion animals who they wish to incorporate into as many aspect of their life as possible. Since one third of the day is spent sleeping, the pet owners desire to be proximate to their

pets is understandable. Pet owners should be counselled to carefully consider the advantages and disadvantages of having their companion animal in the bedroom at night.

References:

1. American Pet Products Association, 2012-2013 APPA
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620 - **Noise sensitive persons are more likely to have sleep problems**
Presented by: Winni Hofman

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Objectives: Many insomnia patients complain about a disturbance by even minimal sounds from the environment. However, the concept of noise sensitivity is still poorly understood. Noise sensitive people are more affected by a noisy environment, but they do not seem to have an increased auditory sensitivity. Nevertheless noise sensitivity can have a large impact on daily life and in general they seem to have more sleep problems and more psychological problems. In this study noise sensitivity is studied in relation to individual sleep patterns, sleep quality and symptoms of sleep problems. In addition the association between noise sensitivity with personality traits is studied.
Methods: A group of 450 first year students in completed a noise sensitivity questionnaire (NoiSeQ) and a questionnaire for general sensitivity to environmental stimuli. In addition individual sleep patterns were measured with a general sleep questionnaire and subjective sleep quality was assessed with the Dutch Sleep Quality Scale. The Sleep50 scale was used to measure presence of symptoms of sleep problems. Two personality tests were administered: the 5 PVT (neuroticism and extraversion) and the ZBV to measure the tendency for anxiety. A group of low noise sensitive persons (LO) and a group of high sensitive persons (HI) were selected from NoiSeQ scores for the sleep subscale.
Results: More than a third of this student sample (36,5%) judged their chronotype as 'extreme evening types'. This can be explained by the fact that these young students were still adolescent s. 14,1% of the subjects had subjective symptoms of insomnia, 12,8% had symptoms of apnea, whereas 9,4% claimed to have parasomnias like sleepwalking or nightmares. The HI group had a longer sleep latency ($p < .05$) and more symptoms of insomnia ($p < .000$), PLMD ($p < .01$) and biological clock disorders ($p < .05$). In addition subjects with higher noise sensitivity had a higher score on neuroticism ($p < .000$) and were more inclined to feel anxious ($p < .000$). Although noise sensitivity was significantly correlated with general sensitivity for environmental stimuli, general sensitivity was not correlated with any of the sleep parameters.
Conclusion: Noise sensitive persons have more sleep problems and are more anxious than persons who are not noise sensitive. This cannot be explained by a general sensitivity to environmental stimuli.

414 - **The risk of sleep disorders in Korean cancer patients**
Presented by: Hyeok Lee

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Purpose: Sleep disturbance in cancer patients is common. Previous study reported that approximately 61% of cancer patients had significant sleep deficits. There, however, was no difference in sleep complaints between the cancer patients and patients with other diseases. Considering the biological, behavioral, and psychosocial effects of initial cancer diagnosis, this result is still controversial. The aim of this study is to investigate the risk of sleep disorders in cancer patients compared to patients with other diseases using the national registry data.
Method: National registry data were collected from the Korean National Health Insurance Research Database, comprising 1,025,340 random subjects who were selected from 46,605,433 Korean residents in 2002. Patients diagnosed with any cancer or psychiatric disorder from 2002 to 2003 and from 2005 to 2013 were excluded. The cancer group was composed of patients with an initial diagnosis of cancer between January 2004 and December 2004 (n=3,358). The remaining people were considered as comparison group (n=493,577). Each sampled subject was tracked until 2013. Cox proportional hazard regressions were used to calculate the overall rate for sleep disorder

development after adjusting for potential socio-economical confounders including age, economic status, type and eligibility of national health insurance, and place of residence.
Results: Cancer patients were associated with an increased risk of sleep disorder in both sexes (male hazard ratio[HR], 1.319; 95% confidence interval [CI], 1.232-1.413 / female hazard ratio[HR], 1.289; 95% confidence interval [CI], 1.198-1.386) after adjusting for potential confounders as mentioned above. Both results were statistically significant ($p < 0.001$). In terms of age, the effect size of the HR was largest among elder adults, aged ≥70 years (male HR, 1.748 / female HR, 1.820). The HR tended to increase consistently.
Conclusion: Initial diagnosis of cancer was significantly associated with sleep disorder development after adjusting for potential confounders. This result suggests that thorough screening and intervention for sleep disorders are required for the newly diagnosed cancer patients to improve their quality of life.
Keywords: cancer patients, sleep disorder, hazard ratio, national registry data
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186 - **Explore the relationships between energy intake and sleep quality in type 2 diabetes adults**
Presented by: Ching-Pyng Kuo

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Objectives: Findings from epidemiologic studies indicate that restriction sleep is a risk factor for diabetes. Laboratory studies also show sleep restriction could affect endogenous processes related to energy balance, which may reflect the relationship between sleep quality and energy intake. Thus, this study will to explore the relationships between sleep quality and energy intake in Type 2 diabetes adults.
Methods and materials: Study used a cross-sectional design. 261 Subjects recruited from a diabetes teaching unit of a medical center in Taiwan. Using questionnaire of basic demographic information, Pittsburgh Sleep Quality Index and 3 days food intake diary collected data. Calculated the calories consumed by researcher based on a standard criteria.
Results: In all, 67.3% and 39.6% of participants did not achieve optimal sleep duration (>7 h per day) and sleep efficiency (>80%). 65% of participants had poor sleep quality. Older, female, use of sleep medication had chronic disease history and more energy intake from lipid significantly had poor sleep quality. Sleep quality significant correlated inversely with age, sleep efficiency, total energy intake and energy intake from lipid. After adjusting for age, gender, sleep medication using and chronic disease history, total energy intake or energy intake from lipid ($p = 0.265$, CI=1.000-1.003; $p=0.086$, CI=1.000-1.003) were not a predictor for low sleep quality.
Conclusions: Two-thirds of diabetes subjects perceived poor sleep quality. Age, gender, sleep medication using, chronic disease history and lipid intake significantly affect their sleep quality. But after controlling above variables, energy intake will not predict sleep quality significantly. Future research needs to incorporate objective measures of sleep and energy intake, using longitudinal and interventional methods to better understand the mechanisms linking energy metabolism to sleep problem.

590 - **Artificial neural networks combined with permutation entropy - a promising approach for sleep staging in healthy individuals and patients with DOC**
Presented by: Tomasz Wielek

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Sleep cycles in patients suffering from disorders of consciousness (DOC) have been proposed to be indicative of the preserved residual brain functions (e.g. Blume et al., 2015). However, reliable and valid characterization of the unusual sleep patterns in this clinical group continues to be challenging for neuroscientists. The main difficulties encountered are absence of well-defined EEG changes or sleep criteria and frequent and extended artifacts in clinical recordings.
In the present study, we address both of these issues and investigate the usefulness of feedforward artificial neural networks (ANN) in handling the nonlinearity of patients EEG while permutation entropy (PE) was employed to measure complexity of the EEG signal irrespective of noise. The potential of an ANN-PE-based classifier to differentiate between sleep and wake as well as different sleep stages

was first validated on healthy subjects (15 subjects, 8h recording for each). The results show a high accuracy (about 85%) for within subject classification (i.e. ANN trained and tested on the same subject), and moderate accuracy (about 70%) for generalized classification (i.e. ANN trained on several subjects and tested on a different data set). The use of multiple electrodes at different locations also allowed for a comparison of the predictive value of PE for classification at different electrode sites. Results suggest that the PE fluctuations on frontal electrodes are a good predictor of wake state and deep sleep.
Currently, the classifier trained and optimized on healthy subjects is applied to DOC data (15 patients). The classification output is validated against periods of eye-opening and eye-closure in those patients. Our preliminary results show that the classifier is able to differentiate between sleep and wake periods, based entirely on EEG data. Forthcoming analyses aim to evaluate the quality of sleep in DOC patienst. The classifier outputs may reveal the stability of sleep or its complexity (presence of various sleep stages) which would provide diagnostically relevant information. In conclusion, ANN using PE as input data may provide a new and promising approach for identifying real “sleep” in DOC patients but also for classifying sleep stages at least in some of the patients.
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4 - **Social addiction in women referred to a sleep lab - retrospective study**
Presented by: Maria J. Matos

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Introduction: Obstructive sleep apnea (OSA) affects mostly men but the prevalence of OSA in women may be higher than previously recognized. Factors such as tobacco, caffeine or alcohol can contribute to OSA or even worsen symptoms. How these factors clearly intervene in OSA by affecting sleep/waking cycle remains unknown.
Aim: Investigate the impact of tobacco, caffeine and alcohol consumption in women referred to PSG.
Material and methods: Retrospective analysis of women submitted to overnight polysomnography (PSG) at a Sleep Laboratory in a University Hospital between 2004 and 2013. Clinical reports were reviewed and pertinent clinical data retrieved, including daily consumption of cigars, coffees and alcohol. PSG allowed to divide in two groups, with or without OSA. Data analysis was executed by SPSS.
Results: A total of 437 women were enrolled in this study. Of these, 224 patients (51%) showed OSA with a significant statistical difference regarding age (mean ± SD, 57.7 ± 10.5 vs 48.7 ± 15.9 years) and BMI (49.8 ± 14.1 vs 44.0 ± 10.8 kg / m^2). Nonsmokers represented 92% of all patients and there was no significant statistical difference in tobacco between OSA and non-OSA smokers (mean ± SD 22.8 ± 16.4 vs 14.1 ± 14.9 pack-years). Caffeine and alcohol consumption had no relevant differences (p< 0,005). Of OSA patients, 116 had mild (51.8%), 49 moderate (21.9%) and 59 severe (26.3%) index and no differences were found related to tobacco, alcohol and caffeine consumption.
Conclusions: About half of the women did not have OSA and the majority were nonsmokers. As expected, women with OSA had higher age and BMI. In the present study no correlations between tobacco, caffeine or alcohol consumption and the diagnosis of OSA and its severity were found.
Keywords: Sleep apnea; women; tobacco, caffeine, alcohol;

670 - **Activity monitor assessment of sleep in pulmonary artery hypertension patients**
Presented by: Buket Akinci

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Objectives: The aim of our study was to evaluate total sleep time and sleep efficiency(total sleep time/duration in bed), in Pulmonary Artery Hypertension (PAH) patients in their home environment using activity monitoring. We also investigated the relationship between sleep parameters and PAH clinical parameters, exercise capacity, physical activity level and spirometric values in these patients.
Materials and methods: Twenty-fivepatients (female:20, male:5)diagnosed with PAH were studied by SenseWear® activity monitor for at least consecutive 3 days. Clinical demographics were recorded.

Each subject completed a 6MWT, spirometric evaluation and International Physical Activity Questionnarie Short Form(IPAQ-SF).
Results: 23 patients established as WHO class II and 2 were WHO class III. 72 % of the patients were sleeping less than 7 hours in a night. The mean sleep efficiency of the patients were 79.2%. There were no differences between sleep parameters recorded with activity monitor and PAH clinical classification, exercise capacity, dyspnea and spirometric values in patients who are sleeping more than 7 hours and less than 7 hours. Also these parameters in PAH spesific medication users did not differ with not users (p< 0,005). There was no correlation between sleep efficiency, total sleep time and PAH clinical classification, pulmonary artery pressures, exercise capacity, physical activity level, PAH spesific medication usage and spirometric values (p< 0,005).
Conclusion: Total sleep time measured with actigraphy were decreased in PAH patients but this is not correlated with clinical parameters of PAH, respiratory function, exercise capacity and physical activity level. Further research is needed to investigate polygraphic sleep parameters in PAH patients with different functional classes.

600 - **Gender differences in patients with obesity hypoventilation syndrome: a prospective observational study**
Presented by: Ahmed S. BaHammam

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Objectives: The role of gender and menopause in obstructive sleep apnoea (OSA) is well known; however, systematic studies in obesity hypoventilation syndrome (OHS) are lacking. Therefore, we prospectively evaluated differences in the clinical characteristics of women and men with OHS in a large cohort of patients with OSA.
Methods and materials: During the study period, 1,973 patients were referred to the sleep clinic with clinical suspicion of OSA. All patients underwent overnight polysomnography, during which time spirometry, arterial blood samples and thyroid tests were also obtained.
Measurements and main results: Among 1,973 consecutive patients, 1,693 (617 women) were diagnosed with OSA, among whom 144 suffered from OHS (96 women). The prevalence of OHS among women and men was 15.6% and 4.5%, respectively (p< 0.001). Women with OHS were significantly older than men with OHS (61.5±11.9 yr vs. 49.1±12.5 yr, p< 0.001). Although there were no significant differences between genders regarding symptoms, Epworth sleepiness scale, body mass index, spirometric restriction, daytime $PaCO_2$ or apnoea-hypopnoea index, women with OHS suffered significantly more from hypertension, diabetes and hypothyroidism. The prevalence of OHS among women was higher in in postmenopausal (21%) compared to premenopausal (5.3%) women (p< 0001).
Conclusions: We found that OHS is more prevalent in women than men and that woman with OHS suffer from significantly more comorbidities. Postmenopausal women with OSA have the highest prevalence of OHS.

444 - **Association of erythrocyte sedimentation rate & C-reactive protein levels and the severity of obstructive sleep apnea**
Presented by: Khosro Sadeghniiat-Haghighi

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Objectives: There is some evidence indicating higher levels of systemic inflammation markers in patients with Obstructive Sleep Apnea (OSA). Levels of inflammation markers may be associated to severity of OSA in these patients. So, to elucidate the role of these markers in progression of disease or to evaluate the correlation between level of inflammation markers and OSA severity needs to be

investigated.
Methods and materials: The study group consisted of 56 patients with clinical suspicion of OSA and free of prevalent medical conditions including cardiovascular disease, diabetes mellitus, hypertension. Full night polysomnography (PSG) was performed on all patients. Blood samples were taken from all patients to analyze serum C-reactive protein (CRP) ,Erythrocyte sedimentation rate (ESR) levels, metabolic factors and thyroid hormones in the morning after PSG.
Result: The participant group had mean age 40.32±10.78 year with Body Mass Index (BMI) 28.72±4.96 Kg/m^2. Forty six subjects were male. Forty three had AHI≥ 5. There was significant difference between serum CRP levels in patients with OSA and without OSA. (Mean: 0.65(±0.42), 0.33(±0.52) respectively, P-value: 0.03). But there was no significant difference of ESR levels between two groups. After adjustment for age, BMI, neck circumference and heart rate, CRP had no significant difference between case and control groups. In linear regression model, only BMI correlated with CRP.
Conclusion: This study showed, only BMI was independent risk factors for elevation of CRP in OSA patients. More research is needed to explore the effects of sleep related hypoxia on inflammatory serum markers.

253 - **RDW, MPV, PDW parameters and disease severity relationship in patients with obstructive sleep apnea syndrome**
Presented by: Sema Demir

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Objective: A relationship that between Redcell Distrubution Width(RDW), Platelet Distrubution Width (PDW), Mean Platelet Volüme(MPV) parameters and the disease severity was planned to evaluate in patients with Obstructive Sleep Apnea Syndrome (OSAS). We planned to evaluate the biomarkers because of to take early measures on disease treatment, follow-up and complications (as thromboembolic events and cardiovascular diseases).
Methods: Our study is a retrospective and a cross-sectional study. We benefit patient's polysomnography(PSG) records. The age range was between 18-78. OSAS and control groups were that 108 patients were mild OSAS [Apnea-Hipopnea Index(AHI):5-15]; 69 patients were moderate(AHI:15.1-30); 66 patients were severe(AHI:>30) and 117 patients were control group(AHI< 5). Inclusion criterions were to be evaluate this parameters routine blood count, RDW, MPV and PDW. Exclusion criterions were thromboembolic events and cardiovascular diseases.
Results: 360 patients were enrolled in the study. 74.2 % of them were male; mean age was found to be 46.5. Mean BMI(body mass index) was 30.4. Active smokers was 25.3%. The average O2 saturation was 93.2 at patients. When moderate OSAS group was compared with the control group, hematocrit(HTC) (p = 0.004) and hemoglobin(HB) (p = 0.002) were also found to be significantly increased. When severe OSAS group was compared with the control group, MPV (p = 0.017) also decreased significantly, HTC (p = 0.006) and HB (p = 0.02) were also found to be significantly increased.
Conclusions: In our study, when the other groups were compared to the control group, we observed significantly increased HB and HTC values in moderate and severe OSAS groups. We observed no increase unlike some other studies in MPV, Even we showed reduction in MPV in severe group. Number of patients may have led to such for result in moderate and severe OSAS groups. Therefore, more extensive and prospective studies are needed.

345 - **Correlation between severity of obstructive sleep apnea and prevalence of silent cerebrovascular lesions**
Presented by: Olga Tikhomirova

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Objectives: We investigated the correlation between obstructive sleep apnea (OSA) and prevalence of silent cerebral white matter lesions (WML).
Methods and materials: 100 consecutive men with different risk factors underwent 1.5 -T magnetic resonance imaging (MRI) scans, B-mode carotid ultrasonography, complex laboratory diagnostics included lipid profile, glucose, hs-C reactive protein (hs-CRP). Silent cerebral WML was detected in 66

patients. These patients had undergone an all-night polysomnography (PSG) to assess apnea.
Results: 66 men with WML were subdivided in two groups. The group 1 without apnea (AHI < 5/h) included 32 subjects with mean age 66 years (range 43-82), with a mean body mass index (BMI) of 27.5 kg/m2 (range 21.0-38.3) and a mean AHI of 2/h (range 0-5). The group 2 included 34 patients with apnea (AHI > 5/h) with mean age 68 years (range 50-88), with a mean BMI of 27.2 kg/m2 (range 18.6-34.5) and a mean AHI of 19.4/h (range 5.5-48.0). The amount of silent lacunar infarctions was 8.3 +/- 0.75 and 11.4 +/- 0.87 in 1 and 2 groups respectively ($p< 0.05$). There were established the correlation between AHI and prevalence of silent lacunar infarctions ($r=0.37$ $p< 0.01$).
Conclusions: Results indicate that patients with OSA have a higher prevalence of silent cerebrovascular lesion than those without OSA.

206 - **Sleep disorders in motor neuron diseases**
Presented by: Gulcin Benbir Senel

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Objective: Obstructive sleep apnea syndrome (OSAS) is known to co-exist frequently in patients with motor neuron diseases (MND). The association of other sleep disorders in these patients, however, is not well explored. Here is investigated the patients with MND clinically, and polysomnographic recordings were reviewed to explore sleep disorders.
Methods: The files of 73 patients with MND having polysomnographic recordings in our sleep disorders unit were retrospectively analyzed.
Results: Thirty-six patients were females (49.3%), and 37 of them were males (50.6%). The mean age of study population was 58±9.8 years, and mean body mass index was 25.71± 4.89 kg/m^2. OSAS was detected in 49 patients (67.1%), the mean apnea-hypopnea index was calculated as 28.0±16.3 per hour of sleep. Thirteen patients (17.8%) had sleep related hypoxemia-hypoventilation syndrome, four patients (5.4%) had central sleep apnea syndrome. Fifty patients (68.4%) had at least one sleep disorder other than sleep related breathing disorder. Of these, 19 patients (26.0%) had restless legs syndrome, 34 patients (46.5%) had periodic leg movements in sleep (PLMS). The mean PLMS index was calculated as 34.0±19.6 per hour of sleep. Ten patients (14.2%) had fragmentary myoclonus, 8 patients (10.9%) had REM without atonia, and four of them had REM sleep behavior disease.
Conclusion: We demonstrated that not only obstructive sleep apnea syndrome but also other sleep related breathing disorders are commonly seen in patients with motor neuron disease. Moreover, other sleep disorders especially sleep related movement disorders exist more commonly in patients with motor neuron disorders in compared to general population.

634 - **Risk of obstructive sleep apnea in patients with chronic kidney disease on hemodialysis**
Presented by: Israel Reis Santos

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Objective: To assess risk of obstructive sleep apnea in patients with chronic kidney disease (CKD) on hemodialysis.
Methods: Berlin Questionnaire w ere applied in the evaluation of patients undergoing hemodialysis in a single nephrology center in the city of Sao Paulo (SP) Brazil where evaluated.
Results: Were involved 170 patients (102 male) with mean age of 56.70 ± 16.12 years, mean w eight of 68.89 ± 07.12 Kg, mean BMI of 24.93 ± 3.47 kg/cm2. The major comorbidities found w ere Diabetes Mellitus (45.88%) and hypertension (76.47%). According to Berlin questionnaire, thirty-three patients had low risk for obstructive sleep apnoea (OSA), while 137 patients (80 %) presented a high risk. The clinical and demographic characteristic of our population is quite similar to that described in the literature, highlighting the prevalence of patients with hypertension as underlying disease.
Conclusion: Patients with CKD on hemodialysis this study to analyze the risk for OSA by Berlin Questionnaire, a considerable number of patients had a high risk, especially when we analyzed the association of diabetes mellitus and hypertension association of Diabetes Mellitus and hypertension.

233 - **The sleep apnea in copper smelter exposed occupationally to lead. The preliminary study**

Presented by: Helena Martynowicz

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Objectives: Lead is an environmental and occupational pollutant with numerous adverse effects on health. Occupational exposure to lead still is an epidemiological challenge in Poland. The aim of the present study was to explored the possibility that occupational exposure to lead could induce sleep disordered breathing and assess the sleep apnea prevalence. Further, we aimed to determine associated clinical factors in workers exposed occupationally to lead.
Methods and material: A group of 48 of copper smelters exposed occupationally to lead were included into the study. Occupational exposure to lead was characterized by estimation of blood lead concentration and blood zinc protoporphyrin concentration. All patients underwent a standardized overnight, single night polysomnography using AURA Grass device.
Results: The mean blood lead concentration in workers occupationally exposed to lead was 242.18 ug/l. Results above maximum admissible concentration (MAC) of blood lead concentration (Pb-B > MAC , Pb-B > 500 g/l) were detected in six participants (13.3% of the studied group). The mean blood zinc protoporphyrin concentration in the studied group was 70.09 g/dl. Transgression of the maximum admissible concentration of ZnPP (ZnPP > MAC,ZnPP > 70 g/dl) was detected in 10 participants (22.2% of the studied group). The prevalence of obstructive sleep apnea in studied group was 62.5%, including of mild, moderate and severe apnea respectively 37.5, 17.5, 7.5%.
Conclusion: We have shown high prevalence of obstructive sleep apnea (OSA), obesity and hypertension in studied group. However, we did not find any relationship between lead exposure and sleep apnea in workers occupationally exposed to lead. The single factor most commonly associated with OSA is obesity, which was also highly prevalent in copper smelters. Prevalence of hypertension in general population in Poland is 32 %. We have showed the higher prevalence of hypertension in workers occupationally exposed to lead (53.3%). The high prevalence of hypertension in studied group may be also secondary to high prevalence of obesity and OSA. Thus, special attention should be given to improve the knowledge, attitude and health behaviors of occupational group of copper smelters. However, further studies with larger group should be considered.

546 - **A case of obstructive sleep apnea due to nasal tumor**
Presented by: Dong Chang Lee

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Introduction: Obstructive sleep apnea syndrome(OSAS) is commonly seen in a pediatric otolaryngology practice. Adenotonsillar hypertrophy causes the majority of cases of OSAS in children.
Case report: A 15 year- old boy visited the Sleep Center with history of snoring for 5 years. The symtom was aggravated for last 3 months. He presented with an
Epworth sleepiness scale (ESS) of 5. He underwent a full-night laboratory nocturnal polysomnography (PSG). PSG study demonstrated an apnea-hypopnea index(AHI) of 24.9/hour, longest apnea duration of 76.1 seconds, lowest SaO2 of 74%, average SaO2 of 94%. In ENT department, there was a huge mass in the oropharynx seen pushing the uvula anteriorly. Anterior rhinoscopy and endonasal endoscopy showed a huge mass in left nasal cavity on physical examination. Endoscopic middle meatal antrostomy and mass excision was performed. The histopathology showed the antrochoanal polyp(ACP). Postoperatively the previous signs and symptoms of disrupted sleep resolved completely. After 1 year, the follow up PSG study demonstrated an AHI of 0/hour.
Discussion: The clinical presentation of ACP includes mostly symptoms with nasal obstruction, rhinorrhea, mouth breathing. As this case, the patient can have the chief complaint of snoring and sleep apnea. we suggest that physicians routinely need to work-up any findings in upper airway which could cause OSAS in patients presenting with sleep disorder.

114 - **Neurovascular reactivity in patients with obstructive sleep apnea**
Presented by: Gulnur Tekgol Uzuner

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Objectives: Obstructive sleep apnea syndrome (OSAS) has been implicated as an independent stroke risk factor. Endothelial dysfunction has been recognized in patients with the obstructive sleep apnea syndrome (OSAS). Cerebrovascular reactivity is somewhat related to endothelial function. There is data regarding lower cerebral vascular reactivity (CVR) using transcranial Doppler (TCD) in patients with OSAS. However, neurovascular dysfunction is not identified which is related to endothelial function as well. We investigated neurovascular reactivity using visual stimulation in patients with OSAS by means of transcranial Doppler (TCD).
Methods: Data were gathered 67 patients who have moderate to severe OSAS (an apnea-hypopnea index of >15/hour), and compared with those of 26 healthy subjects matched for age and vascular risk factors. Reactivity is described as a ratio of the difference between blood flow velocities measured during visual stimulation.
Results: Since there is no significant side difference, the Doppler data of the left and right sides were pooled both in patients and controls. Thus, 134 vessels (posterior cerebral artery) in patients and 52 vessels in controls were analyzed. OSAS patients showed similar reactivity to visual stimulation with respect to controls (28.4% vs. 28.8; $p< 0.05$).
Conclusion: These data demonstrate normal neurovascular reactivity in OSAS patients, suggesting that the weak or mild stimulation produces the normal reactivity in the OSAS patients.

582 - **Association between sleep apnea severity and blood hemorheology**
Presented by: Aleksi Chikadze

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Introduction: Sleep Apnea (SA) and obese are a pathological condition and be associated with hemorheological characteristics which could increase the cardiovascular risk. We investigated the night sleep structure and hemorheological characteristics in patients with obese and sleep apnea using PSG and blood tests.
Materials and methods: 55 male patients (mean age 48.0 year) with clinical manifestation of Dyssomnia, Obstructive Sleep Apnea/Hypopnea Syndrome (OSAHS), Habitual Snoring and Periodic Limb Movements (PLM) were in-vestigated. All of them underwent a Polysomnography by . Sleep questionnaires were completed and sleep parameters calculated in all cases. Body mass index (BMI) and the apnea/hypopnea index (AHI) were determined for categorization of obesity and sleep apnea status. Blood was sampled for hematocrit, blood viscosity, RBC deformability, and aggregation.
Results: In patients with hypopnea, accompanied by less snoring (group I), high percentage of sleep III stages and less of REM sleep, were found as, well as a long sleep latency period. In patients with hypopnea, accompanied by less mixed apnea and high snoring percentage (group II), were found a defragmentation of the sleep II and III stages and high percentage of REM sleep, compared with group I. In the group III (patients with hypopnea, accompanied by the highest percentage of snoring, central, obstructive and mixed apnea indexes), were revealed defragmentation of the sleep II stage and high percentage of REM sleep, compared with group II. In those patients, there were not found sleep III stage but high frequency of PLM were determined. We found that in patients with Sleep Apnea trustworthy changes of hemorheological data were in evidence in cases of OSAHS, than in other types SA.
Conclusions: Investigation of night sleep using polysomnography can help researchers to reveal variability of sleep architecture during the different clinical presentation of SA. We conclude, that HA represents a testing for prothrombotic states in SA patients.

133 - **Obstructive sleep apnea phenotypes: a cluster analysis**
Presented by: Marie Destors

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Rationale: Classification of obstructive sleep apnea (OSA) is on the basis of sleep studies criteria that may not adequately capture disease heterogeneity. Improved phenotyping may improve prognosis prediction and help therapeutic strategies.
Objectives: This study used cluster analysis to investigate clinical phenotypes of OSA.
Methods: An ascending hierarchical clustering analysis was performed on baseline symptoms, physical examination, risk factors exposure and co-morbidities from 18,263 participants in the OSFP (French national registry of sleep apnea). The probability for criteria to belong at one cluster was assessed using odds ratio, determined by a univariate logistic regression.
Measurements and main results: Six clusters were identified (ranging from 1,823 to 4,200 patients in each), in which patients varied considerably among measures of age, sex, symptoms, obesity, co-morbidities and environmental and risk factors exposures. The main significant differences between clusters were related to minimally symptomatic versus sleepy OSA, lean versus obese and among obese OSA different combination of co-morbidities and environmental and risk factors.
Conclusion: Our cluster analysis identified 6 distinct phenotypes of OSA. Our findings underscore the high degree of heterogeneity that exists within OSA patients regarding clinical presentation, risk factors and consequences. This may help research and clinical practice for validating new prevention programs, diagnosis pathways and therapeutic strategies.

547 - **Prevalence of type 2 diabetes mellitus and associated risk factors among obstructive sleep apnoea patients**
Presented by: Muhammad A. Ibrahim

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Introduction: There is a high prevalence of type 2 diabetes mellitus (T2DM) among obstructive sleep apnoea (OSA) patients, however the definite association between T2DM and other cardiovascular (CV) risk factors among OSA patients are not established. This study aims to determine the prevalence of T2DM and associated risk factors among OSA patients.
Methodology: A cross-sectional study from an OSA database in UiTM multidisciplinary sleep clinic between 1st January 2010 and 31st December 2014. Demographic and anthropometric indices, polysomnographic studies, cardiovascular risks-type2 diabetes mellitus, hypertension and dyslipidaemia, blood pressure readings and metabolic profiles (fasting plasma glucose, glycated haemoglobin, triglycerides and high-density-lipoprotein levels) were reviewed.
Results: A total of 183 OSA patients were included in this study. The prevalence of T2DM is 49%, obesity is 91%, hypertension is 78% and dyslipidaemia is 67%. OSA patients with T2DM were associated with older age (54.5 vs. 47.2 years old, p 0.001), higher body mass index (38.2 vs. 35.8 kg/m^2, p 0.041) and higher systolic blood pressure (140 vs. 132 mmHg, p 0.01) in comparison to OSA patients without T2DM. In multivariate analysis, OSA patients with T2DM were associated with older age OR 1.04 (1.01- 1.07), higher BMI OR 1.005 (1.001-1.099), hypertension OR 4.2 (1.3-13.9) and dyslipidaemia OR 4.9 (2.1-11.4).
Conclusion: The prevalence of T2DM among OSA patients was 49%. We conclude that T2DM among OSA patients were associated with older age, a higher body mass index, hypertension and dyslipidaemia.

43 - **Quality of life in obstructive sleep apnea: a role for oxygen desaturation indices?**
Presented by: Wenjie Huang

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Objectives: We aim to determine the impact of obstructive sleep apnea (OSA) on quality of life (QOL) and evaluate the utility of polysomnographic (PSG) parameters, such as sleep architecture, apnea-hypopnea index (AHI) and oxygen desaturation in reflecting QOL.
Methods: Eighty-eight patients who underwent PSG between December 2010 and November 2012 consecutively were recruited and completed the 36-Item Short-Form Health Survey (SF-36) and Epworth Sleepiness Scale (ESS) questionnaires. All patients completed both questionnaires within 60

days before PSG. Based on the AHI, patients were classified as primary snorers (AHI< 5), suffering from mild (5-< 15), moderate (15-< 30) or severe OSA (≥30).
Results: Seventy-nine male and 9 female patients with a mean age of 41 years were recruited. OSA patients scored significantly lower on 7 domains of SF-36 compared to the general population (P< 0.05). The disease impaired physical more than emotional health, with the decrease in Physical Function (PF) being similar to that in patients with anxiety disorders. As OSA severity increased, only PF (P=0.011) and Physical Component Summary (PCS, P=0.036), but not ESS scores significantly worsened.
PSG parameters correlated poorly with all QOL measures except PF, PCS and ESS. After adjusting for age, sex and BMI, multiple linear regression revealed that only the oxygen desaturation parameters, but not sleep architecture indices or AHI were significant predictors of PF (P< 0.05), and to a lesser extent PCS and ESS (P< 0.1). For every fall in the lowest oxygen saturation by 1%, there was a decrease in SF-36 PF score by 0.59 points, and an increase in ESS score by 0.13 points.
Conclusions: OSA patients have a poor QOL compared to the population. Generic questionnaires such as the SF-36 may be useful in assessing QOL in OSA patients. Although excessive daytime sleepiness is the most common symptom of OSA, the disease also produces other neurocognitive effects that may limit physical function.
Finally, while AHI is known to prognosticate long-term cardiovascular risk, oxygen desaturation indices may be more useful in the assessment of day-to-day QOL.

212 - **Prevalence of sleep disordered breathing in orthodontic patients: an Australian experience**
Presented by: Dimitrios Jim Papadopoulos

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Introduction: The aetiology of sleep disordered breathing (SDB) is multifactorial. Even in children with adenotonsillar hypertrophy, other factors particularly orthodontic issues often co-exist (e.g. dolichofacial morphology, high mandibular plane angle, narrow palate and significant crowding of the maxilla/mandible).
Objective: To determine the prevalence of SDB in orthodontic patients.
Methods: Patients attending the Orthodontic Department of the Sydney Dental Hospital who had known orthodontic issues requiring treatment were surveyed using a validated questionnaire (Sleep Disturbances Scale for children [SDSC][1]. This is part of a larger study.
Results: One hundred and ten consecutive patients have thus far been recruited (53 male) with an average age of 12.8 (+/-1.6SD) years. Thirty (27.3%) were found to have a high probability of SDB with a SDSC score of (≥ 7/15 for questions 13, 14 & 15) which has previously been validated to correlate with a high incidence of SDB.
Conclusions: The childhood prevalence of obstructive sleep apnoea is around 2-4%[2], with habitual snoring up to 15%[3]. However, this study demonstrates prevalence rates nearly double in an orthodontic population. If the final results confirm this high prevalence then greater awareness of this vulnerable population is needed to reduce neurocognitive and cardiovascular morbidity. Further research to subcategorize the specific orthodontic complaints, to perform polysomnography and to evaluate whether SDB is ameliorated following orthodontic treatment is ongoing.
References:
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n=110	Severe		Very Severe		**Severe & Above**	
	No.	%	No.	%	No.	%

Sleep Breathing Disorder	15	13.6	15	13.6	**30**	**27.3**

[Table 1]

587 - **Oral appliances for the treatment of sleep apnoea - guidelines and collaboration sleep physician - dentist**
Presented by: Susanne Schwarting

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Objectives: 30 % of patients with obstructive sleep apnoea OSA do not tolerate continuous positive airway pressure CPAP. As OSA is an epidemic modern OSA monitoring systems detect more and more sleep apnoea patients with mild to moderate OSA with less clinical symptoms and without comorbidities, but the treatment armentarium has not kept pace with this development.
Methods and materials: Custom made mandibular advancement splints for the treatment of OSA are worn during sleep to maintain the patency of the upper airway by increasing its dimensions and reducing its collapsibility.
Results: Over the last decade robust randomized controlled trials have demonstrated the efficacy of OAs in the treatment of OSA. International sleep medicine guidelines recommend OAs for the treatment of mild to moderate OSA and for severe OSA in patients with CPAP intolerance with the highest level of evidence. Important is the close collaboration between the sleep physician and the dental sleep professional, which has to follow defined pathways.
Conclusion: OAs for the treatment of OSA: a therapy whose time has come. International guidelines support OA therapy of OSA and the necessary close collaboration of sleep physicians with the dental sleep professionals. The demand of sleep physicians and patients for qualified dental sleep professionals in this rapidly evolving science of dental sleep medicine will increase in the future.

452 - **Effect of continuous positive airway pressure on endothelial nitric oxide production in obstructive sleep apnea**
Presented by: Elena Shaf

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Aim: To investigate the effect of continuous positive airway pressure (CPAP) on endothelial nitric oxide (NO) production in patients with obstructive sleep apnea (OSA).
Materials and methods: 38 male OSA patients aged 39 to 61 years old were studied. The patients were divided into two groups: the treatment group (20 patients) who received CPAP, and the control group (18 patients) who did not receive the CPAP treatment because of bad compliance. There was no statistically significant difference in age, apnea-hypopnea index (AHI), arterial blood oxygen saturation (mean SaO2), body mass index (BMI) between the two groups. When included in the study, all the patients had stage 2 hypertension and received constant antihypertensive therapy within the previous 6 months. CPAP therapy with *Weinmann SOMNObalance E* and *Fisher & Paykel Icon+ Auto* devices was performed nightly for 6 weeks. Laboratory testing included measurement of daily urinary nitric oxide metabolites - nitrite (NO_2^-) at baseline and after 6 weeks of CPAP therapy.
Results: Measurement of daily urinary NO metabolites excretion in the two groups of OSA patients showed comparability between baseline values of the patients who received CPAP therapy and those who received no hardware treatment.

Variables	CPAP group, n=20	Control group, n=18	p
Age, years old	50.1 ± 6.9	52.4 ± 7.2	>0.05
AHI	42.5± 19.3	44.3± 18.7	>0.05
Mean SaO2, %	89.8± 5.6	90.4± 4.4	>0.05

BMI, kg/m2	35.2± 4.7	36.6± 5.6	>0.05
Daily urinary NO2− excretion, µmol (baseline)	113.3 ± 38.4	123.6 ± 31.2	>0.05
Daily urinary NO2− excretion, µmol (after 6 weeks)	162.4± 36.7	133.7± 28.4	<0.04

[Table 1.]

The baseline NO_2^- value was 113.3 ± 38.4 µmol in the treatment group and 123.6 ± 31.2 µmol in the control group (p>0.05). The use of CPAP therapy in the treatment group resulted in a statistically significant increase in the NO_2^- level after 6 weeks of treatment (from 113.3 ± 38.4 to 162.4 ± 36.7 µmol (p< 0.03). A number of patients refused to receive CPAP therapy because of bad compliance during the test session; those patients made up the control group (n=18). The measurement of the NO_2^- level in the control group after 6 weeks showed no statistically significant change (baseline value: 123.6 ± 31.2 µmol, after 6 weeks - 133.7 ± 28.4). Thus, after 6 weeks of CPAP therapy the patients of the treatment group had a statistically significant higher level of daily urinary NO metabolites excretion (162.4 ± 36.7 µmol) compared to the control group (133.7± 28.4 µmol), p< 0.05.
Conclusion: after 6 weeks of CPAP therapy, the daily urinary NO metabolites excretion in OSA patients increased by 43% over baseline values (statistically significant). CPAP therapy improves endothelial dysfunction and can become an important means of cardiovascular disease prevention.

499 - **Efficacy of single-stage multilevel upper airway surgery in patients with severe OSA**
Presented by: Asli Bostanci

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Objective: To investigate the efficacy of single-stage multilevel upper airway surgery in patients with severe obstructive sleep apnea (OSA).
Methods and materials: This prospective case-series with planned data collection enrolled a total of 50 patients with severe OSA, who underwent modified tongue base suspension (mTBS) plus modified uvulopharyngopalatoplasty (mUPPP) with or without septoplasty due to oropharyngeal and/or hypopharyngeal obstruction.
Polysomnography was performed to all subjects preoperatively and at the sixth month of postoperative period. The surgery was considered to be successful when a ≥50 % reduction in the mean apnea-hypopnea index (AHI) to a final AHI of< 20/h was obtained.
Results: The median age was 47.5 years, and 90% of the patients were male. Thirty (60%) patients had mUPPP combined with mTBS and septoplasty, whereas 20 (40%) had mUPPP combined with only mTBS. Postoperatively, mean AHI (52.4±17.8 vs. 20.9±17.4), supine AHI (65.5±18.7 vs. 32.5±22.9), REM AHI (44.3±23.6 vs. 19.3±16.0), and NREM AHI (53.4±19.4 vs.24.1±18.0) were decreased, and all oxymetric values and sleep efficiency were improved significantly ($P < 0.001$ for all parameters). In total, 37 patients (74.0%) met the surgical success criteria. There were no statistically significant differences between patients with and without septoplasty in terms of surgical outcome.
Conclusion: Single-stage multilevel upper airway surgery including mTBS plus mUPPP with or without septoplasty is a highly effective and feasible procedure in well-selected patients with OSA.

302 - **Effect of CPAP treatment on endothelial function, inflammatory markers, blood pressure and glucose control in patients with OSAS with emphasis on gender differences**
Presented by: Anastasios Kallianos

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Introduction: There is growing research evidence suggesting the presence of endothelial dysfunction and systemic inflammation in patients with obstructive sleep apnea syndrome (OSAS). Continuous positive airway pressure (CPAP) is the most effective method for treating OSAS; nonetheless the effects of CPAP on the aforementioned pathophysiologicpathways, as well as on the systemic disease that result or coexist with the OSAS remain elusive.
Aim: To assess the effect of 3 months CPAP therapy on endothelial-dependent dilation, plasma levels of inflammatory markers, blood pressure and glucose control in male and female patients with OSAS.
Methods: Our study group consisted of 40 (24 male and 16 female) patients with no prior history of cardiovascular disease, with an Apnea-HypopneaIndex (AHI) ≥15 who were assigned to receive CPAP treatment. Measurement of Flow Mediated Dilation (FMD), 24-hour ambulatory blood pressure (BP) and blood analysis were performed at baseline and 3 months after CPAP therapy.
Results: Baseline FMD values were negatively correlated the AHI (r=-0.55, p=0.001). After 3 months of CPAP there was an increase in the FMD values (5.40±2.91 vs. 3.13±3.15 %, p< 0.05) and a significant reduction in the patients' 24hr systolic BP (130.24±16.75 vs. 122.82±11.88, p< 0.05), diastolic BP (75.44±9.14 vs. 79.68±11.09, p< 0.05) and Pulse Pressure (PP) (47.38±9.77 vs. 52.72±11.38, p< 0.05), daytime systolic BP (125.76±12.69 vs. 132.55±17.00, p< 0.05) and diastolic BP (77.88±10.39 vs. 82.25±11.01, p< 0.05), nighttime systolic BP (118.17±13.16 vs. 126.22±17.42, p< 0.05) and PP (46.61±10.76 vs. 52.66±11.86, p< 0.05) and in the C-reactive protein (CRP) and HbA1c levels (0.40[0.40-0.70] vs. 0.60[0.40-0.84] mg/L and 5.45±0.70 vs. 5.95±1.08 %, respectively; p< 0,05). When divided by gender, only male patients produced similar statistically significant results, while female failed to show such associations.
Conclusion: Our results suggest that CPAP therapy improves the endothelial function, the blood pressure and glucose control in male patients with OSAS. Further research is warranted in order to verify these results and to further elucidate the impact of CPAP on the cardiovascular risk of male and female patients with OSAS.

319 - **Long term effects of compliance with positive airway pressure (PAP) therapy in patients with obesity hypoventilation syndrome (OHS)**
Presented by: Sophia E. Schiza

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Objectives: To assess the role of different levels of compliance and long-term effects of positive airway pressure (PAP) therapy on gas exchange, sleepiness, quality of life, depression and death rate in patients with obesity hypoventilation syndrome (OHS).
Methods and materials: Two hundred eleven patients with newly diagnosed OHS, who have been recommended PAP therapy, were followed up for a minimum of 2 years. The hours/day and percentage of days PAP was used were monitored. Subjective daytime sleepiness, reflected by Epworth sleepiness scale (ESS), quality of life (Short Form 36-SF-36) and patient's level of depression (Beck Depression Inventory-BDI) were recorded together with the death rate before and at the end of the follow up period.
Results: At the end of the follow-up period (mean duration, 50 months), PaO_2 had increased from baseline (p< 0.0001) and $PaCO_2$ had decreased (p< 0.0001). PAP therapy also significantly improved ESS (p< 0.0001), BDI (p< 0.0001) and SF-36 (p< 0.0001) scores. During follow-up, twelve died (two of them due to the progression of respiratory failure). Patients who used PAP therapy for > 6 hours/day had a considerably greater improvement in blood gases and questionnaires scores than less adherent patients.
Conclusions: Increased hours of use and long-term therapy with PAP are effective in the treatment of patients with OHS. Clinicians should encourage adherence to PAP therapy in order to provide a significant improvement in clinical status and gas exchange in these patients.

663 - **Positional sleep apnea: the difficulty of adherence to therapy**
Presented by: Maria J. Matos

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Background: Obstructive sleep apnea (OSA) is a common disease with significant morbidity. The influence of body position is well recognize, with an increase in sleep disordered breathing severity in the supine posture. In 1984, Cartwright defined the positional obstructive sleep apnea (POSA) with the objective of identifying patients that do not require ventilatory support and could be treated with positional therapy (PT).
Objectives: To determine the effectiveness of the usual conservative measures and of PT and to verify the compliance to this therapy.
Methods: A total of 93 POSA patients were identified after a cardiorespiratory sleep study, in which the supine apnea índex (AHI) was at least twice that of sleep in a non-supine position. Sleep related parameters, characteristics of subjects and Epworth Sleepiness Scale (ESS) were evaluated. A follow-up night study was performed after six months, in average, of positional therapy with the tennis ball technique.
Results: Only 46 patients repeated the study with the positional device: 36 men (78.3%), average age of 54,8 years, IBM of 29,3 Kg/ m^2 and a decrease of ESS from 11 to 7.9. Compared to the baseline, diagnostic, night, mean total AHI decreased from 14.9/h to 9.3/h and mean supine AHI from 34.2/h to 24.3/h. Time spent supine fell from 40% to 17,1%, desaturation index from 14,8/h to 8,8/h and minimum SpO2 increased from 82,2% to 85,6% (all these results with statistical significance).Of these 46 patients only 26 (56.5%) correctly complied with the measures recommended with good clinical results; 11 patients required treatment with APAP and 1 ORL surgery.
Conclusions: The PT and other measures are effective when enforced. There is a high level of therapeutic failure, as expected and reported in the literature, highlighting the fact that 50% of the patients did not attend the follow-up visit or control study. Compliance for TP remains an issue, even with the development of new devices.

315 - **The role of compliance with PAP use on blood pressure in patients with obstructive sleep apnea: is longer use a key-factor?**
Presented by: Sophia E. Schiza

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Objectives: Scientific data about the effects of positive airway pressure (PAP) treatment on blood pressure (BP) control are continuously increasing; however they are controversial. We aimed to determine the long term effects of compliance with PAP therapy on BP in both hypertensive and normotensive patients with OSAHS.
Method and materials: One thousand one hundred sixty eight consecutive patients with newly diagnosed OSAHS, who have been recommended PAP therapy, were followed up for a minimum of 2 years. Patients with previous cardiovascular disease were excluded. BP was measured at baseline and after 2 years of PAP treatment. In addition, the correlation between the changes in BP with different levels of PAP compliance was assessed.
Results: At the end of the follow-up period, in the hypertensive group of patients (n=586), a significant decrease was shown in systolic (-11.2 mm Hg, $p< 0.001$) and diastolic BP (-4.2 mm Hg, $p < 0.001$). Furthermore, in the patients without hypertension (n=528), a significant decrease was noted both in systolic and diastolic BP (-3.6, $p< 0.001$ and -2.4, $p< 0.001$, respectively). A correlation between the magnitude of change in systolic and diastolic BP and hours of use of PAP (r=0.14, p=0.002 and r=0.1, p=0.025, respectively) was observed in the whole group of patients.
Conclusions: Long-term use of PAP treatment as well as increased hours of PAP use showed significant reductions in BP not only in patients with OSAHS and hypertension, but also in normotensive patients. Therefore a significant potential reduction in cardiovascular mortality and morbidity should be expected in these patients.

604 - **4 year follow-up of treatment with dental appliance in patients with obstructive sleep apnea**
Presented by: Pedro Mayoral Sanz

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Study objectives: To evaluate the effects of treatment with a dental appliance on somnographic variables in patients with mild-to-moderate obstructive sleep apnea (OSA) followed up for 4 years, and compliance and complementary treatment.
Setting: Instituto del Sueño, Madrid, Spain.
Patients: Two hundred twenty-five male patients with confirmed mild-to-moderate OSA (apnea index [AI] > 5 and < 25) were send to treatment with a dental appliance. Sleep studies were performed before and 1 year and 4 years after intervention. One hundred seventy five patients (78%) completed the 4-year follow-up.
Results: The success rate (percentage of patients with at least 50% reduction in AI) was 81% (182 patients). Normalization (AI < 5 or apnea/hypopnea index < 10) was observed in 69% (155 patients) after 4 years. The compliance to use of the dental appliance was 72% (162 patients) at the 4-year follow-up. The dental appliances had few adverse effects on the stomatognathic system, and the number of adjustments and repairs of the appliances over time was low.
Conclusions: The dental-appliance showed high success and normalization rates regarding the somnographic variables, and the effectiveness of the dental appliance was validated by the compliance of 72% at the 4-year follow-up. The appliances had few adverse effects on the stomatognathic system and required only moderate adjustments. Use of a dental appliance with regular follow-up can be recommended for long-term treatment of OSA.

241 - **Therapy of OSA by oral appliance SomnoDent® and by Continuous Positive Airway Pressure - results of a comparative study**
Presented by: Thomas Penzel

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Objectives: Continuous Positive Airway Pressure (CPAP) is the most effective treatment of Obstructive Sleep Apnea (OSA) but limited tolerance to this therapy is known for a number of patients. Therefore other treatment modalities like oral appliances (OA) could be an alternative for this group of patients. We compared the effect of OSA treatment by the OA SomnoDent® and by CPAP on sleep, respiration, and cardiovascular function.
Methods and materials: Forty-eight moderate to severe OSA patients were included in the study. Patients underwent treatment with SomnoDent® and with CPAP for 12 weeks each in a randomized crossover trial. At baseline and after each treatment period patients were assessed by polysomnography as well as with a daytime cardiac autonomic function test measuring continuous noninvasive blood pressure (BP), heart rate variability (HRV), and Baroreceptor Sensitivity (BRS) under conditions of controlled breathing.
Results: Forty patients successfully finished the study. With both, SomnoDent® and with CPAP values of AI, HI, and AHI were found to be significantly reduced, although the reduction was more pronounced with CPAP. The daytime cardiac autonomic function test revealed reductions of BP with both therapy modes. At the same time selective increases due to therapy with MAD were found for HRV values indicating enhanced autonomic vagal activity. No changes were observed for BRS in both therapy modes.
Conclusions: Both, 12 weeks of therapy with SomnoDent® and with CPAP eliminated breathing cessations but with more extend on CPAP. At the same time similar valuable changes in cardiac autonomic function were found during daytime, mainly in blood pressure.

438 - **Sleep-like behaviour in a sentitive plant (Mimosa Pudica)**
Presented by: Ugo Faraguna

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Background: Sleep is behaviorally acknowledged as a vigilance state characterized by
a) a species-specific posture
b) behavioral quiescence
c) an elevated arousal threshold

d) state reversibility with stimulation (Campbell and Tobler, 1984).
Although this definition has been confined to animals, all features of sleep could be applied to other organisms lacking a nervous system but still capable of movements, and responsive to external stimuli. In this perspective, we investigated whether Mimosa Pudica, also called Sensitive Plant, does fulfill the criteria for sleep. The behavior of M.Pudica is characterized by nastic movements in response to light, thermic and mechanical stimuli. Therefore, it seems a valid candidate to formally test the presence of a sleep-like behavior.
Methods and materials: 23 adult plants (1 year old) were kept indoor in constant temperature and humidity conditions, under a 12h light/12h dark cycle (lights on at 8 a.m.). We constantly recorded the spontaneous movements of M. Pudica (n=10) under continuous video-monitoring. Spontaneous movements were quantified by
i) a local manual index of single petiole tracking and
ii) a global automatic movement index.
In another set of experiments, the response threshold to mechanical stimuli was tested via controlled air-puffs. For each plant (n=14) we set 3 different pressure levels (low, medium and high) and visually scored the extent of the induced movement.
Results: There was a significant difference between spontaneous movements during the light (16.181±1.459 a.u.) and the dark phase (13.029±0.741 a.u, p=0.004, Mann-Whitney), when the plant took a typical posture (upright state) raising its petioles to the greatest extent. During this phase the spontaneous movements were at their lowest value.
In parallel, the plant motor response to air puffs slowly decreased during the day. From 8 a.m. to 2 p.m. M.Pudica showed its peak responsiveness (1.876±0,187 SE), while at night (12 a.m.-8 a.m.) its lowest (0,421±0,104 SE), revealing a significant difference in responsiveness between the night and every other period ($p < 0.05$, Kruskal-Wallis). Moreover, in a subset of experiments (n=7) we observed an increased response threshold at night (12a.m.-4 a.m.) as compared to the morning (8 a.m.-2 p.m.; 1,5±0,4 versus 1,1±0,14 a.u., p=0.045, paired t-test).
Conclusion: In M. Pudica two of the criteria necessary to define sleep as a behavioral state are satisfied.

197 - **Prazosin blunts sleep-related changes of arterial blood pressure in mice**
Presented by: Alessandro Silvani

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Objectives: in mice and human subjects, arterial blood pressure (BP) physiologically decreases from wakefulness to non-rapid-eye-movement (NREM) sleep and rises again during rapid-eye-movement (REM) sleep. The mechanisms that drive these sleep-related changes of BP are unclear. The sympathetic control of vascular resistance is mainly exerted through arteriolar alpha-1 adrenergic receptors. We investigated whether sleep-related changes of BP depend on the sympathetic control of vascular resistance through alpha-1 adrenergic receptors in mice.
Methods and materials: 5 adult male mice of widely studied strains (2 C57BL/6J and 3 FVB/NJ) were implanted with electrodes for sleep scoring, a telemetric transducer (TA11PAC10, DSI) to measure aortic BP, and a peritoneal catheter. Recordings were performed for 6-8 hours during the light period on mice undisturbed and freely behaving in their own cages during continuous infusion of saline (vehicle) or, 2 days later, of the vascular alpha-1 adrenergic receptor blocker prazosin through the peritoneal catheter.
Results: compared to saline, prazosin significantly lowered BP during wakefulness and, to a lower extent, also during REM sleep, but not during NREM sleep. Accordingly, the drop in BP between wakefulness and either NREM sleep or REM sleep was significantly smaller during prazosin infusion than during saline infusion.
Conclusions: infusion of prazosin, which blocks vascular alpha-1 adrenergic receptors, blunts sleep-related changes of BP in mice, suggesting that these changes critically depend on the sympathetic control of vascular resistance through alpha-1 adrenergic receptors.
Funding: University of Bologna.

95 - **Behavioral and wireless electrophysiological characterization of sleep in a lizard, the Argentine Tegu (*Tupinambis merianae*)**
Presented by: Paul-Antoine Libourel

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Based on behavioral and electrophysiological characteristics, two distinct sleep states: NREM and REM sleep (or active and quiet sleep) have been identified in terrestrial mammals and birds, both homeotherms. However, whether reptiles display those states remains unresolved.
In order to precisely implant electrodes in specific brains regions, we first constructed a stereotaxic atlas for the argentine Tegu (*Tupinambis merianae)*, based on MRI, micro CT Scanning, and immunohistochemistry. Next, wireless electrophysiological recordings were performed simultaneously with behavioral recordings obtained through four infrared cameras. We recorded EMG, EEG, ECG, EOG, brain and body temperature, and LFP with bundles of 35 µm diameter tungsten electrodes in the medial cortex (hippocampus homologue), the dorsal cortex, the dorso ventricular ridge, and the nucleus sphericus. 9 h of gentle handling deprivation were also performed. The arousal threshold, or the delay to induce an arousal, was evaluated by activating a vibrator fixed on the head of the animal during 5 s every hour during 3 days.
The first lizard recorded displayed the behavioral characteristics of sleep during the entire night (12h/12h), including a stereotypical posture and a rebound of behavioral sleep after the deprivation compared to the baseline. The arousal threshold was significantly higher during the sleep period compared to the diurnal rest. This behavioral state was associated with frequent eye movements (EM), whereas rare phasic EM and slight twitches of the toes where observed during the sleep period. Although the EEG of the lizard did not allow a differentiation between waking and sleeping behavior, the LFP recordings revealed a polymorphic signal in amplitude and frequency. A preliminary spectral analysis show differences depending on the area recorded during the two states. In particular, phasic oscillations in the 9-16 Hz spectral band appeared specifically during sleep. The rebound of sleep that follows the total deprivation was associated with an increase of the low frequency (0-4 Hz) and of the 9-16 Hz bands.
Our preliminary results suggest that this lizard displays the behavioral characteristics of sleep. Some behavioral and electrophysiological phasic phenomena were observed during sleep, suggesting that this lizard has a non-homogenous sleep, raising the possibility that active sleep and a quiet sleep could be both present in reptiles.

507 - **D-amino acid oxidase (DAAO, DAO) knockout mice show increased EEG gamma oscillations associated with cognitive function**
Presented by: Sibah Hasan

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Objectives: D-serine (the primary endogenous co-agonist of the synaptic NMDA receptor) concentrations in serum and cerebrospinal fluid have been reported to be decreased in schizophrenia patients, while human D-amino acid oxidase (DAO) activity and expression are increased. Therefore, DAO inhibitors have been recently developed as a novel class of drugs for schizophrenia therapy. Moreover, we have lately described enhanced cognitive performance in the DAO knockout ($DAO^{-/-}$) mouse, which is promising for the treatment of cognitive symptoms by DAO inhibitors. However, our $DAO^{-/-}$ mice also show heightened anxiety.
Untreated schizophrenia patients show reduced EEG gamma oscillations during impaired cognitive functions but not necessarily at rest or during low cognitively demanding conditions.
Here, we investigated how the lack of DAO would modulate cortical EEG oscillations: first under baseline sleep-wake cycle followed by gentle sleep deprivation, second during medium to high cognitive demands, and third under anxiety-like behaviours.
Methods and materials: WT and $DAO^{-/-}$ mice (n=3 per genotype) were implanted with DSI-telemetry EEG transmitters on 12L:12D. After a period of recovery, recordings commenced for a baseline 24h, after which mice were sleep deprived (SD) during the first 6h of the light period followed by 18h of sleep recovery. Two to 3 weeks later, mice were subjected to an open field test and after 5 days, mice were tested with the light/dark box. Five days later, mice underwent a series of spontaneous recognition memory tasks with a delay phase of 6 min. EEG data were scored visually per 4s. EEGs were subjected to power spectra analysis.
Results: The lack of DAO did not affect greatly EEG oscillations during the normal sleep-wake cycle. During the light phase, waking EEG theta activity (6.5-7.5 Hz) was slightly increased (1.5 fold) in the

$DAO^{-/-}$. $DAO^{-/-}$ showed an increase (up to 1.8 fold) of gamma activity (35 - 50 Hz) during the delay phase of the short-term memory tasks, accompanied by higher theta activity. However, $DAO^{-/-}$ showed less (down by 50%) theta activity (8-9 Hz) under anxiety paradigms.
Conclusions: Our preliminary findings suggest that the deletion of DAO increases the EEG gamma oscillations during cognitively demanding conditions, where memory encoding is necessary. This mouse model would allow a better understanding for the role of gamma in cognitive function (and its modulation by DAO inhibitors) in the context of schizophrenia.

658 - **Cortical evoked responses to cardiac activity in the sleep-wake cycle in cats**
Presented by: Victoria Lavrova

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Objectives: The objectives of this study were checking if the heart activity is reflected in the cerebral cortex during sleep or not, as well as trying to localize those cortical areas, which are involved in the processing of this information.
Methods: According to the visceral sleep theory (Pigarev, 2013), the brain cortical areas which are involved in the exteroceptive information analysis in wake, switch to the analysis of interoceptive information coming from the visceral organs. Earlier this theory was supported by the studies of the cortical responses to the stimulation of the gastrointestinal system. The aim of this work was to find manifestations of cardiac activity in the sensory areas of the cerebral cortex in the sleep-wake cycle. EEG and local field potentials were recorded in two adult cats, using monopolar and bipolar leads from the frontal and occipital cortex regions. Electrode placement was selected according to the pre-existing information about the possible localization of the cortical areas related to the heart activity. ECG was recorded from the electrodes in stomach and on head of the cats. Additionally, the breath rhythm and the eye movements were recorded in order to define the sleep states. For the analysis, long (four to six hours) records were used, including periods of wake, NREM and REM sleep. The processing and statistical analysis were made with Spike2 program.
Results: As a result of analysis, three types of responses were found:
1st type, electrical artifact (passive spread of current from heart to EEG),
2nd type, slow wave response (caused by blood pulsation),
3rd type, cortical neural evoked response, that correlated with R-spike of EEG and was our aim to be found (latency 40-120 ms).
If the full-record averaging developed us a response, which may represent neural activity of the cerebral cortex, the averaging of ECG and EEG was made separately in areas of sleep and wakefulness. The comparison developed that the 3rd type responses take place in sleep and don't appear in wakefullness.
Also, the location of the brain regions involved in the cardiac analysis was narrowed.
Conclusion: The cardiac activity is reflected in the activity of neurons in the cerebral cortex indeed. The relationship between heart and cortical areas is active during sleep and is not found in wakefullness. This phenomena is found in the frontal brain region and is virtually absent in the occipital one.

196 - **Peripubertal diet-induced obesity programs sleep disturbances by affecting serotonergic signaling in the brain**
Presented by: Mayumi Kimura

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Objectives: Overconsumption of palatable foods causes obesity, which increases in the adolescent population. Recent work shows that early-life obesity may amplify health risks in later life. Many medical conditions are associated with the combination of obesity and sleep disorders. However, the causal link between obesity and sleep disturbances is still not well understood; it may involve altered setpoints in the homoeostatic control of both feeding and sleep-wake behaviors and hedonic mechanisms that modulate eating behavior. This hypothesis was here examined in the context of obesity during peripubertal development.
Methods: Our mouse model of peripubertal diet-induced obesity (ppDIO) was generated by feeding

male C57BL/6N mice a high-fat diet (HFD) between postnatal weeks 4 and 10. Termination of HFD exposure was followed by a standard diet (SD). EEG/EMG recordings were performed at different ages (10, 24 and 52 weeks). In addition, neurotransmitter and neuropeptide levels in areas related to reward, feeding and sleep-wake regulation were evaluated. Mice that were maintained on SD served as controls.
Results: Peripubertal HFD exposure produced a hypo-dopaminergic and hypo-serotonergic state in ppDIO mice as compared to controls. These changes were accompanied by sleep fragmentation during the resting phase and increased sleep time during the active period. Termination of HFD and re-exposure to SD resulted in bodyweight loss and a dramatic reduction in sleep time during the active phase below those observed in control mice. Concomitant with HFD withdrawal, dopamine levels in reward-related areas were reduced, while serotonin levels in the lateral hypothalamus were increased; the latter area was previously suggested as the link between sleep-wake and feeding behaviors. By contrast, aged ppDIO mice (52 weeks) showed increased nocturnal sleep time in parallel with a hypo-serotonergic tone in the lateral hypothalamus. Interestingly, i.p. injection of $PYY_{3-36,}$ a peripheral satiety hormone, rescued sleep disturbances observed in both young and aged mice.
Conclusions: ppDIO exerted long-term effects on sleep-wake and feeding behaviors. Our results suggest that reduced serotonergic tone may link sleep disturbances with obesity. HFD withdrawal induces weight loss and increased serotonergic tone, which may enhance wakefulness. Finally, PYY_{3-36} has the potential to ameliorate sleep disturbances triggered by ppDIO.
Supported by the EU grant FP7 SWITCHBOX Project

312 - **Serial activations of lateral and perifornical hypothalamic orexin-containing neuronal region lead to elevation of CSF OrexinA content, shorten anesthesia time and fasten recovery of normal sleep cycles from barbiturate anesthesia induced sleep**
Presented by: Neli Maglakelidze

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Objectives: Study was aimed to the assessment of hypothalamic Orexinergic system as the neuronal substrate for speed up regulation of disturbed sleep homeostasis and recovery of sleep-wakefulness cycle behavioral states from barbiturate anesthesia induced sleep. Pre-clinical evidences in relation to this question are very sparse and therefore their investigation is highly topical.
Methods and materials: In white wild rats (n=12) after surgical implantation of recording electrodes and postoperative recovery deep anesthesia was induced by chloralhidrate and/or sodium ethaminal. EEG registration was started immediately and lasted continuously for 48 hours. 10 min after administration of anesthetic drugs serial electrical stimulations (8-12v, 200c/sec, 0.1 msec) of Dorsal, lateral, posterior and perifornical hypothalamic Orexin-containing neurons were started. Stimulations lasted for 1 hour with the 5 min intervals between subsequent ones applied by turn to the left and right side hypothalamic parts. CSF OrexinA concentration was measured by ELISA method. Statistical processing was made by Students' t-test.
Results: Spontaneous recovery of the first fragments of EEG wakefulness from deep anesthesia-induced sleep required 5.0-5.5 hour depending from the depth of narcosis. Serial electrical stimulations of dorsal, lateral, posterior and perifornical hypothalamic Orexin-containing neurons significantly speed up wakefulness recovery from both type of narcotic sleep with the first fragments of wakefulness appearing 3.5-4 hour after deep anesthesia. The first fragments of wakefulness were soon (20-30 min) followed by normal deep slow wave sleep episodes. Especially strong influence of serial electrical stimulations of hypothalamic Orexin neuron containing parts was manifested in the recovery of REM sleep. Spontaneous recovery of this behavioral state took 23-24 hour after deep anesthesia but under the impact of electrical stimulations of above mentioned hypothalamic parts REM latency became more than two times shorter. Significant elevation was noted in CSF OrexinA concentration in stimulated animals.
Conclusion: Serial electrical stimulations of hypothalamic Orexin-containing neuronal regions significantly elevate CSF OrexinA concentration and speed up recovery of normal sleep-wakefulness cycle behavioral states from deep anesthesia-induced sleep.
Acknowledgements: Supported by Shota Rustaveli National Science Foundation, Grant #11/04

310 - **Development of animal model of depression by new approach intended to induce early postnatal malfunctioning of brain muscarinic cholinergic system leading to its lasting adult**

super-sensitivity
Presented by: Nargizi Nachkebia

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Objectives: Animal model of depression was developed by new methodical approach intended to induce the malfunctioning of muscarinic cholinergic system (MChS) in rat pups during early postnatal period and lasting super-sensitivity of MChS in adult age. Character of Sleep disturbances and the rate of M2/M4 muscarinic cholinoreceptors in neocortex and hippocampus were studied in adult age.
Methods and materials: Rat pups received subcutaneously Atropine (Atr, n=10) and/or Scopolamine (Scop, n=10) 15 mg/kg two times daily during two weeks as follows: Atr injection at postnatal day 7 (P7) until P21; Scop injection at P7 until P21. Afterwards rat pups were maintained in home cages under special care. Rat pups (n=10) receiving distilled water (15 mg/kg) two times daily, at P7 to P21, served as control.
Surgery and implantation of stainless screws was made 8-12 weeks after the end of the treatments. EEG registration of sleep-wakefulness cycle was started 5-7 days after surgery and continued for 10 h daily during 7 consecutive days, in control and experimental animals.
Density of M2/M4 muscarinic cholinoreceptors in hippocampus and neocortex was measured by Western Blotting by means of specific antibodies. Statistical processing was made by Students' t-test.
Results: Sleep-wakefulness cycle was significantly disturbed in modeled animals. Light and deep slow wave sleep became fragmented and superficial. Number of awakenings from slow wave sleep was raised considerably. Incidence for delta waves at the frequencies of 1-1.5 c/sec became very low. REM sleep latency was four times shorter and REM sleep incidence was three times frequent than in controls. REM total time was increased for two times due to increased REM sleep incidence.
The rate of M2/M4 muscarinic cholinoreceptors appeared significantly higher in neocortical and hippocampal plasma membranes in rats with postnatal exposure to muscarinic antagonists.
Conclusion: Early postnatal malfunctioning of MChS leads to its adult super-sensitivity accompanied by sleep disturbances alike those characteristic for major depressive disorder and significant up-regulation of M2/ M4 cholinoreceptors. Early postnatal malfunctioning and consequent adult super-sensitivity of MChS is the essential factor for the development of depression-like disturbances in rats.
Acknowledgements: Supported by Science Technology Center in Ukraine and Shota Rustaveli National Science Foundation, Grants # 545 and 6-465

174 - **Intracerebral recordings of slow wave and rapid eye-movement sleep in naturally sleeping pigeons**
Presented by: Jacqueline van der Meij

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Objectives: Mammalian sleep-related slow oscillations (SO) of neuronal activity are thought to play a role in processing hippocampal memories at the systems level. Besides mammals, birds also show SO during sleep. However, in contrast to the mammalian hippocampus which receives input from most of the cortex, input to the avian hippocampus is limited to olfactory and visual information, the latter originating from the hyperpallium. This variation between mammalian and avian brain connectivity may be an indication of fundamental differences in the manner of information processing at the systems level during sleep. Hence, examining sleep-related brain activity at the systems level in birds provides us with an opportunity to test models proposed in mammals, and to reveal fundamental principles that could expand our understanding of mammalian sleep.
The objective of the current study was to explore activity in the avian hyperpallium during both natural slow wave sleep (SWS) and rapid eye-movement (REM) sleep, and to compare this to activity recorded under anaesthesia.
Methods and materials: We used a 32-channel silicon probe connected to a transmitter to make intracerebral recordings of the hyperpallium in naturally sleeping and isoflurane anesthetized pigeons (Columba livia) using a within-bird design.
Results: The local field potential (LFP) recordings during natural SWS reveal high amplitude SO (<

2Hz) across most recording sites. In addition, these oscillations show diverse propagation patterns (i.e. slow waves) across the recording array. Similar results are found in the recordings under anaesthesia, with the difference being that SO show higher amplitude and seem more synchronized between electrode sites. On the contrary, LFP recordings during REM sleep show a reduced amount of slow wave activity and lack the traveling SO seen during SWS.
Conclusions: We show that the travelling nature of slow waves can be found in the avian hyperpallium during both natural SWS and anaesthesia. As travelling slow waves have previously also been found in mammals, it appears that these waves are a fundamental feature of slow wave sleep. However, simultaneous recordings of the hyperpallium and the hippocampus during natural sleep are needed to evaluate the potential role that these slow waves play in information processing at the systems level in the avian brain.

639 - **Differential firing of neurons recorded in the hippocampus and related cortical structures during naturally sleep-wake cycle**
Presented by: Pierre-Hervé Luppi

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A number of studies reported that unit activity in the cortex and hippocampus is different during waking and slow wave (NREM) sleep (SWS). Only a few studies studied the firing rate of neurons during paradoxical (REM) sleep (PS). It seems nevertheless crucial to examine such activity in particular when considering that it has been shown that memory consolidation involving the hippocampus and related limbic structures is impaired following PS deprivation. To this aim, we implanted in the hippocampus and the retrosplenial cortex of rats, customized mutlielectrodes arrays movable by a nanodrive. Recordings were made in freely moving rats (n=16) to evaluate the modifications of the firing rates across all vigilance states. Our preliminary results show that multi-unit (n=76) discharges rates of neurons of the retrosplenial cortex decrease by 50% during SWS and in contrast increase of 30% during PS in comparison to waking periods. The activity of putative inhibitory interneurons (PIN, short peak-to-peak duration; n=37) was more markedly modulated by sleep than that of putative excitatory neurons (PEN, long peak-to-peak duration; n=57). Interestingly, activity of PIN neurons in the hippocampus was phase-locked with theta oscillations during both waking and PS. Nevertheless, we found out that the increased theta frequency occurring during PS compared to waking was not sufficient to explain the increased firing rate observed during this state. Our results corroborate and expand previous observations that neuronal activity in limbic structures is modified by sleep. We are now performing automatic PS deprivation to determine whether the firing rate of neurons is modified during the PS episodes following specific PS deprivation. Future experiments are also planned to unveil whether exposing animals to cognitive tasks with different emotional valences can modify state-dependent modification of firing rate.

351 - **Limbic-pontine mechanisms inducing blood pressure fluctuation during REM sleep**
Presented by: Yoshimasa Koyama

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During REM sleep, animals display large fluctuations of autonomic signs such as blood pressure, heart rate or body temperature which are considered to reflect the emotional changes during REM sleep. Amygdala, center of emotion during waking, becomes active even during REM sleep as well as during waking.
We found that of 103 neurons recorded from amygdala, about half of them became active during REM sleep and about 40 % showed specific firing in close correlation with blood pressure during REM sleep.
REM sleep center in the brainstem has a role, as well as in inducing and maintaining tonic components of REM sleep such as EEG desynchronization or muscular atonia, in inducing or regulating phasic events including rapid eye movement or PGO wave. So, it is highly probable that the brainstem REM sleep center is also involved in inducing blood pressure fluctuation during REM sleep. Using head-restrained unanesthetized rats, single neuronal activity across sleep-waking cycles was

recorded from the laterodorsal tegmental nucleus (LDT), areas crucial for REM sleep regulation containing abundant cholinergic neurons.
About 41% (7/17) of the LDT neurons showed firing correlated with blood pressure fluctuation during REM sleep. Of 7 neurons correlated with blood pressure, 6 were cholinergic, judging from the shape of action potential. In most cases, the increase in firing occurred in advance of blood pressure increase, indicating that the cholinergic neurons in the LDT are the main population of neurons that drive blood pressure fluctuation during REM sleep.
Our results lead to the suggestion that the amygdala and the cholinergic LDT neurons are closely involved in inducing blood pressure fluctuation during REM sleep. Relation of the amygdala and LDT for the regulation of blood pressure during REM sleep would be discussed.

105 - **Sleep episodes dynamics in the rat model of Parkinson's disease cholinergic neuropathology**
Presented by: Jelena Petrovic

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Objectives: Our previous study evidenced the emergence of two distinct REM states (pathological REM1 and physiological REM2) following the bilateral pedunculopontine tegmental nucleus (PPT) lesion in rat, as a model of Parkinson's disease cholinergic neuropathology. The aim of this study was to follow the impact of bilateral PPT lesion on all sleep episodes numbers and durations (sleep episodes dynamics), particularly on the REM/REM1/REM2 episodes.
Methods and materials: Experiments were performed in two experimental groups of adult Wistar rats, chronically instrumented for sleep recording: the physiological controls (n=14) and the PPT lesioned rats (n=11). The bilateral PPT lesions were performed by 0.1 M ibotenic acid microinfusion, and were verified by NADPH-diaphorase histochemistry. Following two weeks of recovery, we recorded sleep for 6 h, weekly, during four weeks. We analyzed the sleep architecture and sleep episodes dynamics.
Results: Two weeks after the PPT lesion the REM duration prolonged, due to the prolonged pathological REM1 ($z \geq -2.38$; $p \leq 0.03$), and also the NREM and REM episodes dynamics altered ($z \geq -2.43$; $p \leq 0.04$). The total REM duration increased due to the increased number of REM episodes ($z=-2.08$; $p=0.04$), but they were of stable duration ($z=-0.19$; $p=0.85$). While the physiological REM2 did not affect total REM, the prolonged pathological REM1 episodes ($z=-2.43$; $p=0.02$) yielded the prolonged total REM duration. Although the lesion increased the mean number of NREM episodes ($z=-2.41$; $p=0.02$), the total NREM duration did not change, due to the shortened NREM episodes ($z=-2.08$; $p=0.04$). However, all the PPT lesion induced alterations of sleep architecture and sleep episodes dynamics were transient, and returned to control values four weeks following the PPT lesion ($z \geq -0.89$; $p \geq 0.39$).
Conclusion: Beside the emerged pathological REM1, the PPT lesion through the transient prolongation of the total REM duration (due to the prolonged pathological REM1 episodes), along with the increased number of shortened NREM episodes induced the transient sleep fragmentation.

521 - **Time variant spindle dynamics using statistical signal analysis**
Presented by: Anand Kumar

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Objectives: A spindle reflects neurophysiological mechanisms of interactions between inhibitory cells in the thalamic reticular nucleus (RE) and bursting thalamocortical (TC) relay neurons. A gradual cell recruitment in RE-TC-RE loops is linked to the waxing of spindles. The cause of spindle waning is less clear, but a depolarizing action by the thalamic IH current may be involved **.** The influence of these neurophysiological mechanisms on spindle morphology in the scalp EEG is still to be clarified.
The transient nature of spindling and the lack of knowledge of the precise mechanism behind spindles require that the analysis of scalp EEG spindles should be performed with a minimum of assumptions and a high temporal resolution. This paper presents a statistical approach for the analysis of scalp

EEG to determine the dynamics of spindle power.
Methods: The algorithm, developed in the Galaxy sleep system, has a very high time-resolution and deploys a minimum of assumptions. EEG is band-pass filtered (11.0-16.0 Hz) using a FIR-filter. The standard deviation of the signal is computed with a moving window of 0.2 second. The resulting power has a time resolution of the sample rate of the signal. Waxing and waning characteristics of a spindle are represented by the time-variant characteristics of the power. A pattern recognition algorithm detects all waxing/waning couplets. Various characteristics like peak power, total intensity, duration, symmetry, polarization/depolarization speed etc. are calculated for each waxing and waning couplet. In addition power dynamics in different spindle bands are calculated.
Results: Sleep EEG data of previously published studies on sleep and memory were reanalyzed to compare the statistics of the waxing/waning dynamics with spindles detected heuristically by visual criteria. The statistical analysis without prior assumptions provided more details of a spindle that could not be detected by visual heuristics (even with automated detection). The power dynamics showed that the power within the slow band (10-13 Hz) increased during the waxing part whereas the power in the fast band (13-16Hz) increased during the waning part of the spindle.
Conclusion: Detecting all waxing/waning patterns without prior criteria like amplitude, duration etc. is useful. Subsequent analysis of waxing/waning parameters reveals more details missed by analyzing only heuristically detected spindles.

182 - **Sleep communication**
Presented by: Kristoffer Appel

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Objectives: One big difficulty in experimental sleep and dream research lies in the fact that conscious interaction between the experimenter and the sleeping subject is not possible during sleep.
Sleep Communication is the method which aims at solving this problem. The goal is to enable a voluntary, conscious and bidirectional communication, without the need for the sleeping person to wake up.
Methods: Previous works have shown that waking world stimuli are (to some extent) incorporated into the dreams of a sleeping person. Moreover, studies from the field of lucid dreaming showed that movements of the (closed) eyes can be controlled from within a lucid dream.
In this proof-of-concept pilot study, we combined both directions and added a coding scheme in order to exchange arbitrary messages. Morse-coded acoustic stimuli, which contained math problems like "3+5" or "7-2" with random numbers and operators, were presented to the subjects during REM sleep. The subjects were instructed to try to become aware of their dreaming state ("lucid dreaming") and to decode the incorporated Morse-coded stimulus within their dream. Next, they were asked to signal back the answer of the math problem by applying Morse Code onto left/right eye movements.
To make sure that subjects were asleep during their task, polysomnographic measures including EEG, EOG and EMG were recorded and evaluated.
Results: The correct answer to an into the dream incorporated random math problem could be transferred to the waking world in at least one case using Morse-coded eye movements. Thus, it could be demonstrated that a bidirectional, voluntary and conscious communication between a sleeping person and the waking world is in principle possible. Additionally, there were multiple partly successful sleep communication attempts, in which the subjects were lucid and detected the incorporated stimuli but woke up before they could answer the math problems.
Conclusions: It could be demonstrated that conscious communication with a sleeping subject is in principle possible. However, practical difficulties and questions appeared, which have to be solved in future studies. It is difficult for many subjects to realize during a dream, that he/she is dreaming. Moreover, other stimulus types, coding schemes and tasks should be explored systematically.
With more research on sleep communication, advanced applications might become possible (e.g. learning of new knowledge during sleep).

572 - **How fast do cognitive functions return to normal in the awakening brain?**
Presented by: John Axelsson

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Objectives: It is largely unknown of how fast the brain goes from sleep to being fully awake and whether sleep stage affects this process. It has for example, been proposed that rapid eye movement sleep (REM) prepares the brain for wakefulness. To address these questions, we investigated how fast cognitive functioning and subjective sleepiness returned to normal after awakenings from different sleep stages.
Materials and methods: 31 healthy participants (mean age 25±4SD yr, 10 women) went through the study protocol twice. The participants carried out a test battery (*Karolinska WakeApp*), during baseline (≥1h prior bedtime), and directly upon awakening from slow wave sleep (SWS), NREM stage-2 sleep (N2) and REM. The test battery included five cognitive tests - each test being 2min long - and ratings of sleepiness and effort to perform.
Results: Cognitive speed was negatively affected after all sleep stages, and performance was most adverse after waking up from SWS, followed by REM and N2 (p´s < .05). Performance when waking up after REM was for several cognitive functions as bad as from waking up from SWS (e.g. working memory), and in no case better than when waking from N2 (p´s>.05). REM was not better with respect to sleepiness as compared to neither SWS nor N2 (p´s >.05).
Conclusions: All cognitive functions had returned to normal within 10-13 minutes after awakening with worst performance after slow wave sleep, followed by REM. Performance was close to normal after awakenings just before normal wake up time and after N2 sleep. Lastly, we found no scientific support for REM to prepare the brain for wakefulness.

378 - **Automatic threshold-free sleep spindle detection in eeg recordings**
Presented by: Dorothée Coppieters 't Wallant

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Objectives: An `automatic spindle detection´ (ASD) system is developed such that detection is robust, reproducible and systematic over time and recordings. ASD is applied on electro- and magnetoencephalographic (respectively EEG and MEG) sleep recordings. Finally, a novel display is proposed to visualize spindles over time (as a video) and overall channels.
Methods and materials: All data used are whole night sleep recordings from EEG (20 recordings from 10 subjects) and MEG (20 recordings from 20 subjects). The implementation of the method will be made available on line for the community as open source code in a Matlab-based toolbox.
The `continous wavelet transform´ (CWT) and the `inverse continuous wavelet transform´ (ICWT) are used respectively to detect activities occuring in the sigma band (10 - 18Hz) and rebuild wavelet of interest at a specific frequency (potential spindle). A `teager energy operator´ (TEO) is then used to determine the beginning and end of the pattern detected. Finally, wave features - frequency, amplitude, energy, power and duration - are used to label each detected pattern as spindle or not. Eventually spindles are displayed over time on a `scalp map´ with derivations used for the detection. At each time bin, the derivations on which a spindle was detected, are highlighted with a circle: the radius is proportional to the spindle power and main frequency is color code.
Results: CWT and ICWT are accurate method with high frequency resolution (0.1Hz). Moreover, the TEO method used to detect the spindles delimitations have a resolution about the sampling rate used. These high time and frequency resolutions allow the distinctive detection of superposed spindles.
Conclusions: This new visualization of spindles will highlight different spindle characteristics in single plot. The tracking of spindles over scalp will also be easier.
Fundings: FRIA.FNRS-WBI-AXA-Ulg-FMRE-ARC-FEDER-WELBIO.

40 - **Modeling K-complexes and sleep spindles as evoked responses using physiologically based neural field theory**
Presented by: M. S. Zobaer

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Objectives: To explain K-complexes, evoked response potentials (ERPs), sleep spindles, and spontaneous EEG in terms of their underlying physiology, and demonstrate that physiologically based neural field theory can also unify them with other brain activity phenomena.
Methods and materials: Physiology-based neural field theory of the corticothalamic system is used to model cortical excitatory and inhibitory populations, and thalamic relay and reticular nuclei. By calculating the impulse response function of the model system, we predict the responses to impulsive stimuli and compare these with transient waveforms in sleep studies. Fitting to empirical data then allows underlying brain physiology to be inferred and compared with that expected in sleep.
Results: It is demonstrated that spontaneous K-complexes, spindles, and hybrid forms can be treated as sleep-state ERPs via neural field theory. The model reproduces time series of experimentally observed K-complexes and sleep spindles for physiological parameters consistent with the underlying sleep states. This unifies spontaneous K-complexes and spindles with other brain activity phenomena such as waking EEGs and ERPs. The model parameters quantify the strengths of intracortical, intrathalamic, and corticothalamic feedbacks and are related to neural gains. They enable brain states to be mapped in a 3D space and it is found that the locations corresponding to K complexes and spindles are consistent with those expected in sleep stage 2.
Conclusions: Spontaneous K-complexes, spindles, and other transient waveforms can be reproduced by treating them as sleep-state evoked responses. This demonstrates that neural field theory can explain a wide variety of short-lived waveforms that have only been cataloged to date, and enables noninvasive fitting to infer underlying physiological parameters.

279 - **CSF biomarkers associated with sleep deprivation in healthy volunteers**
Presented by: Martin Olsson

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Objectives: This study addresses potential cerebrospinal fluid (CSF) and blood biomarkers that may be affected by controlled sleep deprivation in healthy human subjects. We hypothesize that relevant biomarkers might be found among those conventionally related to some forms of neuronal degeneration and damage.
Methods and materials: Study participants were subjected to one period of sleep deprivation (5 nights with < 4 hrs of sleep) and one period of controlled normal sleep (5 nights with 8 hrs in bed). Sleep was monitored polysomnographically during nights at the study centre (7 nights) while actigraphy was applied during nights at home (3 nights). Approximately 10 ml of CSF was collected by a routine lumbar puncture in the morning following each period. CSF was also collected 3 days after the sleep deprivation period (recovery). CSF was stored at -80° C until analysis, which included total-tau (TT), phospho-tau (PT), amyloid β42 (Aβ42) and orexin (OX). Four healthy volunteers aged between 20 and 40 years with self-reported normal sleep and no daytime excess sleepiness were included in the current interim analysis. This ongoing study aims to include 16 subjects in total.
Results: CSF concentrations of TT (262 and 270 ng/L), PT (40 and 40 ng/L) and Aβ42 (966 and 1001 ng/L) remained relatively unchanged from the normal sleep to the sleep-deprived state. In contrast, there was a pronounced increase in the concentration of TT (270 and 605 ng/L), PT (40 and 82 ng/L) and Aβ42 (1001 and 1628 ng/L) following three days of recovery. OX, on the other hand, followed an expected pattern (from 754 to 857 and 638 pg/mL, respectively) which corroborates that the observed changes in TT, PT and Aβ42 were unrelated to possible changes in CSF dynamics/volumes.
Conclusions: Recovery sleep following brief sleep deprivation induced pronounced changes in CSF concentrations of TT, PT and Aβ42. These markers have been associated with Alzheimer's disease but their role in normal physiology is largely unknown. Cell and animal data suggest that tau and Aβ are secreted from neurons in an activity-dependent manner. There are also data indicating that they may reflect synaptic and neuroaxonal plasticity. The observed changes may shed further light on sleep-associated physiological effects in the brain, particularly during recovery from sleep loss.

33 - **Valproic acid but not D-cycloserine facilitates sleep-dependent offline learning of extinction of conditioned fear in humans**
Presented by: Kenichi Kuriyama

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Objectives: The effectiveness of D-cycloserine (DCS), an N-methyl-D-aspartate glutamate receptor partial agonist, and valproic acid (VPA), a histone deacetylase inhibitor, in facilitating the extinction of fear-conditioned memory has been explored in humans and animals. Here, we confirmed whether DCS (100 mg) and VPA (400 mg) act in off-line learning processes during sleep or waking, for further clinical application to anxiety disorders and posttraumatic stress disorder (PTSD).
Methods and materials: We performed a randomized, blind, placebo-controlled clinical trial in 90 healthy adults. Visual cues and electric shocks were used as the conditioned stimulus (CS) and unconditioned stimulus (US), respectively. The experimental protocol consists of the first and second learning sessions separated by a 2-h interval, and a test session started after 12-h intervals involving a waking period with or without a habitual sleep period in accordance with group allocation. Psychophysiological fear was conditioned to a visual cue at the first learning session, and then it was extinguished during the second learning session. The extinction and reinstatement effects were evaluated at the test session.
Results: The extinction effect was observed not in simple recall after the extinction of coupled CS-US, but was observed in the post-re-exposure phase after unexpected re-exposure to reinstatement CS-US coupling. Newly acquired conditioned fear was also eliminated by DCS and VPA administration. Furthermore, VPA facilitated the off-line learning process of conditioned fear extinction during sleep, while DCS facilitated this process during waking.
Conclusions: These findings suggest that DCS and VPA might enhance exposure-based cognitive therapy for anxiety disorders and PTSD by reducing the vulnerability to reinstatement and preventing relapses of fear-conditioned responses, and provide evidence for a peculiarity of the sleep-dependent off-line learning process for conditioned fear extinction.
Acknowledgments: This work was supported by a grant from the Core Research for Evolutional Science and Technology (CREST) program, and Grants-in-Aid for Scientific research (#25670122, and #15H04897) from the Japan Science and Technology (JST) Corporation.

372 - **Training schedules and sleep quality amongst elite athletes**
Presented by: Luke Gupta

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Objectives: While earlier training start times have been shown to reduce night-time sleep quantity (TST) in elite athletes, the impact of training schedules on sleep quality has not been explored. We evaluated relationships between training start times, rise times, sleep efficiency and global sleep quality in elite athletes from multiple Olympic and Paralympic sports.
Methods and materials: Online assessments of sleep quality (PSQI), sleep schedules and training schedules were conducted among 394 (172 female) elite British athletes (78% competed at Olympic/Paralympic games, Commonwealth games, or senior world championships; mean training volume: 18.5±7.8 hours/week). Training start times were categorised: < 0700; 0700-0800; 0800-0900; 0900-1000; 1000-1100; >1100. Rise times (range: 0400-1130) were categorised: < 0700; 0700-0800; >0800.
Results: The mean PSQI score was 5.6±2.8, with 44% scoring above the 'poor sleeper' threshold of >5. PSQI scores were significantly lower (indicative of superior sleep quality) among those with earlier training start times ($F_{(1,392)}$=2.5;P=0.03) but not rise times ($F_{(1,392)}$=0.76;P=0.47). However, the bivariate correlation between rise times and training start times indicated limited shared variance (r=0.39;P< 0.01). Combining rise time, training start time, gender and age as covariates in separate regression models, rise time accounted for a significantly greater proportion of variance in TST (R^2=0.07; $F_{(1,392)}$=28.2;
P< 0.01) and sleep efficiency (R^2=0.12; $F_{(1,392)}$=54.0;P< 0.01).
Conclusion: Among elite athletes showing relatively poor sleep quality, better sleep quality may reflect sleep debt arising from rise or training times. Since later training sessions do not demand later rise times (while early training does) rise time rather than training start time emerges as a superior predictor of sleep duration and sleep quality outcomes.

347 - **The effects of sleep deprivation on pain sensitivity and its relation to EEG power spectra**
Presented by: Jin-Seong Lee

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Objectives: Subjective or objective sleep quality is correlated with pain sensitivity and tolerance. Sleep restriction increases pain sensitivity and decreases pain tolerance. This study investigates potential biomarkers for the pain perception.
Methods: Healthy controls (n = 25; all male; age 28.4 ± 4.3, BMI 22.6 ± 2.2) attended a sleep center for polysomnography at baseline and after a week of sleep restriction (2 hours bedding opportunities). In the following morning, resting EEGs without and with pain stimuli (capsaicin) was recorded. Subjective pain sensitivity and tolerance were reported. Power spectra were calculated for quantitative analysis. Paired t-test and Pearson's correlation were performed.
Results: Stimuli enhanced the alpha (8-12Hz) spectral power (in %) significantly at the baseline (39.8 ± 3.2 vs. 35.0 ± 3.2, $p< 0.01$). This enhancement was associated with EEG D/A (delta (0.5-4.5Hz) to alpha ratio) during NREM sleep (Pearson's $r = 0.423$, $p< 0.05$). However, these were not observed under sleep restriction. Sleep restriction reduced the alpha significantly (22.8 ± 3.0 vs.35.0 ± 3.2 without stimuli; 25.2 ± 3.1 vs.39.8 ± 3.2 with capsaicin). Subjective pain sensitivity increased (6.4 ± 2.1 vs. 5.5 ± 1.4, $p< 0.01$) and pain tolerance decreased (40.5 ± 16.1 vs. 52.3 ± 12.0, $p< 0.01$). The reduced subjective pain tolerance was correlated to the changes in the alpha under sleep restriction ($r = -0.441$, $p = 0.04$).
Conclusion: Greater EEG D/A could be a potential biomarker for enhanced pain sensitivity measured by increased alpha spectral power.

183 - **Sleep in space versus sleep on earth: the effect of gravity**
Presented by: Alain A. Gonfalone

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In this paper a new hypothesis on sleep in space is proposed. Although it has been assumed for a long time that sleep in zero-g should be similar to the sleep on ground, this may have to be reconsidered and modified. By now it is clear that sleep is affected by gravity or at the very least by its absence. Astronauts do not stand, do not carry load, do not walk and the tone of their antigravity muscles is lower during waking, as a result they sleep less: approximately 6 hours and not 8! The total energy expenditure in space is less than the total energy expenditure on ground. If sleep is a necessary and repetitive state for the body and the brain to rest, then the need for sleep in microgravity should be reduced. This assumption also implies that sleep on ground is due in part to the effort to compensate for the presence of gravity and its effects on the posture and motion of the human body.

380 - **The paradoxical effect of cognitive fatigue upon visuomotor sequence learning**
Presented by: Guillermo Borragán

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Introduction: Automatic and controlled memory processes are in a continuous competition in the human brain. Supporting the hypothesis that procedural learning is enhanced in conditions in which cognitive control is diminished, performance in implicit memory tasks improves under various conditions including hypnosis, disruption of prefrontal activity by TMS or non-optimal time of the day. Another condition depleting the availability of controlled resources is cognitive fatigue. In this study we tested the hypothesis that inducing cognitive fatigue will actually expedite the acquisition of the automatic components in procedural sequence learning.
Method: In a two days experiment, twenty-three young healthy participants were administered a serial

reaction time task (SRTT; 8 Blocks, 96 trials/block, 12 elements-sequence) after high (HCL) or low (LCL) cognitive fatigue levels, in a counterbalanced order. Fatigue level was induced using the Time Load Dual task, a working memory task that allows tailoring the level of cognitive fatigue to the individual´s optimal performance capacity.
Results: Participants were significantly faster in the SRTT when performing after the HCL than the LCL fatigue condition ($F_{(1, 19)}$ = 168.72, MSE = 725; $p < .001$; $\eta^2 = .27$). Furthermore, performance improvement on RTs benefited to the sequential more than to the motor components in the SRTT ($F_{(1, 19)}$ = 4.40, MSE = 181; $p < .05$; $\eta^2 = .19$). Finally, we found higher proactive interference effects from Day 1 to Day 2 when participants learned first in the HCL condition
($F_{(1, 19)}$ = 6.41, MSE = 999; $p < .05$; $\eta^2 = .13$).
Discussion: Altogether, our results suggest a paradoxical, positive facilitating impact of cognitive fatigue on procedural motor sequence learning. We surmise that this facilitation stems from the reduction in cognitive resources devoted to controlled processes in the HCL as compared to the LCL condition, processes that normally opposes automatic procedural acquisition mechanisms.

295 - **Dreaming of a learning task improves memory performance**
Presented by: Monika Schönauer

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Objectives: Neuronal activity observed during learning is replayed during later sleep periods. We assume that this reactivation supports beneficial effects of sleep on memory performance. In humans, sleep states are accompanied by vivid conscious experience during dreams. Dream content has long been known to contain residues of daytime experiences. It has therefore been suggested that dreams reflect the content of night-time memory reactivation. We tested whether the content of previous learning material can be inferred from dream reports collected during sleep following memory acquisition, and whether dreaming of a learning task improves later memory performance.
Materials: 20 participants listened to one of four different audiobooks while falling asleep. They were asked to remember the content well enough so they could retrieve it later. Participants were awoken several times from NREM sleep periods during the night and asked to report their dreams. Afterwards, we tested how well they remembered the content of the audiobook. This procedure was repeated multiple times throughout the night. To assess whether the specific content of an audiobook is reprocessed in subsequent dreams, three independent and blind raters were asked to guess from the transcripts of dream reports only which audiobook had been listened to beforehand. They also had to judge the confidence of their decisions according to how much information about the audiobook they detected in the reports.
Results: Dream reports could be successfully matched with the corresponding audiobook condition (Cohen's k = 0.20, p = 0.02). The amount of information that was reprocessed during dreams, measured as the stated confidence with which raters made their decision, correlated significantly with later memory for the listened audiobook passage (r = 0.37, p = 0.02).
Conclusions: New memories are reprocessed during subsequent dreams to such an extent that verbal dream reports contain sufficient information to identify the specific content of the previous learning material. Moreover, this memory reprocessing during NREM dreams is associated with better retention of the information, which indicates that dreams may in fact hold a functional role in memory consolidation.

390 - **Local sleep and spatial memory consolidation: local use-dependent electroencephalographic changes in wake and sleep**
Presented by: Angelica Quercia

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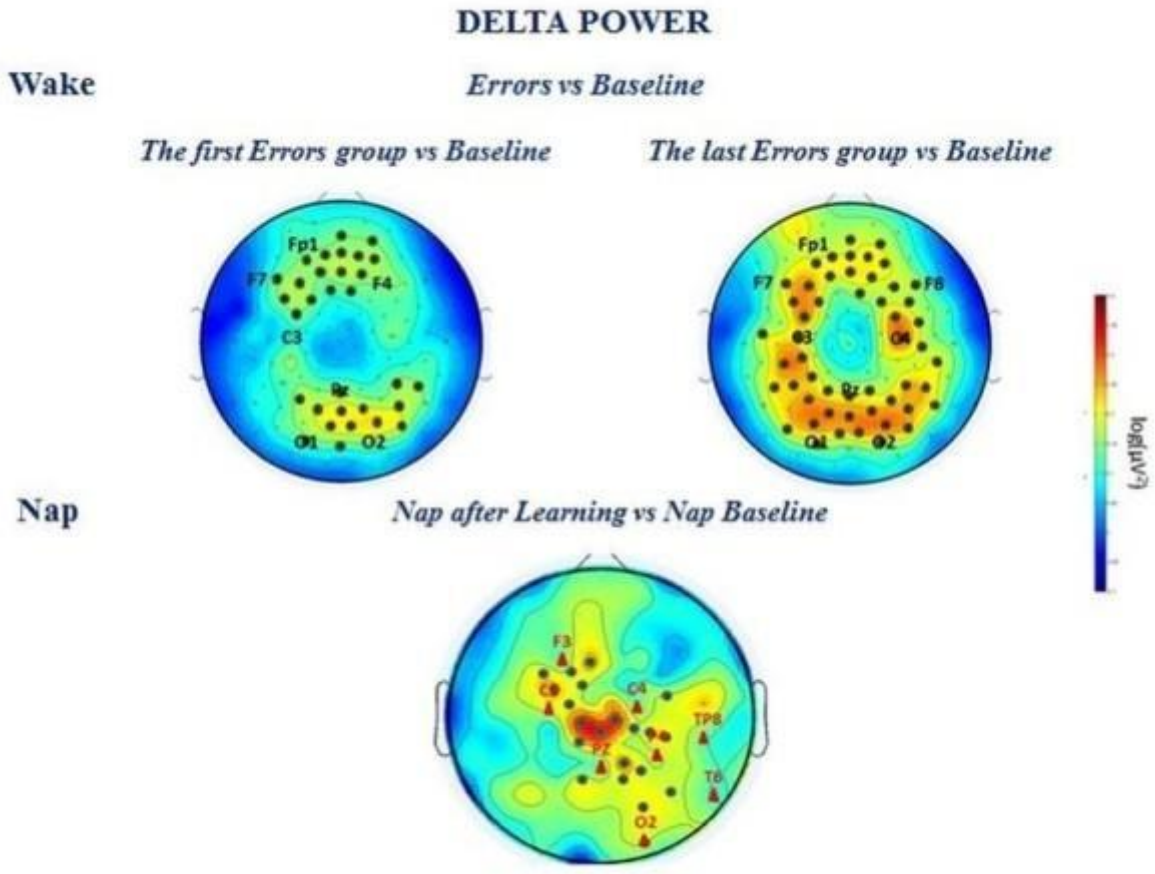
Introduction: Recently, it has been shown in *awake* rats that task performance may be degraded by *local*, *use-dependent sleep*, namely, an increase in slow/theta waves (2-6 Hz) in neuronal groups

associated with the task at hand. SWA is the hallmark of *sleep plasticity* and increases locally during non-REM *sleep* in the brain regions related to a previous learning task. The present study investigates *local use-dependent* EEG changes during an *intensive spatial navigation task*, related to errors in task performance, and during a daytime *nap* after the task.
Methods: The *spatial navigation task* required participants (13 healthy males, mean ± SD: 24.9±2.23 years) to form a mental representation of a virtual city *(Learning Phase)* and to use it to travel between different *Landmark* locations (n=16) within the city, following the shortest pathway and as quickly as possible (*Retrieval Phase*, 16 retrievals as *baseline* and 8 of them repeated continuously). Subjects *performance* was measured as *path errors* (graphic layout and video recording), time and units to completion of each retrieval. A *control task* (*spatial navigation without learning*) was repeated by 9 out of the same 13 subjects. In the afternoon after each task, subjects were asked to sleep. Wake and sleep activities were recorded with video high-density electroencephalogram (hd-EEG, 128 channels).
Results: During the spatial navigation task, subjects made several *errors* (mean±sd: 42 ±18.53). Delta power (0.5-4 Hz) increased *locally* and *progressively* during *errors* compared to *baseline* over task-related cortical regions (frontal, central and parietal-occipital cortex), in contrast to the *control task.* Also, the task induced a local increase in SWA over the parietal cortex only during *post-learning* nap. Topographic distribution of absolute delta power in wake and sleep (Fig.1) was obtained using a statistical nonparametric mapping (supra-threshold cluster test controlling for multiple comparisons, $p < 0.05$).
Conclusions: During the prolonged performance of *spatial navigation tasks*, the *local slowing* of EEG rhythms over task-related regions was associated exclusively to the *learning task* and to transient impairments in performance. Moreover, these local effects in waking EEG are followed by and strictly related to a local increase of SWA exclusively during the daytime nap after the *learning task*, as predicted by the local sleep model.



[Topographic EEG changes during wake and sleep]

420 - **Sleep alleviates proactive interference due to competition between memory systems**
Presented by: Guillermo Borragán

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Introduction: There is competitive interaction for limited cognitive resources between memory systems (1-4), possibly mediated by post-learning sleep (4-5). We previously disclosed a transient increase in motor performance (boost effect) occurring 5-30 minutes after learning (6-7), which might reflect initial steps for the consolidation of motor memories. Here, we investigated proactive interference effects due to the administration of a declarative memory task immediately after motor sequence learning (i.e., during the boost period) and how sleep modulates this early competition between declarative and procedural systems.
Method: 81 participants were administered a Serial Reaction Time Task (23 Blocks, 64 trials/block, 8 elements-sequence). After initial learning (9 Blocks), half of the participants were presented with a declarative word-list learning task (WLT), the other half with a control vowel-counting task (VCT). They were then retested 30 minutes (4 Blocks) and 12 hours (4 Blocks) later. Half of the participants in each condition slept normally during the 12-hours interval, the other half stayed awake.
Results: Improved motor performance at 30 minutes (Boost; $F>4.7$; $p< .05$) was not modulated by the intermediate declarative memory task (WLT vs VCT; $F< .5$; $p>.6$). A repeated measure ANOVA computed on performance improvements (RTs) after the 12-hours period with Declarative task (WLT vs VCT) and Sleep (Absent/Present) factors disclosed a trend for a triple interaction ($F>3.4$; $p< .07$). Post-hoc tests evidenced faster RTs after the 12-hours interval in the VCT ($p< .005$) but not in the WLT ($p>.6$) condition in participants kept awake. At variance, RTs decreased in both WLT and VCT conditions ($p< .05$) in subjects allowed to sleep, suggesting suppression of proactive interference effects.
Discussion: Our results show that the boost effect is not modulated by an intermediate declarative memory task. Rather, longer-term memory consolidation at the scale of hours is affected by proactive declarative interferences, an effect alleviated by post-training sleep.

636 - **Ghost hunting or does perfectionism matter for sleep disturbance? A polysomnographic study**
Presented by: Anna F.D. Johann

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Objectives: The hypothesis that higher levels of perfectionism are linked to sleep disturbances has not been investigated using objectively determined sleep parameters as provided by polysomnography (PSG). To fill that gap, this study drew on the Frost Multidimensional Perfectionism Scale (FMPS) and PSG.
Methods and materials: The sample comprised 355 sleep laboratory patients (208 women, 147 men; 44.7 ± 15.7 years), who underwent 2 nights of PSG. Perfectionism was assessed using the FMPS, which comprises the subscales concern over mistakes (CM), doubts about action (DA), parental expectation (PE), parental criticism (PC) and personal standards (PS). The impact of FMPS scores on PSG parameters (total sleep time (TST), sleep-onset latency (SOL), wake after sleep onset (WASO), number of awakenings (NOA), arousal index per h, amounts of stage 1 and 2, slow wave sleep (SWS), and rapid eye movement (REM) sleep as percentage of sleep period time) was analysed using linear regression models, which controlled for age, gender and depressive symptoms (BDI scores).
Results: The total FMPS score was significantly associated with several sleep continuity parameters of the first sleep laboratory night (TST: $t=-2.01$, $p=0.045$; NOA: $t=3.93$, $p< 0.001$; arousal index: $t=2.13$, $p=0.034$). A statistical trend for the association between the total FMPS score and WASO ($t=1.83$, $p=0.068$) and REM % ($t=-1.76$, $p=0.080$) was found. With regard to the FMPS sub-scales, CM was significantly associated with TST ($t=-3.03$, $p=0.003$), WASO ($t=2.33$, $p=0.020$), NOA ($t=2.84$, $p=0.005$) and arousal index ($t=2.46$, $p=0.014$). PE was significantly associated with NOA ($t=4.07$, $p< 0.001$). PC was significantly associated with NOA ($t=3.32$, $p=0.001$). PS was significantly associated with TST ($t=-2.98$, $p=0.003$), WASO ($t=2.19$, $p=0.030$) and NOA ($t=2.79$, $p=0.006$). With respect to the second night, a statistical trend for the association between the total FMPS score and the arousal index ($t=1.95$, $p=0.052$) and the amount of stage 1 ($t=1.77$, $p=0.077$) was found. With regard to the FMPS sub-scales, CM was significantly associated with the arousal index ($t=2.14$, $p=0.033$) and SWS ($t=-2.02$, $p=0.044$).
Conclusion: These results provide rather weak support for the assumption that perfectionism is linked with polysomnographically determined sleep disturbances. Future studies should further elucidate this

association employing longitudinal designs.

404 - **The effect of sleep loss on emotional working memory**
Presented by: Andreas Gerhardsson

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Objectives: Sleep deprivation (SD) affects important functions mediated by the prefrontal cortex such as working memory (WM) and emotion processing. One recent study suggests that although general performance on an emotional WM task decreases during sustained wakefulness, the performance is less adversely affected if stimuli are negative. However, it is unclear whether the beneficial effect of emotional stimuli on WM performance following sleep loss depends on the cognitive load required by the WM task. Previous findings are inconsistent regarding at what cognitive load WM performance is affected by SD, and to date no study has examined the effect of SD on higher cognitive load in emotional WM. The aim of the present study is to examine the effect of one night's sleep deprivation on emotional WM using both low and high cognitive load (1-back and 3-back).
Methods and materials: As part of an ongoing study, young healthy subjects (expected n ≈ 60 at time of the congress; age 18-30yrs) are randomized to a total sleep deprivation (SD) or a normal night sleep (NSD) condition. Participants perform an N (1 and 3) -back task consisting of positive, negative and neutral pictures. A (2x2x3) mixed model analysis of variance was applied with sleep (SD, NSD) as between subject variable and cognitive load (1-back, 3-back) and valence (positive, neutral, negative) as within subject variables.
Results: Preliminary results in 25 subjects showed an expected adverse effect of SD on number of correct responses and reaction time and a main effect of cognitive load. Furthermore, there were indications of a three-way interaction of slower reaction times for SD for negative pictures in the 3-back task.
Conclusion: Thus far results show that sleep deprivation has a general adverse effect on working memory performance. We expect the final results to further benefit a better understanding of the interplay between higher order cognitive functions and working memory.

90 - **Phenotypes of resting-state cognition in insomnia disorders: mind-*wandering* activity is associated with insomnia related cognitive processes and insomnia severity**
Presented by: Laura Palagini

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Introduction: The state of wakeful rest—or “resting state”—from a cognitive point, serves as a model to study stimulus independent thought, which is thought tightly linked to the default mode network. Previous research showed cognitive processes such as daytime rumination and unhelpful sleep related beliefs to play a role in perpetuating insomnia: investigating the mind-wandering experiences in insomnia may be particularly useful. To this aim the Amsterdam Resting-State Questionnaire (ARSQ), a validated tool to quantify thoughts and feelings during rest was administered.
Methods and material: The study consisted of 45 subjects with Insomnia Disorder according to the DSM-5 and 33 healthy controls. In addition to the ARSQ, Insomnia Severity Index (ISI), Pittsburgh Sleep Quality Index (PSQI), Dysfunctional Beliefs about Sleep scale (DBAS), Daytime Insomnia Symptom Response Scale (DISRS) and another set of variables were administered. Statistical analyses included Pearson Correlation and multiple logistic to elucidate the independent determinants of ARSQ phenotypes.
Results: Subjects with Insomnia (F=22; 47$\pm$1.6 years) presented higher ISI, PSQI, DBAS and DISRS ($p< .05$) scores than Healthy (F=18; 48$\pm$1 years). They also show higher scores in ARSQ: Discontinuity of Mind, Health Concern, Self and Sleepiness ($p< . 05$). Discontinuity of Mind correlated with ISI
(r=. 43, p=.001), DBAS (r=.36, p=001) and was best determined by ISI (B=.25 p=.01), Self with ISI (r=.37, p=.009), DBAS (r=. 37, p=.01), and DIRS (r=.29, p=.02), Health Concern with ISI (r=.46, p=.001), DBAS (r=.34, p=.01), DIRS (r=.29, p=.02) and was best determined by ISI (B=.27, p=.01),

Sleepiness correlated with DBAS (r=.32, p=.04).
Conclusions: Mind-wandering activity in insomnia resulted to be focused on thoughts and feelings about self, or worries about their own thoughts, feelings and health. These experiences were related especially to sleep-related rumination and unhelpful beliefs, and to insomnia severity. The study of thoughts and feelings during the resting state may provide additional information about cognitive and emotional processing that may be ongoing during the sleep-onset period.

176 - **Mismatch between subjective perception and objective findings on sleep time in insomnia patients**
Presented by: Kyungyeol Bae

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Objectives: Polysomnography in insomnia patients has often revealed a mismatch between the subjective perception and the objective findings of sleep time. We aimed to examine this mismatch and investigate the characteristics associated with the mismatch in insomnia patients.
Methods: In 121 insomnia patients, findings of nocturnal polysomnography, responses to a subjective questionnaire after sleep, and medical records were reviewed. The patients were classified into two groups - total sleep time (TST) underestimation group (N=56) and TST non-underestimation group (N=65) -depending on the presence of a 2-h difference between the subjective and the objective TSTs. The demographic characteristics, type of insomnia, use of sleep-promoting medication, polysomnography findings, and subjective reports were compared between the two groups.
Results: Nocturnal polysomnography showed significantly longer TST ($p<0.001$) and shorter sleep latency ($p< 0.001$) than the subjectively reported values. In comparison with the TST non-underestimation group, the TST underestimation group were significantly older (p=0.043) more likely to have longer TST (p=0.012), shorter sleep latency (p=0.002), and a smaller proportion of slow-wave sleep ($p<0.001$) in the polysomnographic analysis and more likely to show shorter TST ($p<0.001$) and shallower sleep ($p<0.001$) in the subjectively reported values.
Conclusions: We found a significant mismatch between the subjective perception and the objective findings of sleep time as determined using polysomnography in insomnia patients. Underestimation of sleep time may be more closely associated with the proportion of slow-wave sleep, which reflects sleep depth, than with objective TST.

540 - **Examining the link between cortical hyperarousal and sleep misperception**
Presented by: Célyne H. Bastien

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Objectives: Many studies have reported that insomnia sufferers (INS) are cortically hyperaroused, this arousal being likely linked to sleep misperception, especially amongst paradoxical insomnia sufferers (PARA-I). Using spectral analysis (PSA), 1 Hz increments were chosen over large frequency bands (beta, gamma, etc). Our hypothesis was that increased cortical activity would be linked to greater sleep misperception.
Methods: 77 individuals [(32 GS; M*age*: 36,28, SD = 9,67); (45 INS subdivided in 28 PSY-I; M*age*: 42,25, SD = 9,07 and 17 PARA-I; M*age*: 41,06, SD = 9,38)] participated in this study. Subjective and objective sleep measures were obtained for sleep latency (SL) and total sleep time (TST). The sleep misperception index was derived from these data. PSA was conducted on EEG segments between 14 and 30Hz since these frequencies are known to reflect cortical hyperarousal in insomnia. Separated Pearson's correlations were conducted on the two time measures (SL, TST).
Results: Significant correlations ranged between 21 and 26 Hz (r between -0,29 and -0,25) for the SL in relation to sleep overestimation. As such, increased cortical activity seems to be linked with longer SL perception. Significant correlations were obtained between 16 and 28 Hz (r between 0,35 and 0,54) for the TST in relation to sleep underestimation, that is, increased cortical activity would mean a shorter TST perception.
Conclusions: These results suggest that cortical hyperarousal and sleep misperception are not independent phenomena. Specific mechanisms could be linked to specific frequency bands, such as attention, information processing or mesograde amnesia in the case of overestimation, and cognitive

functions such as long-term memory for underestimation. Moreover, heightened cortical arousal may blur the distinction between sleep and wake, thus altering sleep perception. Finally, using 1 Hz increments instead of large frequency bands allows a more precise understanding of cortical activation, especially when assessing sleep misperception.

374 - **Twenty-four hour activity level and light exposure in community-dwelling insomnia patients**
Presented by: Jung Hie Lee

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Objectives: The light is a strong modulator of circadian rhythm and its timing and amount affect sleep. It has been reported that light therapy could be effective for insomnia in the elderly and shift workers. We aimed to measure the 24-h patterns of activity and light exposure in order to evaluate the daily bidirectional relationship between light exposure pattern and sleep in community-dwelling adults with insomnia.
Methods and materials: Sixty nine insomnia patients (Age:60.7±12.2 years) and 57 normal control (NC) subjects (Age:52.3±13.3 years) were recruited from Public Health Centers in a rural area of Korea in 2014. The actigraphy recording for 7 days was conducted for each subject. For the analysis of the daily profile of light exposure, the data obtained from actigraphy were firstly analyzed as lux and then were log-transformed. The amount of light exposure was averaged in 3 hour bins for statistical analysis, as the amount of activity was.
Results: There was no significant difference in the means of sleep parameters from actigraphy between the insomnia and NC groups. The mean activity amount between midnight and 3:00 AM in the insomnia group was significantly greater compared to that of the NC group. However, the differences in activity between the two groups were not found in the other bins. There was no significant difference in light exposure in all the bins between the two groups.
Conclusions: There was no evidence of the change in daily light exposure pattern in community-dwelling adults with insomnia. However, they only showed the increase in their activity between midnight and 3:00 AM relatively. The hypothesis that the change in sleep and light exposure might be interconnected was not supported by our results.
Keywords: Insomnia, light exposure, activity
Support: Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (2013R1A1A2009888).

124 - **Repetitive negative thinking mediates the relationship between impaired attentional control and insomnia severity**
Presented by: Romola Bucks

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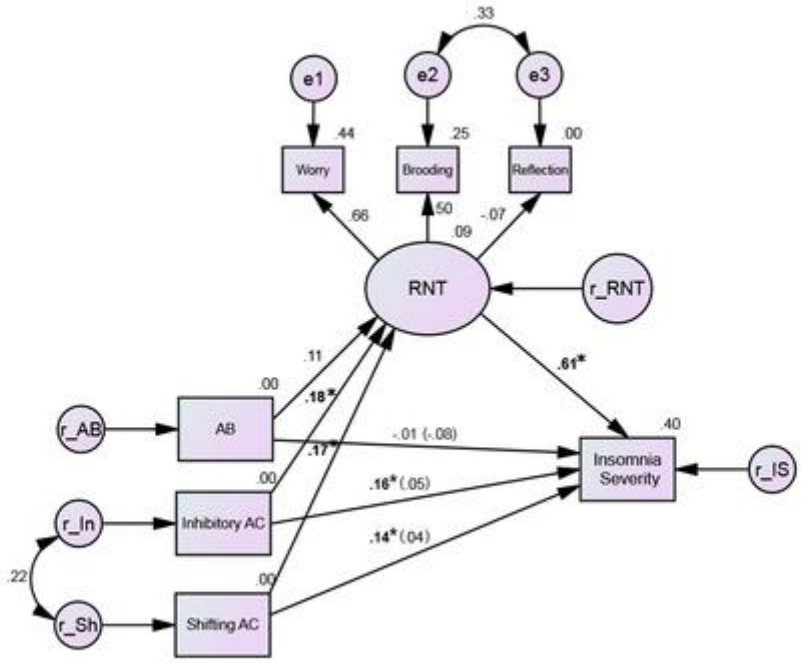
Objectives: This study examines a) whether attentional bias (AB) for negative information (sleep-related or non-sleep-related) and impaired attentional control (AC) predict insomnia severity (IS), and b) whether these relationships are mediated by repetitive negative thinking (RNT).
Methods and materials: One-hundred-and-twenty young adults (age 20.51±7.26 years) completed questionnaires assessing sleep quality, a novel computer-based task assessing inhibitory and general AC, and an attention probe task assessing AB to sleep-related and non-sleep-related negative information.
Results: Lower levels of inhibitory and general AC predicted greater insomnia severity, and this effect was fully mediated by heightened RNT. In contrast, AB to negative information predicted neither insomnia severity nor RNT, regardless of whether this information was sleep-related or not.
Conclusions: These findings suggest that impaired attentional control, but not negative attentional bias, may exacerbate insomnia, by directly increasing RNT which in turn disrupts sleep. Suggestions are made concerning how this research approach can be extended beyond the laboratory, to illuminate how insomnia is influenced by attentional processes that operate during the pre-sleep

period, and to evaluate whether training regimes that enhance attentional control can attenuate insomnia severity.



[Figure 1. Mediation model.]

Figure 1. Mediation Model: Observed Variables AB, General AC, and Inhibitory AC as predictors of insomnia severity, mediated by the latency construct of RNT. The direct effect (c) is in parentheses. Boldface* indicates significant, p < .05.

89 - **Cognitive arousal may depend on sleep related metacognition in insomnia disorder**
Presented by: Laura Palagini

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Objective: According to the hyperarousal model, cognitive and somatic arousal is a characteristic of subjects with insomnia and contribute to perpetuate it. Insomnia related cognitive processes also have a role in maintaining it. As metacognitive beliefs serve as a resource for interpreting and controlling cognitive events themselves, our aim was to evaluate the possible associations between cognitive and somatic arousal and the sleep related metacognitive processes, in subjects with Insomnia Disorder (ID).
Methods: Forty-five ID (DSM-5) patients (25 F, mean age 48±12 yrs) and 30 healthy controls (17 F, mean age 49±14 years) were evaluated using Metacognition Questionnaire - Insomnia (MCQ-I), Insomnia Severity Index (ISI), Pittsburgh Sleep Quality Index (PSQI), Pre Sleep Arousal Scale (PSAS C: Cognitive, PSAS S: Somatic), Self Efficacy for sleep Scale (SES), Beck Depression Inventory (BDI) and Zung Self-Rating Anxiety Scale (SAS). Univariate correlational analysis and multiple linear regression were used to identify independent determinants of PSAS C and PSAS S. Principal Component Analysis (PCA) was also performed.
Results: As might be expected, patients with ID had higher scores than controls on all variables (all p< .01). In terms of our relationships of interest, cognitive arousal (PSAS C) correlated with ISI (r=.32, p=.02), MCQ-I (r=0.55, p< .0001), PSAS S (r=0.61, p< .001), SES (r=-0.39, p=.02), but was best determined by MCQ-I (B=.11, p=.002) and Somatic Arousal (B=.55, p< .001). Somatic Arousal

(PSAS S) correlated with ISI (r=. 31, p=. 02), MCQ-I (r=0.39, p=.002), BDI (r=0.34, p=.02), and SES (r= -0.43, p=. 002) but was best only determined by Cognitive Arousal (B=.47, p< . 001). PCA extracted 2 components: MCQ-I PSAS, PSAS C and SES significantly loaded on the same component.
Conclusions: Although our cross-sectional design does not investigate cause-effect relationships, our findings may suggest that metacognition plays a role in modulating cognitive arousal, which, in turn, may modulate somatic arousal and insomnia related behaviors. Therapeutic strategies acting selectively on metacognition, therefore, may be useful in the treatment of ID. Further research on these possibilities is required.

88 - **Insomnia symptoms are associated with high perceived stress and less effective coping strategies in subjects with systemic lupus erythematosus**
Presented by: Laura Palagini

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Objective: Systemic Lupus Erythematosus (SLE) is a chronic multisystem autoimmune disorder which may lead to progressive disability; recurrence of flares have been related to elevated stress. Aim of the study was to evaluate appraisal of stress, coping strategies and their determinants in patients with SLE according with the presence or absence of insomnia symptoms.
Methods and materials: One hundred-five SLE women at their first visit at the Lupus Outpatient Clinic of the University of Pisa were enrolled in a cross-sectional study using a set of variables that included the Perceived Stress Scale (PSS), Brief-COPE, Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), Beck Depression Inventory (BDI) and Self-rating Anxiety Scale (SAS). High level of perceived stress were defined as PSS >14. Problem-focused vs. emotion-focused coping strategies were computed. Patients with self-reported sleep apneas or snoring (n=8) or with incomplete data (n=7) were excluded.
Results: Data from 90 women were analyzed (mean age 44±3 years). Insomniacs (n=57, 63.3%) presented higher PSS (13±5 vs 19±3, p< 0.001), ISI (p< 0.001), PSQI (p< 0.001), BDI, (p< 0.001) and showed less effective coping strategies such as the use of Behavioral Disengagement (p=0.04), of Self Blame (p=0.02) and emotional focused coping (p=0.001) than non-insomniacs. In a multiple logistic regression model insomnia symptoms were the only determinant of Perceived Stress (ISI: B=.04, p=.0007), and of the use of Self Blame (ISI: B=.02, p=.001). Disengaging Behaviors were best determined by poor sleep quality (PSQI: B=.03, p=.001), and emotional focused coping by both poor sleep quality and insomnia symptoms (PSQI: B=.01, p=.01; ISI: B=.02, p=.01).
Conclusions: SLE patients with insomnia symptoms showed higher perceived stress than non insomniacs SLE. They also present higher level of psychiatric comorbities frequently related to insomnia such as depressive symptoms, which are also included in the SLE neuropsychiatric manifestations. In addition SLE insomniacs report less effective coping strategies used to deal with stress. As stress is related to SLE flares' recurrence, prevention and treatment of insomnia symptoms should receive attention in these subjects.

21 - **The exploratory power of sleep effort, dysfunctional beliefs, and arousal for insomnia severity and PSG determined sleep**
Presented by: Elisabeth Hertenstein

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Differences between subjective sleep perception and sleep determined by polysomnography (PSG) are prevalent, particularly in patients with primary insomnia, indicating that the two measures are partially independent.
To identify individualized treatment strategies, it is important to understand the potentially different mechanisms influencing subjective and PSG determined sleep. The aim of this study was to investigate to which extent three major components of insomnia models, i.e. sleep effort, dysfunctional beliefs and attitudes about sleep, and pre-sleep arousal, are associated with subjective insomnia severity and PSG- determined sleep. A sample of 47 patients with primary insomnia according to DSM-IV criteria and 52 good sleeper controls underwent two nights of PSG and filled in the Glasgow

Sleep Effort Scale, the Dysfunctional Beliefs and Attitudes about Sleep Scale, the Pre-Sleep Arousal Scale and the Insomnia Severity Index. Regression analyses were conducted to investigate the impact of the three predictors on subjective insomnia severity and PSG- determined total sleep time. All analyses were adjusted for age, gender, depressive symptoms, and group status.
Subjective insomnia severity was positively associated with sleep effort. PSG determined total sleep time was negatively associated with somatic pre-sleep arousal and dysfunctional beliefs and attitudes about sleep. Suggesting that subjective insomnia severity and PSG determined total sleep time are associated with different cognitive and somatic variables, our results might contribute to the formulation of new hypotheses for future research. The reduction of sleep effort appears to be a particularly important therapeutic target.
Based on the results of this study, we suggest that future treatment studies investigate the efficacy of treatments designed to reduce sleep effort, such as mindfulness based treatment or acceptance and commitment therapy.

56 - **Discriminant validity and other psychometric properties of the sleep condition indicator a new tool to evaluate insomnia disorder in routine clinical practice**
Presented by: Laura Palagini

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Introduction: The Sleep Condition Indicator (SCI) is validated to appraise insomnia, according to DSM-5, however, it has not undergone full psychometric testing. The present study sought to evaluate the reliability and the discriminant validity of the SCI in its Italian version, in Insomnia Disorder (ID), Obstructive Sleep Apnea Syndrome (OSAS) and healthy subjects (H).
Methods: Subjects with ID according to DSM-5, OSAS according to ICSD3 and a group of H subjects were recruited. At the first evaluation (T0), SCI, the Insomnia Severity Index (ISI) and the Pittsburgh Sleep Quality Index (PSQI) were administered. ID patients also completed the SCI two months later (Time Retest: TR). Statistical analyses included Cronbach´s alpha co-efficient calculation, Intraclass Correlation Coefficient (ICC), Receiver Operating Characteristic (ROC) curves and Pearson correlations.
Results: Eighty-eight ID (50 F, mean age 49.9±15.1 years), 43 OSAS (22 F, mean age 50.2±9.1years) and 40 H (22 F 49.3±13 years) were recruited at T0. SCI, PSQI and ISI mean scores were significantly higher in the ID group vs H and OSAS (both $p < .001$). Cronbach´s alpha co-efficient was 0,718 at T0 and 0,785 at TR for ID, 0.76 and 0,818 respectively for H and OSAS. ICC revealed SCI stability over repeated assessment (for each item $p < .0001$). ROC analysis revealed cut off of >18 to correctly identify 100% H, cut off of >17 the 100% OSAS and a cut of < 17 the 100% of ID. At T0, Pearson analysis showed a convergent negative correlation with ISI ($p < .01$) and PSQI ($p < .05$).
Conclusion: The Sleep Condition Indicator shows good internal consistency, temporal stability, at the test-retest evaluations, and current validity in Insomnia Disorder. Importantly, the present study shows that the Sleep Condition Indicator effectively discriminates insomnia from both normal sleep and OSAS. It may be helpful in detecting Insomnia Disorder subjects in the real world of clinical practice.

346 - **Sleep and psychological problems in medical students**
Presented by: Jin-Seong Lee

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Introduction: Although it is well known that medical students are not getting an adequate amount of sleep, there have been only a few studies on the sleep patterns of medical students and the related factors. Therefore, the present study aimed to investigate the medical students' sleep patterns and the related factors.
Methods: A questionnaire package was administered to the 1st to 4th year medical students at one

medical school. It consisted of questions asking about their lifestyles as well as Pittsburgh sleep quality index (PSQI), Epworth sleepiness scale (ESS), global assessment of recent stress scale (GASS), the center for epidemiologic studies-depression scale (CES-D), and Moudsley obsessive-compulsive inventory (MOCI). A total of 352 students (206 males and 146 females) responded to the survey and the result was analyzed using the independent t-test, the chi-square test, the paired t-test, Pearson's correlation and ANOVA. P-values of less than 0.05 were considered statistically significant in analyses.
Results: The weekend bedtime was significantly delayed (0:49 on weekday; 1:34 on weekend; t=-5.23, p< 0.001), the weekend rise time was delayed (6:58 on weekday; 9:30 on weekend; t=-24.48, p< 0.001) and the total sleep time was increased on weekends (5:36 on weekday; 7:39 on weekend; t=15.94,
p< 0.001). The PSQI score of all subjects was 6.43±2.64. PSQI was positively correlated with ESS (r=0.383, p< 0.01), GASS (r=0.326, p< 0.001), CES-D (r=0.393, p< 0.001), and MOCI (r=0.247, p< 0.001), but not with GPA (r=0.072, p=0.228). The more senior students had lower PSQI, GASS, CES-D, and MOCI score (p< 0.05).
Conclusion: Medical students were experiencing a lack of sleep during weekdays as they have a later bedtime and earlier rise time, and consequently had more hours of sleep on weekends. Overall, the medical students were experiencing poor sleep quality and sleep deprivation. Poor sleep quality is associated with psychological problems (daytime sleepiness, stress, depression, and obsessive tendency).

83 - **Sleep disturbances and social support in male population 45-69 years in Russia / Siberia (epidemiological study)**
Presented by: Valery Gafarov

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Objective: To determine the prevalence of social support (indices of close contacts (ICC) and social network (SNI)) in male population aged 45-69y with violations of quality and duration of sleep in Russia / Siberia (Novosibirsk).
Methods: Under the screening random representative sample of men aged 45-69y (n=1770) were surveyed in Novosibirsk. Berkman-Sym test was used to measure social support. Sleep disorders studied by the test C.D. Jenkins et al. (JSQ).
Results: The prevalence of high and very high level of SNI were in 15,8% and 2,3% of population, respectively. ICC was high in 7,2%. SNI, and ICC Indices in the analysis by age groups were similar and are not associated with age. At a low level SNI more common persons with severe sleep quality (22.4%) than with high or very high levels (14.7% and 19.5%, respectively). Disturbances of sleep duration remain approximately the same as in those with high level SNI (56.1%), and as with low (55.4%). Sleep quality is much worse than in men with low levels of ICC (20,3%), than with a high ICC (14,1%). Severe disorders of sleep duration in men with high or low levels of ICC remains approximately the same (61.4% and 58.4%, respectively).
Conclusion: At low levels of SNI and ICC are more common persons with severe sleep quality. The expressed disturbances of sleep duration in men with high or low levels of SNI and ICC remains approximately the same.
Supported by Grant of Russian Foundation for Humanities №14-06-00227.

569 - **Effectiveness of an online cognitive behavioral therapy for insomnia**
Presented by: Erla Björnsdóttir

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Introduction: Insomnia is a common health problem with serious mental and physical consequences as well as increased economical costs. The use of hypnotics in Iceland is immense in spite of cognitive behavioral therapy for insomnia (CBT-I) being recommended as the first choice treatment of chronic insomnia. To meet the needs of more individuals suffering from insomnia, online CBT-I was established at betrisvefn.is. The objective of this research was to evaluate the effectiveness of this internet-based CBT-I.

Material and methods: One hundred seventy-five users (mean age 46y (18-79y)) started a 6 week online intervention for insomnia. The drop-out rate was 29%, leaving a final sample of 125 users. The intervention is based on well-established face-to-face CBT-I. Sleep diaries were used to determine changes in sleep efficiency, sleep onset latency and wake after sleep onset. Treatment effects were assesed after 6 weeks of treatment and at the 6 week follow-up.
Results: Significant improvement was found in all main sleep variables except for 5% decrease in total sleep time (TST). Effects were sustained at 6 week follow-up and TST increased. The use of hypnotics decreased significantly. This form of treatment seems to suit its users very well and over 94% would recommend the treatment.
Conclusion: Internet interventions for insomnia seem to have good potential. CBT-I will hopefully be offered as the first line treatment for chronic insomnia in Iceland instead of hypnotics as the availability of the CBT-I is growing. Thus, the burden on health care clinics might reduce along with the hypnotics use and the considerable costs of insomnia.

246 - **Cognitive behavioural therapy for insomnia among different types of shift workers**
Presented by: Heli Järnefelt

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Objectives: Because of irregular sleep-wake pattern shift work is a challenge in the diagnosis and treatment of chronic insomnia. However, our earlier results showed that cognitive behavioural treatment for insomnia (CBT-I) delivered by occupational health (OH) nurses may be effective treatment also among workers with irregular work hours. The aim of the present study is to compare the implementation and effectiveness of group and self-help based CBT-I in OH services in a randomized and controlled design (RCT) among different types of shift work.
Methods: Participants (n=90-120) will be shift workers with insomnia disorder that has lasted at least three months. The participants are randomized to
a) group-based CBT-I (6 group sessions); or
b) mainly computerized self-help CBT-I (an individual session before and after the intervention) delivered by a trained OH nurse or psychologist; or
c) control group given a sleep hygiene intervention (1 individual session).
Outcomes are assessed using a sleep diary, questionnaires, actigraphy and cognitive performance tests. To study the effect of CBT-I program at molecular level, blood samples of participants will be collected at baseline and at the end of the program for genetic analyses. The measurements are conducted at five time points for a period of two years.
Conclusions: We expect to find that both group and self-help based CBT-I among different types of shift workers are effective low-intensity treatments of chronic insomnia compared to control intervention. Through the training of OH or general practitioners and by computerised self-help interventions we can make CBT-I more accessible to a larger number of insomniacs also with different types of working hours. Additionally, it may be possible to decrease chronic insomnia and unfavourably consequences of insomnia to the health and performance capacity in shift workers.

245 - **Cognitive behavioral therapy for chronic insomnia in occupational health services: analyses of outcomes up to 36 months post-treatment**
Presented by: Heli Järnefelt

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Objectives: The purpose of this study is to examine effectiveness of cognitive behavioural therapy for insomnia (CBT-I) among daytime and shift workers over a 36-month follow-up in occupational health services (OHS). In addition, response patterns of participants over a follow-up period is presented.
Methods: The participants were 59 media workers with chronic insomnia, of whom 66 % were reached at 36-month follow-up. Sleep diaries and questionnaires over eight measurement points were used as outcomes. Trained OHS nurses led the CBT-I groups. The study design was a non-

randomized group intervention.
Results: Self-perceived severity of insomnia, sleep-related dysfunctional cognitions, and psychiatric symptoms in particular showed improvements over a 36-month follow-up among both daytime and shift workers. Based on the Insomnia Severity Index (ISI), 62 % of the participants showed a moderate improvement after CBT-I, whereas the remaining participants showed only a minor improvement.
Conclusions: Our results indicate that CBT-I delivered by OHS leads to long-term improvements regardless of working hour arrangements. Two groups were identified according to the degree of improvement of insomnia; one comprising two thirds of the participants with a moderate response and the other comprising one thirds of the participants with a modest response. The results need to be interpreted cautiously as insomnia of participants was on average mild, and the study design was non-randomized.

341 - **Optogenetic dissection of the MCH system: implications for sleep-state modulation**
Presented by: Antoine Adamantidis

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The hypothalamus consists of intermingled inhibitory and excitatory neural circuits. The activity of those circuits correlates with vigilance states, including wake, non-Rapid Eye Movement (REM) sleep or REM sleep. Neurons expressing Melanin-Concentrating Hormone (MCH) have been recently identified as possible sleep-promoting neurons; however, their selective modulation of NREM and REM sleep remain unclear. To investigate the role of MCH neurons modulation of sleep states, we first genetically targeted the expression of excitatory (ChETA) or inhibitory (eNpHR3.0) opsins to MCH neurons and showed that optical stimulations reliably activate or inhibit ChETA and eNpHR3.0-expressing MCH neurons, respectively. Using real-time detection of EEG/EMG, we found that bilateral optogenetic activation of MCH neurons during NREM sleep increased the probability of NREM-to-REM sleep transitions, while MCH neuron activation during REM sleep extended its duration. In contrast, we showed that optogenetic silencing of MCH neurons during REM sleep reduced the amplitude of cortical theta rhythm concomitant to an increase of slower oscillations in the range of (~ 4 Hz). Finally, optical activation of MCH terminals induced fast $GABA_A$-mediated inhibitory currents in local wake-promoting histaminergic (HA) neurons. This inhibitory tone was enhanced by optogenetically-induced MCH peptide release. Collectively, these results support a causal role for MCH neurons in the onset and maintenance of cortical REM sleep in the mammalian brain.

544 - **The targeted antidepressant effects of ketamine and the ‚Mammalian Target of Rapamycin' signaling pathway: preliminary data**
Presented by: Peter Sos

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Objectives: The discovery of the rapid antidepressant actions of ketamine represents a major advance in the field of psychiatry. One possible signaling pathway that has been targeted in antidepressant treatment is the mTOR (Mammalian Target of Rapamycin) pathway (Duman et al., 2012). Ketamine rapidly (within 30 min), but transiently increases the phosphorylation and activation of mTOR in the prefrontal cortex (PFC) of mice, leading to a delayed, but sustained induction of synaptic proteins with a time course (2 h to 7 d) (Li et al., 2010) similar to its therapeutic response (Sos et al., 2013). We hypothesized that deficits in the mTOR signaling pathway contribute to the molecular pathology seen in the PFC of MDD (major depressive disorder) patients, and that a rapid reversal of these abnormalities may underlie antidepressant activity.
Methods: In our study, we examined in cross-over design the expression of mTOR in the peripheral blood mononuclear cells of 21 depressed subjects before and after ketamine infusion using the K-LISA mTOR Activity Kit.
Results: Our findings show deficits in mTOR signaling pathway in MDD and indicate a potential

association between ketamine's antidepressant effects and the restoration of mTOR signaling in MDD.
Conclusions: Future research should investigate the involvement of the circadian clock in regulation of the mTOR signaling pathway in humans.
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402 - **REM density as potential predictor for the selection of depression therapy**
Presented by: Sara L. Weinhold

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Alteration of sleep quantity and quality are well known to occur in patients with major depressive disorder (MDD). Typically these patients have reduced total sleep time, reduced sleep efficiency, decreased REM sleep latency and increased REM density. Earlier studies already provided a relationship between abnormal sleep at baseline and poor treatment outcome. Markers for success of different therapies would be helpful for a tailored selection of treatment type on the one hand and for better understanding of the underlying mechanisms of depression on the other hand. Therefore our study aimed to investigate potential treatment outcome predicting measures in sleep.
We studied patients with MDD during an episode with a minimum Hamilton Depression Scale (HAMD) score of 18. Patients were randomly assigned to pharmacotherapy (selective serotonin or noradrenalin reuptake inhibiter, n=25) or interpersonal psychotherapy (ITP, n=13) for four weeks. Patients were subjected to standard polysomnography prior and after two and four weeks of therapy. Depression status was measured by Beck Depression Inventory and HAMD and subjective sleep quality by PSQI. To identify significant group differences, we performed two-factor univariate analysis of variances with the factors “treatment” (ITP/pharmacotherapy) and “treatment response” (responder/non-responder). Response was defined by a reduction in HAMD score of more than 50% four weeks after the therapies` beginning.
We included 38 patients (16 male, 13 outpatients). 10 patients of the pharmacotherapy and 5 patients of the ITP group were responders. At baseline responders in both groups had a significantly lower PSQI score than non-responder indicated by main effect of therapy response (p=0,026). Higher treatment response was associated with lower pre-treatment REM density in the ITP group and higher pre-treatment REM density in the pharmacotherapy group, shown by a significant interaction effect ($p< 0.05$, no main effects) and post hoc analysis.
Whereas a low PSQI score indicated a positive treatment outcome, independently of the chosen method, our study gave evidence that REM density might serve as predictive marker for treatment selection: In patients with high REM density, pharmacotherapy was more successful, whereas patients with low REM density in this study benefitted from ITP. Limitations of this study are the small sample size and the lack of control group without treatment.

140 - **Oxygen desaturation and beck depression inventory relationship in patients with obstructive sleep apnea syndrome**
Presented by: Sema Demir

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Objective: Sleep fragmentation occurs proportionally with the severity of disease in Obstructive Sleep Apnea Syndrome(OSAS) patients. Deep sleep decreases in patients. Depression increased incidence depending on poor sleep, cognitive impairment, the character and personality changes. Our aim in this study, we examined the relationship between oxygen desaturation and the Beck Depression

Index(BDI) in patients with OSAS.
Methods: It was a cross-sectional retrospective study. 219 patients that polysomnography (PSG) and Beck Depression Index records were made, were included . The age range of patients were in 18-78. OSAS and control groups were that 57 patients were mild OSAS(AHI:5-15);54 patients were moderate(AHI:15.1-30); 52 patients were severe(AHI:>30) and 56 patients were control group(AHI< 5). Exclusion criterions were major depression, other psychiatric disorders and to receive depression treatment when PSG recordings were made. The results of Beck Depression Inventory were evaluated according to the criterion that BDI:0-13 Normal; BDI:14-19 mild depression, BDI:20-28 moderate depression, BDI:>29 severe depression.
Results: The results of beck depression index were observed normal or mild depression at the all study population. The oxygen desaturation in patients with OSAS was increasing due to the severity of disease. But, between Beck depression index and the oxygen desaturation were no correlation in OSAS patients compared with control group.
Conclusion: Depression are common due to chronic insomnia and especially the fragmentation of sleep in OSAS. However, in our study, we observed that the patients with normal or mild depressive symptoms. Between Beck depression index and the oxygen desaturation was no correlation. Hypoxemia was not provoked depression,but was suggested in the mood changes that due to insufficient sleep and the reduction sleep depth.

401 - **Investigating the link between sleep, chronotype and adolescent self-harm behaviour**
Presented by: Kirsten H. Russell

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Objectives: Adolescent self-harm is a major public health concern worldwide and there is an urgent need to identify risk factors for the development of these behaviours. Evidence consistently suggests a link between sleep problems and self-harm behaviours in adolescents. However, very few studies have begun to look at the psychological mechanisms underlying this relationship and, to our knowledge; none have done so in adolescents. As a result, the current investigation intends to address this gap in the literature.
The overall objectives of this investigation are twofold:
1) Carry out a detailed prospective examination of the relationship between sleep problems, chronotype and self-harm/suicide behaviours in adolescents.
2) Begin to unravel the mechanism underlying the link between poor sleep and adolescent engagement in self-harm behaviours by exploring the contribution of theoretical constructs from prominent models of such behaviour.
Methods and materials: Fifteen and sixteen year old volunteers from secondary schools across Scotland will complete a modified version of the Child and Adolescent Self-Harm in Europe Survey at two time points, six months apart. Measures will assess sleep quality/timing, mood, lifetime engagement in self-harm/suicide behaviours and psychological variables that play a key role in prominent models of suicide behaviour including: defeat, entrapment and hopelessness.
Results: Data will be analysed using both univariate and multivariate logistic regression techniques. It is expected that both sleep quality and timing will be associated with an elevated risk for self-harm, suicidal ideation and suicidal behaviours.
Conclusions: It remains difficult to predict, with acceptable levels of specificity and sensitivity, which young people are at risk of self-harm. Highlighting the contribution of specific sleep parameters, and beginning to explore the mechanisms underlying the link may contribute to an enhanced understanding of adolescent self-harm, inform future research and, in the long term, aid in the development of prevention efforts and theory driven interventions.

643 - **Treatment of insomnia in patients with major depression disorder using cognitive behavioral therapy for insomnia - a randomised controlled study**
Presented by: Dyrberg Henny

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Insomnia is a problem among patients with affective disorders. Insomnia in patients with depression is related to higher levels of depression, increased risk of suicide and lower rates of remission (Kupfer

1987) We want to examine whether cognitive-behavioural therapy for insomnia (CBT-I) developed for individuals in the general population generalize to those with depression.
The aim of this study is to determine if patients with major depression can achieve improvement in sleep parameters and clinical level of depression.
Participants (N=48) are patients with major depression in an Outpatient clinic for affective disorders. Participants are assessed with clinical interview, polysomnograhic evaluation and screening with Insomnia Severity Index, Dysfunctional Beliefs About Sleep scale and Sleep Diary pre - and post treatment. Participants are randomly assigned to either treatment as usual or CBT-I. The latter receives an Add on treatment of 6 sessions with cognitive-behavioural group therapy. Treatment manual are based on material from Morin (2003) and Maroti et al. (2011)
The study starts in august 2015. We hope that the results will contribute to expand treatment options for patients with affective disorders. Furthermore we assume that focusing on treatment of insomnia could help avoid relapses to depression and hospitalization.

289 - **Sleep at baseline and after electroconvulsive therapy in patients with major depression**
Presented by: Robert Göder

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Objectives: Electroconvulsive therapy (ECT) is regarded as one of the most effective forms of treatment for major depressive disorder. The aim of the study was to look for sleep changes within the course of ECT and an association of REM-density at baseline and treatment outcome after ECT.
Methods: We studied 15 inpatients with an age range from 30 to 80 years. ECT was applied two times a week. Patients spent two nights in our sleep laboratory at baseline and after termination of ECT. ECT-remission was defined as a score < 8 on the 21-item Hamilton Rating Scale of Depression.
Results: The main results were:
(1) A higher REM-density of the first REM sleep period at baseline in ECT-remitters compared to non-remitters.
(2) Increases in sleep continuity and slow wave sleep in the course of ECT in all patients.
Conclusions: Sleep recordings before treatment may help to identify patients at risk of responding less well to ECT.

388 - **Emotions and perceptual anomalies mediate the relationship between sleep quality and paranoid thoughts: an analogue study**
Presented by: Aliyah Rehman

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Objectives: Psychotic like symptoms such as paranoia can be found in the general population suggesting continuum of experiences. Recent evidence suggests that sleep problems are predictive of paranoia. In two separate studies we sought to investigate the hypothesis that negative emotions and perceptual anomalies mediate the relationship between sleep quality and paranoia (Freeman et al., 2010). We also investigated additional emotion variables including positive affect and alexithymia.
Methods and materials: Participants in both studies were healthy volunteers who completed a series of questionnaires in an anonymous online survey.
Results: In study 1 (n=401) our hypothesis was supported; the relationship between sleep quality and paranoia was mediated by negative emotions and perceptual anomalies. A novel finding was that greater alexithymia (low levels of emotional awareness) predicted increased paranoia and mediated the relationship between sleep quality and paranoid thinking. In study 2 (n=402) we replicated these findings, increasing the robustness of our findings.
Conclusions: Sleep quality predicts paranoid thoughts and one of the mechanisms which drives this relationship is alexithymia. Alexithymia is a key construct that has been neglected in studies examining sleep, emotion and paranoia. Individuals who experience low levels of emotional awareness (high alexithymia) may be more at risk for experiencing paranoia and sleep problems. It is proposed that screening for patients with high alexithymia would help identify a vulnerable group of patients who may respond to treatment poorly. Improving sleep in such a group may be a possible intervention target.

396 - **The effect of sleep deprivation at home on memory of an analogue traumatic event**
Presented by: Kate Porcheret

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Objectives: To investigate, how total sleep deprivation at home immediately following an analogue traumatic event, effects the intrusive and explicit memory of that event, in healthy subjects.
Methods: Subjects (aged 18-35 yrs) where shown a traumatic film before either total sleep deprivation or normal sleep. Subjects were screened to ensure no personal history of psychiatric conditions, no smoking and no illicit drug intake. Polysomnographic and actigraphic recordings were conducted during the sleep/sleep deprivation period following the study film. Memory of the study film was assessed by self-reported intrusive memory frequency (over one week following trauma film) and visual and verbal memory recall (two days after then trauma film).
Results: This study is ongoing. The sleep deprived (SD: n=8) group showed significantly less sleep actigraphically on the night following the trauma film than the sleep (S: n=9) group. Currently a trend is found for the sleep deprived participants reporting fewer intrusive memories compared to the sleep group. No difference is seen for visual or verbal memory recall.
Conclusion: Our findings to date tentatively suggest that a period of sleep deprivation at home results in fewer intrusive memories to a trauma film being reported than sleep as normal. These findings support our previous findings that sleep deprivation in the lab results in fewer intrusive memories being reported (Porcheret et al Psychological Effect of an Analogue Traumatic Event Reduced by Sleep Deprivation, Sleep, In Press). Moreover our current data suggests that intrusive memories are differentially affected by sleep deprivation compared to explicit recall of the trauma film.

651 - **Sleep instability in frontotemporal dementia**
Presented by: Luca Carnicelli

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Background: Frontotemporal dementia (FTD) represents a major issue among neurodegenerative dementias, particularly in early-onset cases. Although sleep disorders significantly impair patients´ and caregivers´ quality of life in FTD as well as in other forms of neurodegenerative dementias, such as Alzheimer´s Disease (AD), polysomnographic (PSG) reports are very few in literature. Aim of our study was to investigate sleep microstructure, by means of Cyclic Alternating Pattern (CAP), in FTD. Methods and materials: Eleven behavioral variant FTD (6 M, 5 F; mean age 62.5 ± 8.6 years) underwent nocturnal sleep-lab based PSG for the evaluation of nocturnal sleep architecture and CAP parameters. Data obtained were compared with the relevant parameters obtained from age- and sex-matched mild to moderate AD, and cognitively intact elderly controls.
Results: Compared with healthy controls, nocturnal sleep was at least as much impaired as observed in AD,and in a shorter disease duration. Sleep macrostructure showed decreased total sleep time, and REM sleep, with increased light sleep and arousal index. Compared with healthy controls and AD, FTD subjects showed increased sleep instability (CAP rate, %= 55.3±13.9 vs 47.3±5.9 vs 26.9±9.2; $p< 0.05$), and CAP disruption most prominently involved slow wave activity related phases (A1, %: 19.5±6.9 vs 58.6±8.7 vs. 35.1±6.2; $p< 0.05$).
Conclusions: Sleep in FTD appeared at least as much disrupted as observed in AD, and in a shorter disease duration. Sleep impairment is obvious at both macrostructural and microstructural level, and may be specifically related to the specific frontal lobe involvement in the neurodegenerative process. These data suggest the potential role of sleep parameters, disrupted from the early phases of the disease, as in-vivo biomarkers, and confirm the importance of correctly address sleep, and its disorders, in individuals with neurodegenerative diseases.

275 - **A new EEG marker of Alzheimer's disease for the elderly based on sleep EEG**

Presented by: Po-Hao Huang

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The objective of this study is to develop a marker of Alzheimer's disease for the elderly using sleep EEG signals. An experiment was conducted on 18 subjects over 75 years old. Four of them were AD patients, and the remaining subjects were normal. The all-night sleep EEG signals were recorded from 8 scale electrodes for each patient. The signals were firstly transformed into the delta, theta, alpha, sigma, and beta band power time series. Observing the band power time series, it was found that the waveforms of the theta and alpha band power time series in the C3 channel looked similar for the Non-AD subjects. Such similarity did not exist for the subjects with AD. The similarity seemed to provide a clue to AD.
To measure the similarity, an index is proposed as follows: The theta and alpha band power time series are first normalized using the standard deviations of the amplitudes. Secondly, the theta band power time series is shifted vertically to match the alpha band power time series so that their Euclidean distance is minimal. The minimal Euclidean distance is then used as a measure of the similarity between the two band power time series.
The aforementioned index was computed for each of the 18 subjects. According to the Mann-Whitney U test, the similarity indices for the AD patients are significantly larger than the indices for the Non-AD subjects (p-value < 0.008). Hence, the similarity index between the theta and alpha band power time series seem to be able to develop into a marker of AD for the elders which is more advantages than conventional approach because only one channel measurement is required.

519 - **Bound to supine sleep: Parkinson's disease and the impact of nocturnal immobility**
Presented by: Philipp O. Valko

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Background: Impaired nocturnal mobility is a well-known problem in Parkinson's disease (PD), and clinical experience suggests a predominance of supine body position during sleep. However, this assumption - and potential consequences - still awaits objective validation by a polysomnography-based and adequately controlled study.
Methods: Clinical and polysomnographical analysis of 80 consecutive PD patients and 80 control subjects carefully matched for age, sex, body mass index and apnea-hypopnea index.
Results: PD patients slept twice as much in supine position than control subjects (62.2±32.9% vs. 34.2±28.5%, $p< 0.001$). In PD, but not in control subjects, more supine sleep correlated with fewer changes in body position (rho=-0.434, $p< 0.001$). Longer PD disease duration was an independent predictor of more supine sleep in multiple linear regression analysis (β=0.389, $p< 0.001$); conversely, more supine sleep was associated with higher apnea-hypopnea index and daytime sleepiness.
Conclusions: We confirmed that supine sleep is common in PD, and increases with longer disease duration. Our findings indicate that supine sleep may contribute to the overall disease burden by deteriorating sleep-disordered breathing and daytime vigilance.

409 - **Effect of bilateral subthalamic deep brain stimulation therapy on the sleep architecture of Parkinson disease patients**
Presented by: Béla Faludi

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Objectives: The Parkinson disease (PD) is well known representant of the movement disorder group of neurological disorders. The diagnosis of the PD is based on the specific symptoms and signs of the movement abnormalities. Beside the classic motor symptoms, PD has characteristic non-motor features, some of these emerges the classic signs. Sleep disorders are among the non-motor complaines. There are several new therapeutic approaches of PD including the electric stimulation of

the subthalamic nucleus bilaterally (deep brain stimulation, DBS). The main goal of the present study was to determine the effect of DBS therapy of PD patients on the sleep architecture and sleep related respiratory and movement events.
Methods and materials: Alltogether 14 patients with PD was examined. DBS therapy was applied according to the international guidelines. We performed three polysomnographic (PSG) examination in each patient: before the DBS implantation, after the implantation with switched off DBS and with effective DBS therapy. The overnight polysomnographic examinations were performed according to the gold standards.
Results: Our results showed the decreasement of wake after sleep onset time (WASO) and arousal index while the amount of N3 deep sleep stage increased postoperatively with effective DBS therapy. The changes of REM amount showed no any specific pattern according to the DBS therapy. The apnoe-hypopnoe index (AHI) and periodic limb movement index (PLMI) was unaffected or improved with DBS therapy
Conclusion: Our result underlines the effectiveness of DBS therapy on the restoration of sleep architecture in PD. The treatment achieves better sleep architecture through more continuous and deeper sleep with less nocturnal arousal, most likely due to decreased night time motor events, causing less sleep fragmentation. Beside the effect on the sleep architecture, DBS therapy does not aggravate sleep related breathing disorder, nor sleep related movement disorder. The inconsistent REM sleep change requires further examinations.

627 - **The use of melatonin for the treatment of REM sleep behavior disorder in Parkinson's disease**
Presented by: Michail Poluektov

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Background: REM sleep behavior disorder (RBD) characterized by the loss of the normal muscle atonia during REM sleep. Thus the patients appear to act out their dreams. Behaviors include yelling, laughing or crying, complex voluntary movements, falling out of bed, and even violent behaviors with injury. RBD is strongly associated with synuclein-associated neurodegenerative diseases such as Parkinson's disease (PD). This study aimed to estimate effectiveness and safety of melatonin treatment in RBD patients with PD.
Methods: 60 patients with RBD and 1-3 stages of PD were evaluated with detailed clinical history and neuropsychological examination before and after treatment. RBD was confirmed by polysomnography according AASM 2007 criteria. Clinical exam included RBD screening questionnaire (RBDSQ), UPDRS, H&Y, Schwab and England (S&E) scale, Parkinson´s disease Sleep Scale (PDSS), Epworth Sleep Scale (ESS), hospital anxiety and depression scale (HADS), Beck Depression Inventory (BDI) *and* Montreal Cognitive Assessment (MoCA) scale.
Results: The use of 3-6 mg of melatonin for 4 weeks leads to the reduction of RBD symptoms in 84% of patients. A small but significant reduction in daytime sleepiness (from 10.6±3.9 to 9.5±4.1 points on ESS, p=0.02), anxiety (from 7.0±3.9 to 6.3±3.8 points on HADS, p=0.02) and depression (from 15.7±7.5 to 12.9±7.2 points on BDI, p< 0.01) was observed.
Conclusion: These results indicate that circadian dysfunction may affect the severity of RBD, excessive daytime sleepiness and other nonmotor symptoms in PD. Treatment approach aimed to strengthen circadian clock with melatonin use is beneficial for RBD in PD patients.

664 - **REM sleep in Parkinsonian LRRK2 mutation carriers**
Presented by: Ana Martinez Zuluaga

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Introduction: The aim of this study was to compare REM sleep in PD symptomatic carriers of the LRRK2 mutations and idiopathic Parkinson´s disease (iPD) patients.
Material and methods: We studied PD patients: 16 with the LRRK2 mutation (9G2019S, 6 R1441G) and 14 with iPD.
All patients underwent video-polysomnography for 1or 2 nights.

Results: We didn´t identify REM sleep in 2 LRRK2 carriers and in 4 iPD. None of the LRRK2 carriers had REM sleep behavior disorder(RBD) and three of the iPD had clear RBD. Three of the patients with iPD and nine of the LRRK2 carriers had normal REM SLEEP.
Discussion: Carriers of the LRRK2 mutation had less REM sleep impairment than those with iPD.

156 - **Sleep and cognition in Parkinson's disease: a meta-analysis**
Presented by: Romola Bucks

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Objective: Whilst there is clear evidence that sleep disorders have neuropsychological consequences in otherwise healthy people, the relationship between sleep problems and cognition in Parkinson's disease (PD) is more mixed. This review aimed to meta-analyse PD research investigating sleep-cognition relations, and to explore factors which may explain these mixed results.
Methods and materials: A literature search was conducted of published and unpublished studies, resulting in 16 papers that met inclusion criteria. Data were analysed in the domains of: global cognitive function; memory (general, long-term verbal recognition, long-term verbal recall); and executive function (general, shifting, updating, inhibition, generativity, fluid reasoning).
Results: There was a significant effect of poor sleep on global cognitive function, long-term verbal recall, long-term verbal recognition, shifting, updating, generativity, and fluid reasoning (Table 1).
Conclusions: Although memory and executive dysfunction were associated with poor sleep in PD, the effects were driven by a small number of positive studies. Numerous methodological issues were identified. Further studies are needed to determine whether disturbed sleep impacts on cognition via mechanisms of hypoxia, hypercapnia, sleep fragmentation, chronic sleep debt or decreased REM and/or slow wave sleep in PD, as this may have important treatment implications.
Table 1. ***Mean overall effect sizes, confidence intervals and homogeneity statistics***

	Hedges' g	95% CI		Z	*p*
Domain		LL	UL		
Global Cognitive Function	0.33	0.11	0.55	2.95	<.01
Memory (General)	0.23	-0.59	0.12	-1.30	.20
Long Term Verbal Recall	0.51	0.24	0.77	3.79	<.01
Long Term Verbal Recognition	0.78	0.41	1.15	4.14	<.01
Executive Function (General)	0.10	-0.18	0.37	0.70	.49
Executive Function- Shifting	0.27	0.04	0.49	2.35	.02
Executive Function- Updating	0.59	0.25	0.93	3.36	<.01
Executive Function- Inhibition	0.47	-0.17	1.11	1.44	.15
Executive Function- Generativity	0.66	0.06	1.26	2.16	.03
Executive Function- Fluid Reasoning	0.49	0.05	0.92	2.21	.03
Visuospatial/Constructional	0.45	0.01	0.88	2.02	.04
Psychomotor Ability	0.05	-0.35	0.46	0.25	.81

[Table 1.]

The authors have no conflicts of interest to declare

526 - **Effects of sodium oxybate on neuropsychological and sleep wake disturbances in a patient with thalamic stroke**
Presented by: Ulker Kilic-Huck

U. Kilic-Huck[1,2], J. Hubbard[1,2], L. Weiner[1], I. Hubbard[2], E. Ruppert[1,2], L. Calvel[2], C. Schroder[2,3], M. Bataillard[1,2], L. Hugueny[1], P. Bourgin[1,2]
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Objectives: Our objective was to improve persistent attention disturbances two years after a thalamic stroke with intralaminar lesion by restoring slow wave sleep with sodium oxybate.
Methods and materials: A 41 yo male without medical history presented persistent attention disturbances and chronic asthenia following a thalamic stroke that occurred 2 years ago with a patent foramen oval. Millimetric MRI sections showed that the lesion was restricted to the intralaminar nuclei i.e. stuctures connected to the anterior cortex and the hippocampus and known to be involved in attention and memory processes. He underwent clinical examination, neuropsychological tests (focused on attention, memory, fluency and error control), questionnaires (sleep, daytime functionning, mood), actigraphic and polysomnographic recordings.
Sodium Oxybate was introduced at 4.5g/night and then progressively increased (6g after 12 weeks; 7.5g after 5 weeks; 9g after 10 weeks) with PSG monitoring for two days at each step.
The patient underwent neuropsychological testing before treatment and under 4.5g, 6g, 7.5g and 9 g of sodium oxybate (SO).
Results: First, we observed attention (sustained,divided and selective attentions) and working memory disturbances as well as an altered sleep architecture with lower slow wave sleep (SWS) amounts under baseline condition, and decreased homeostatic response (EEG delta activity assesment) after a 40 hours sleep deprivation (as compared to normative values in controls).
Under treatment, we observed a positive relationship between slow wave sleep amounts and the dose of sodium oxybate (13.2 minutes of SWS without treatment; 25.5min of SWS with 4.5g SO; 64 min of SWS with 6g SO; 88.8min of SWS with 9g). We also noticed a normalization of sustained attention, set shifting and working memory but still impaired selective and divided attentions. Clinically, the patient was improved and went back to work.
Conclusion: Thalamus infarcts, especially with intralaminar and dorsomedian lesion, are known to induce alterations of sleep architecture and cognitive impairments. We hypothesized that restoring slow wave sleep might lead to cognitive performance improvement. Our case study suggests that sodium oxybate can be a therapeutic response to long term cognitive impairment reported in patients with poor sleep quality after a thalamic stroke.

161 - **Relationship between gait and nocturnal oxygen saturation levels in stroke patients**
Presented by: Charlotte Edelsten

C. Edelsten[1,2,3], A. Saj[1,2], A. Coeytaux-Jackson[1], F. Assal[1], R. Sztajzel[1], S. Perrig[4], S. Armand[3], G. Allali[1,5]
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Objectives: Sleep apnea syndrome (SAS) and gait disorders are common after stroke, however the impact of SAS on gait disorders is still not known. This study aims to investigate the relationship between nocturnal oxygen saturation levels and gait parameters in stroke patients.
Methods and materials: Thirty eight individuals who had recently suffered a stroke (Mean±SD: Age 63.5 ± 13.5 yrs, BMI 27.2 ±4.9, months since stroke 4.6 ± 1.1, ODI 3% 12.3 ± 8.4) performed a gait analysis at self-selected speed over a 10m walkway and nocturnal oximetry was recorded over one night.
Results: Gait speed, swing time and stride length all showed significant correlations with Mean nocturnal O_2 saturation level ($r= .54$, $p< 0.01$, $r= -.75$, $p< 0.01$, $r=.39$, $p< 0.05$), and time spent at SpO2 < 88%
($r= -.44$, $p< 0.01$, $r= .69$, $p< 0.01$, $r= 0.33$, $p< 0.05$).
Conclusions: This study demonstrated the impact of decreased nocturnal oxygen saturation on gait in stroke patients. Clinically this is important as regaining independence post stroke is a key rehabilitation outcome, so any factor that could affect a key mobility outcome such as gait should be assessed and addressed in patients' treatment plan.

34 - **Prevalence of restless legs syndrome in adults with sickle cell disease**
Presented by: Siraj Wali

R. Alsaggaf[1], S. Wali[1], F. AlSayes[2], S. Batawy[3], L. Mukharesh[3], G. Batawi[3]
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Purpose: The purpose of this study is to determine the prevalence of restless legs syndrome (RLS) among adult patients with sickle cell disease (SCD) and compare it to non-SCD anemia patients.
Methods: This is a cross sectional study that was conducted from December 2013 - July 2014. Data was collected from patients attending the Hematology Clinics at King Abdulaziz University Hospital. Patients were of two groups; SCD and non-SCD anemia. Patients with secondary RLS, including that resulting from iron deficiency anemia, were excluded. All patients were individually interviewed and data was collected on the following: demographic features, clinical features, laboratory tests, the International Restless Leg Syndrome Study Group Criteria (IRLSG), International Restless Leg Syndrome Rating Scale, and daytime sleepiness using Epworth Sleepiness Scale (ESS).
Results: Eighty-nine patients were recruited, 44 of which were patients with SCD and 45 with other types of anemia. The two groups were comparable in age, gender, body mass index, smoking habit, and co-morbidities. The prevalence of RLS, severity of RLS and levels of daytime sleepiness were similar in both groups of patients, with no statistically significant differences. The prevalence of RLS among SCD patients and non-SCD anemia patients was 13.6% (6/44) and 8.8% (4/45) respectively, and the majority of patients had moderate to severe RLS. Daytime sleepiness was similar in both groups with the rate of excessive daytime sleepiness being 20.5 % and 17.8 % in SCD and non-SCD anemia groups respectively .
Conclusion: RLS is common in adult SCD patients, but as common as in other anemia patients. Moreover, its severity is similar in both groups. Based on previous epidemiological studies, the prevalence of RLS in SCD patients is similar to that in the general population.
Clinical implication: SCD patients are not at a higher risk of RLS than other anemia patients. However, expanded research is needed to compare the prevalence of RLS between SCD patients and the general population, and to understand the implications of RLS on SCD patients' health and quality of sleep.
Keywords: Restless leg syndrome, severity, Sickle cell disease, anemia.

35 - **Risk of obstructive sleep apnea among SCD adult patients**
Presented by: Siraj Wali

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[1]Sleep Medicine and Research Center, King Abduaziz University Hospital, [2]Internal Medicine Department, [3]Haematology Department, King Abdulaziz University Hospital, Jeddah, Saudi Arabia

Purpose: We aimed to investigate the prevalence of symptoms of obstructive sleep apnea (OSA) among adult patients with sickle cell disease (SCD).
Methods: This cross sectional - observational study was carried out at hematology clinics at King Abdulaziz University hospital, from December 2013 - July 2014. The prevalence of OSA was assessed using the Berlin questionnaire. The presence of daytime sleepiness was evaluated using the Epworth Sleepiness Scale (ESS). Data were also collected on the medical history, clinical, and laboratory findings of the patients.
Results: Participants included 106 patients. 44.3% were patients with Sickle cell disease and 55.7% were patients with other types of anemia and used as a control group. The overall prevalence of high risk of OSA patients was 12.3% (SCD patients, 6.6%; non-SCD patients, 5.7%). The prevalence of Excessive Daytime Sleepiness (EDS) was 9.4%. Multivariate analysis revealed that diabetes mellitus and obesity were the only comorbidities significantly associated with OSA ($P = 0.024$, and < 0.001 respectively). Daytime sleepiness was similar in both groups with the rate of those with excessive daytime sleepiness being 3.8 % in SCD and 5.7 % in other types of anemia.
Conclusion: Symptoms of OSA are common in adult SCD patients, but as common as in other anemia patients.
Clinical implication: Based on this study, SCD patients are not at a higher risk of OSA than other anemia patients. However, expanded research is needed to compare the prevalence of OSA between SCD patients and the general population, to determine the risk factors of OSA in SCD patients, and to understand the effects of OSA on SCD patients' health and quality of sleep.

Keywords: Prevalence, risk factors, Obstructive sleep apnea, Anemia, Sickle cell disease, polysomnography.

03.11.2015 - 08:30-10:30
Symposium: Hypertension in obstructive sleep apnoea. Mechanisms, epidemiology and treatment

696 - **Pharmacotherapy for hypertension in obstructive sleep apnoea: what are the best antihypertensive treatment approaches?**
Presented by: Craig L. Phillips

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Epidemiological studies and numerous randomised controlled trials provide strong evidence that OSA is an independent cause of hypertension. Although OSA treatment has been proven to lower blood pressure, the effects are modest, and the higher than expected prevalence of OSA amongst patients with resistant hypertension indicates that OSA is a major barrier to effective treatment. Pharmacotherapy remains the most effective treatment for hypertension in OSA however there is still very limited evidence to indicate which class of antihypertensive is superior. Chronotherapy for hypertension involving ingestion of medication at night instead of the morning has recently been shown to have powerful blood pressure lowering effects in patients with essential hypertension. This discussion will include new data from a recently completed randomised trial which tested the chronotherapeutic effectiveness of nocturnal administration of an ACE inhibitor to lower blood pressure in patients with moderate-severe OSA and co-morbid grade I/II hypertension.

03.11.2015 - 08:30-09:30
Sleep Functions and Pathologies in Rodents

660 - **Evaluation of the effect of REM sleep reduction on the active avoidance learning in rats**
Presented by: Lia Maisuradze

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Introduction: REM sleep reduction performed through various methods is often used to investigate REM sleep role in memory processing. It is known that antidepressants decrease REM sleep and increase slow wave sleep in both human and animals. However, reports on the relationship between learning and REM sleep are quite different. Therefore we studied the effects of amitriptyline on the learning and memory in rats.
Methods: 24 adult rats (weight 250-300 g) were divided in two groups: control - injected with Saline and experimental - with amitryptyline (5 mg/kg) administration. Third group of animals (n=12) were 'depressive' rats selected by Porsolt Swim Test, also treated with amitriptyline. Two way active avoidance (AA) was used as learning test. The acquisition of AA was performed in multi-session (20 trials per session) or one-session (120 trials) before (Experiment 1) or following (Experiment 2) administration of compounds. All groups were examined for AA learning and retention. The learning criterion was nine successive avoidance reactions on the sound signal. Retention session was performed following 24 hr after acquisition. The difference between groups was verified by Student's *t-test*.
Results: REM sleep reduction trough the amitriptyline administration did not delay learning process of AA. Amitriptyline injection prior to the AA acquisition session facilitated achievement of learning criterion in 'depressive 'rats, i.e. they reached learning criterion faster than control group of animals; however, statistically significant difference between these groups was not found in the retention session. REM sleep lack in memory consolidation phase had no negative effect on the remembering of acquired AA. The rats with REM sleep expected rebound did not differ from other animals in testing or retention sessions.
Conclusion: The assessment of these findings allows us to suggest that REM sleep suppression did not disturb learning processes or memory consolidation. It seems that slow wave sleep is more

important for memory processing than REM sleep.

646 - **Paradoxical sleep (REM sleep) homeostatic regulation in a mouse model of narcolepsy with cataplexy**
Presented by: Christelle Peyron

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Objectives: The symptomatology of narcolepsy suggests an impaired REM Sleep (REMS) regulation, as seen by the presence of cataplexy, sleep paralysis and sleep-onset into REMS (SOREM). To our knowledge, only one study conducted with 6 narcoleptic patients has ever looked at REMS homeostatic regulation (Vu et al., 2009), and none were done on narcoleptic mice.
Method: Here, we looked at the homeostatic regulation of REMS in orexin/hypocretin Knockout narcoleptic mouse (KO) by specifically REMS depriving them for 48hrs using platforms-over-water technique and analyzing the following recovery period. We compared the effect of REM deprivation in KO (n=9) versus C57Bl6 wild-type (WT, n=13) mice.
Results: During the recovery period, KO mice showed a REMS rebound similar to wild type mice (WT) indicating that REMS homeostatic regulation is maintained in KO. However, REMS latency during recovery is much shorter in KO (20 ± 4.2min) than WT (113 ± 5.6min). As it could be due to a higher REMS pressure, we used our newly developed automatic REMS deprivation method to objectively evaluate it (Libourel et al, 2014). When REMS is detected, a TTL-signal is sent by the computer to the cage floor to move it up and wake-up the mouse.
Interestingly, KO were stimulated more often (782.3 ± 60.7) than WT (367.6±42.0) revealing a stronger need to enter REMS, therefore a stronger REMS pressure. Furthermore, WT mice showed a higher REMS pressure during the light phase than the dark phase in accordance to the well-established REMS circadian distribution. KO mice however accumulated REMS pressure similarly during the light and the dark phase and similarly to WT mice during the light phase.
Conclusion: These findings may reflect a lack of inhibition of REMS during the dark phase in KO mice.
References:
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192 - **Hypersomniac feature in mice with high trait anxiety is due to an imbalance of orexin and melanin-concentrating hormone systems**
Presented by: Mayumi Kimura

M. Kimura, M. Gazea, M.L. Curzi, C. Flachskamm, V. Jakubcakova
Max Planck Institute of Psychiatry, Munich, Germany

Objectives: Impaired sleep is a common symptom of many psychiatric diseases. Compared with depression, however, altered sleep profiles in anxiety disorders have been yet undefined because of a wide spectrum of the diseases. Recently, we conducted sleep recordings in a mouse model of extremes in trait anxiety and found that the mouse line showing high-anxiety related behaviour (HAB) spent remarkably more time in REM and non-REM sleep than the other lines. Previously, elevation of arginine vasopressin (AVP) was discovered in the hypothalamus of the HAB line, supporting its increased stress-related behaviour. However, AVP does not likely account for hypersomnia, therefore, there might be another mechanism underlying such a sleep phenotype. In the present study, we hypothesized that (1) arousal regulation would have malfunctioned in HAB mice and (2) the orexin system was affected.
Methods: Two extreme lines of a robust mouse model of trait anxiety, *i.e.* with high (HAB) and low (LAB) anxiety-related behaviour, were used. For orexin immunohistochemistry, brain slices were prepared from animals sacrificed at dark onset. To analyse the release of orexin, a microdialysis probe was implanted into the lateral hypothalamus, and the hourly concentration of orexin in the dialysates was determined by radioimmunoassay. In addition, extra brain slices were used for *in situ* hybridization for measuring the expression of orexin as well as melanin-concentrating hormone (MCH)

mRNA.
Results: HAB mice, compared with LAB, displayed a significantly lower number of orexin-immunoactive cells during the peak time of orexin neuronal activity. Concomitantly, the release of orexin from the lateral hypothalamus was also lower in HAB mice, whereas LAB mice showed a circadian variation of its release as reported earlier. However, mRNA levels of orexin were not different between the two lines. By contrast, MCH mRNA was more expressed in HAB mice.
Conclusions: The results demonstrate that the activity of the wake-promoting orexin system was reduced in HAB mice, although the system itself was not impaired. Reduced orexin signals could be caused by a disproportional amount of MCH in this model. Since MCH is anxiogenic and sleep-promoting (especially REM sleep), anxiety with hypersomnia in HAB mice might be attributed to both MCH and MCH-suppressed orexin activity.

299 - **Characterisation of the emergence of sleep disturbances in the unpredictable chronic mild stress murine model of major depression**
Presented by: Mathieu Nollet

M. Nollet[1,2], G. Stenson[1], B. Martynhak[1], K. Wafford[2], D.-J. Dijk[1], R. Winsky-Sommerer[1]
[1]Surrey Sleep Research Centre, Faculty of Health and Medical Sciences, University of Surrey, Guildford, [2]Lilly Research Centre, Erl Wood Manor, Eli Lilly and Company, Windlesham, United Kingdom

Objectives: While there is evidence of a bidirectional relationship between sleep disturbances and major depression (MD), this relationship remains poorly understood. Indeed, insomnia is a recognised risk factor in MD. Alterations in sleep, such as decreased amount of non-REM sleep (NREMS) and increase in REM sleep (REMS), are commonly observed in MD. However, little is known about the emergence of sleep disturbances in MD. The aim of this study was to characterise sleep alterations in an established murine model of MD and compare the emergence of sleep abnormalities to the time-course of the depressive-like symptoms.
Methods: BALB/c mice (18 weeks old) were subjected to a 9-week unpredictable chronic mild stress (UCMS) paradigm, consisting of daily exposure to social and environmental mild intensity stressors applied in a randomised manner. Physical, behavioural and endocrinal parameters were assessed in the UCMS-subjected group and compared with an undisturbed control group (n=9/group). Electroencephalogram/electromyogram (EEG/EMG) recordings were performed at various time-points during the 9-week paradigm (24-h recordings) to characterise the UCMS-induced changes in sleep architecture.
Results: The UCMS paradigm induced a decrease of self-care and motivational behaviour respectively after 1 and 2 weeks of UCMS, which is characteristic of a depressive-like disorder. In addition, alterations in the hypothalamic-pituitary-adrenal axis functioning was observed after 2 weeks of UCMS. The UCMS also induced a reduction in locomotor activity during the active (dark) period after 4 weeks. EEG/EMG analyses showed a decrease in total sleep time during the inactive (light) period after 4 weeks of UCMS. The UCMS also induced an increase in REMS and a decrease in NREMS in both light and dark periods; these alterations occurred after 3 days and 1 week of UCMS in the light and dark periods respectively, and were sustained throughout the UCMS regimen.
Conclusions: The UCMS paradigm induces changes in sleep which are observed in MD. The current study suggests that sleep abnormalities constitute precursor symptoms in the UCMS-induced depressive-like state and the UCMS paradigm is a promising translational model of the emergence of sleep disturbances in MD. As current antidepressants are only effective in one third of depressed patients, the use of this translational model could accelerate the development of more effective drugs to treat MD and associated sleep disturbances.

03.11.2015 - 09:30-10:30
Sleep Cognition in Children and Adolescence

137 - **The effects of prolonged sleep restriction on adolescents' sustained attention, response times, and subjective sleepiness**
Presented by: Alex Agostini

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Objectives: Adolescents often do not obtain adequate sleep. Changes in both biological and psychosocial factors result in later bedtimes, while rise times are held constant to allow for school attendance. This can lead to a chronic sleep debt, which may have negative effects on alertness and performance. This research was conducted to assess the time course and severity of adolescents' performance and alertness deficits caused by five consecutive nights of sleep restricted to five hours.
Methods and materials: Twelve (six male) secondary school students aged 15-17y (M=16.08, SD=0.9) participated in a ten-day laboratory study. After one adaptation night and one baseline (BSLN) night (10h time in bed [TIB]), TIB was restricted to 5h for five nights, followed by two recovery (REC) nights (10h TIB). A 10min Psychomotor Vigilance Task (PVT) and the Karolinska Sleepiness Scale (KSS) were completed 5 times per day at 3h-intervals starting 1h after waking.
Results: Mixed model analyses assessed the effect of sleep condition and time of day on PVT performance and KSS scores. Significant main effects of sleep condition for PVT lapses ($F(8,484)=16.53$, $p< .001$), and fastest 10% of responses ($F(8,484)=19.25$, $p< .001$) and KSS scores ($F(8,481)=48.79$, $p< .001$) were found. All three variables showed deterioration from SR1 to SR5. While subjective sleepiness returned to BSLN levels at REC, PVT lapses and fastest 10% did not. Significant time of day effects were found for PVT lapses ($F(4,484)=4.20$, $p=.002$) and fastest 10% of responses ($F(4,484)=2.67$, $p=.031$), indicating that performance was at its worst at the first test of the day (0830). The opposite effect was found for KSS scores, with greatest subjective sleepiness found at the end of the day (2030; $F(4,481)=4.81$, $p=.001$).
Conclusions: Sleep restriction is detrimental to adolescents' response times, sustained attention and perceived sleepiness. Across a school week, adolescents may accumulate a substantial sleep debt that may have negative implications for school performance. Adolescents may not be fully aware of their diminished performance, as the time of day at which they feel sleepiest does not correspond to the time of day at which their performance is at its worst. Furthermore, weekend recovery sleep may be inadequate to overcome deficits incurred.

359 - **Sleep restriction impairs vocabulary learning in adolescents: the need for sleep study**
Presented by: Joshua Gooley

S. Huang, A. Deshpande, S.-C. Yeo, J. Lo, M. Chee, J. Gooley
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Objectives: Sleep is thought to facilitative memory consolidation, but few studies have explored the impact of sleep restriction on learning and forgetting. Here, we examined the role of sleep and study spacing on vocabulary learning in adolescents.
Methods and materials: In a between-subjects study carried out at a boarding school, adolescents aged 15-19 years were exposed to a week with either 5h (n = 30) or 9h (n = 26 after exclusions) of time in bed for sleep each night. Subjects completed a vocabulary learning task in which they studied 40 GRE-level English words using digital flashcards. All flashcards were shown 8 times, but study spacing was manipulated such that half of the word pairs were shown twice each day over 4 consecutive days (spaced studying), whereas the other word pairs were shown 8 times during a single study session with 5 different cards shown each day (massed studying). Cued recall performance was assessed after each study session, and also 24h and 120h after learning.
Results: There was a significant interaction between study spacing and time in bed for sleep, such that cued recall performance on massed items was impaired by a greater amount in individuals exposed to sleep restriction (F = 8.4, P < 0.01). By comparison, performance on spaced items was similar between sleep groups. Across all retention intervals (0h, 24h, and 120h), the spacing effect was about twice as great for students with 5h of time in bed per night, indicating that students who slept less benefited more by increased study spacing.
Conclusions: The effects of study spacing on vocabulary learning were modulated by time in bed for sleep. Students who underwent sleep restriction showed a reduced ability to learn massed items, but not spaced items. These results highlight the importance of combining good study habits and good sleep habits to optimize learning outcomes.

570 - **Working memory training in children with periventricular leukomalacia: insights from sleep electrophysiology**
Presented by: Tommaso Banfi

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Background: High Density (hd) EEG during sleep has been successfully applied to the investigation of cortical maturation. More specifically NREM sleep SWA (slow wave activity) topography has emerged as a promising marker of plastic events occurring across development. More recently a few studies have applied hdEEG during nocturnal sleep in children with neurodevelopmental disorders. Still, nocturnal sleep hdEEG monitoring is a rather costly procedure. Here we have implemented a mid-afternoon napping paradigm, preceding and following five weeks of a working memory training in children with Periventricular Leukomalacia (PVL).
Methods and materials: Thirteen children (age: 5.8±2.1 years; 7 female) underwent the Cogmed Working Memory training and a neuropsychological evaluation at NEPSY-II. hdEEG recordings were scheduled at three time points:
a) T0 6 weeks before the beginning (n=5),
b) T1 at the beginning (n=13) and
c) T2 right after the training conclusion (n=13). hdEEGs were visually scored.
Only NREM sleep N3 epochs were included in the analysis. Frequency bands of particular interest were identified (SWA 1-4.5Hz, alpha 8-10Hz, sigma 10-15Hz). After ICA-based artifact rejection and topographic spectral analysis computation for each session, we computed the difference between maps at baseline (T1-T0) and after the training (T2-T1), for time-windows matched to the shortest across sessions.
Results: Mean baseline sleep duration (T0-T1) was 55,5±9,9 min versus 54,3±12,0 min at T2, while NREM sleep stage N3 mean duration was 30,27±8,91min at baseline and 28,8±9,7 min at T2. We found a significant positive correlation between the improvement achieved in visual memory and manual motor tasks (Memory for design p=0.02, r=0.67; Imitation hand position (p=0.03, r=0.62) and the SWA change between T2 and T1, in two clusters of electrodes at the frontal and occipital area respectively. These relations proved to be frequency-specific for the SWA band, and did not emerge in the comparison between the two baselines.
Conclusions: We found a positive correlation between the improvement of specific neuropsychological functions, known to be impaired in PVL children, and the change in the SWA band localized to areas functionally connected with these tasks. This evidence suggests that a cortical reorganization process takes place across the training and that such a reorganization can be tracked by electrophysiological hdEEG traces, recorded during daytime napping.

03.11.2015 - 11:00-13:00
Symposium: Sleep and daytime function in developmental disorders

694 - **Sleep and obstructive sleep apnoea - correlates with temperament and behaviour in 201 young children with Down syndrome**
Presented by: Catherine Hill

C.M. Hill[1], *H. Elphick*[2], *H. Evans*[3], *M. Farquhar*[4], *P. Gringras*[4]
[1]Clinical Experimental Sciences Division, University of Southampton/Southampton Children's Hospital, Southampton, [2]Respiratory Medicine, Sheffield Children's Hospital, Sheffield, [3]Respiratory Medicine, Southampton Children's Hospital, Southampton, [4]Children's Sleep Medicine, Evelina Children's Hospital, London, United Kingdom

Down syndrome (DS) is a leading genetic cause of childhood intellectual disability. Life-expectancy in the first world has dramatically improved such that today's children will live to middle age and beyond (Bittles, 2006) and many will experience dementia. Optimising early cognitive development is critical. Obstructive sleep apnoea (OSA) affects a significant number of DS children. De Miguel-Diez (2003) reported rates of OSA, defined by obstructive apnoea/hypopnoea index (OAHI) >2, of 64.8% with a higher frequency in boys and young children. While it is well established that OSA causes impaired attention, learning and school performance in typically developing children, less is known about the effects of OSA in DS. Our multi-centre study has established a young cohort of DS children with the aim of studying sleep, cognition and behaviour over time. Baseline characterisation of OSA status using cardiorespiratory polygraphy (Somnotouch, S-Med) and pulse oximetry (Masimo) in 183/201 children (mean age 35.7 months, range: 6-72; 102 male) demonstrated OSA (OAHI > 2/hour) in 43%.

There was no correlation between OAHI and BMI, age in months or gender. Sleep behaviours have been characterised using the Composite sleep score (Quine), Child Sleep Habits questionnaire (Owens) and Infant Sleep Questionnaire (Sadeh). Behaviour (Strengths and Difficulties questionnaire); temperamental characteristics (Rothbart scales) and parent report of executive function (BRIEF-p) measures will be reported in relation to sleep and OSA. Children with DS and OSA have limited cognitive reserve to compensate for OSA related neural insult and some authors have indicated that OSA may be a risk factor for the development of dementia in later life (Fernandez, 2013). Understanding the contribution of sleep and OSA to cognitive development/decline in this population in an important research goal.

562 - **Obstructive sleep apnoea and behavioural and emotional disturbances in adults with Down syndrome**
Presented by: Elisabeth Hill

E.A. Hill[1], D.M. Fairley[1], L.J. Williams[2], S. Van Putten[3], S.-A. Cooper[4], R.L. Riha[1]
[1]Sleep Research Unit, [2]Division of Community Health Sciences, University of Edinburgh, [3]Down's Syndrome Scotland, Edinburgh, [4]Department of Health and Wellbeing, University of Glasgow, Glasgow, United Kingdom

Objectives: Individuals with Down syndrome (DS) are predisposed to obstructive sleep apnoea (OSA) due to overlap between the DS phenotype and OSA risk factors. This study aimed to assess prevalence of OSA, behavioural/emotional disturbances and the effect of continuous positive airway pressure (CPAP) in an adult DS population.
Methods: Standard questionnaires including pictorial Epworth Sleepiness Scale (pESS; Ghiassi et al, Thorax 2010) and Developmental Behaviour Checklist for Adults (DBC-A; Einfeld & Tonge, J. Autism Dev. Disord. 1995) were sent to UK adults aged ≥16yr with DS and their caregivers. Responders were invited to have a home sleep study. Symptomatic individuals with ≥10 apnoeas/hypopnoeas per hour in bed (AH/hr) were randomised to CPAP or lifestyle advice, with review at 1, 3, 6 and 12m. The lifestyle group were offered CPAP at 1m. Standard measurements were undertaken, including cognitive function tests (Edgin, J.O. et al, J Neurodevelop Disord 2010; 2:149-164).
Results: Of 5266 questionnaires sent, 1093 responses were valid (21%). Responders (54% males) were overweight/obese young adults: BMI 29.0±6.9kg/m^2, age 28±9 years. Women had a higher BMI ($p< 0.001$), but collar size was greater in men ($p< 0.001$). Men were sleepier than women ($p=0.02$). Mean pESS scores were mainly within the normal range (7±5/24), with 23% reporting pESS>10/24. No significant gender differences in OSA symptoms were noted. OSA prevalence was estimated at 19-21%. Individuals with probable OSA had higher DBC-A Disruptive, Anxiety/Antisocial and Depressive DBC-A scores. The treatment study included 28 adults with DS (19 male): age 28±9yr; BMI 31.5±7.9kg/m^2; collar 41.5±4.9cm; AH/hr 39.6±32.2; pESS 11±6/24. Groups did not differ significantly at baseline. By 12 months, 3 participants had withdrawn, with all remaining participants on CPAP. Patient ($p=0.001$) and carer ($p=0.029$) pESS, Disruptive ($p< 0.0001$), Anxiety/antisocial ($p=0.024$) and Depressive ($p=0.008$) scores were reduced.
Conclusions: In this first large-scale study in adults with DS, OSA prevalence was estimated at 20%, ~4 times higher than in the general adult population. CPAP use led to significant improvements in sleepiness and behavioural/emotional outcomes at 12 months. A larger trial of CPAP in this population is warranted.
Acknowledgements: Chief Scientist Office, Scotland; Fondation Jérôme Lejeune; Baily Thomas Trust; Down's Syndrome Scotland; Down's Heart Group; Down's Syndrome Association; Sleep Scotland

617 - **Defining the relation between sleep and the cognitive phenotype of individuals with Down syndrome: a lifespan developmental perspective**
Presented by: Goffredina Spano

G. Spano, B. Demara, J.O. Edgin
University of Arizona, Tucson, AZ, United States

Sleep disruption may be an important factor relating to individual differences in cognition in Down syndrome (DS). In Breslin et al. (2014) we examined the relation between Obstructive Sleep Apnea Syndrome (OSAS) and cognitive outcomes on the Arizona Cognitive Test Battery for Down syndrome (Edgin et al., 2010) in school-age children with DS, ages 7-12 years. Our findings show that children

with DS with comorbid OSAS had impaired executive function and a verbal IQ nine points lower than those without apnea. These results are unique because we compared children of the same age and background factors who differed only on OSAS status, defined by polysomnography, the gold standard of sleep assessment. OSAS has also been reported to be prevalent in early infancy and childhood in this population (Goffinski et al., 2015), and this poor sleep could disturb the early stages of cognitive and language development. In a study conducted in toddlers, Edgin et al. (in press, *Child Development*) examined language and behavioral development in relation to actigraphy-derived sleep patterns in young children with DS (ages 2-5 years), finding that children with sleep disruption had impaired expressive language in comparison to peers that were sleeping well. Taken together, these findings suggest that across development, sleep disturbances seem to exacerbate cognitive impairments in this population.
Based on these studies, I discuss the candidate mechanisms underlying these associations, including the potential for sleep disruption to disturb periods of deep sleep (i.e., slow wave sleep) that are necessary for memory consolidation. As such, even when individuals with DS can overcome encoding difficulties to learn new information (i.e., through more repetitions), they may be unable to consolidate information across sleep periods. I expand to discuss new avenues for understanding links between cognition and sleep in DS, including preliminary data from a study of sleep-dependent learning in toddlers with and without DS. While previous research has often suggested instability in knowledge acquisition (Wishart et al., 1993) in this population, more work is needed to define the specific mechanisms underlying delayed loss of learned materials. Defining these mechanisms could guide novel treatment approaches for cognitive and language dysfunction in DS.

685 - **Cross-syndrome comparison of sleep related learning in children with Williams syndrome and ADHD**
Presented by: Frances Knight

D. Dimitriou, F. Knigh
UCL-IoE, London, United Kingdom

There is now compelling evidence that sleep plays a key role in the ability to form and retrieve certain types of memories. Children with developmental disorders experience considerable problems with sleep and also with learning; yet scarcely any studies have investigated this relationship. I will present findings from our cross-syndrome comparison studies, which focus on sleep-dependent learning in children with developmental disorders, namely, ADHD, Down syndrome, and Williams syndrome. Results show that sleep problems are specific for different clinical groups as well as learning profiles show different developmental trajectories. Our current findings have significant implications for educational strategies, which I shall discuss.

03.11.2015 - 11:00-13:00
Symposium: Effective strategies to increase social awareness about sleep

184 - **Qualification of health professionals as a social and political awareness about sleep**
Presented by: Lenise Jihe Kim

L.J. Kim
Psicobiologia, Universidade Federal de São Paulo, São Paulo, Brazil

It is widely known about the impact of sleep disturbances on several physiological parameters, comprising cognitive and metabolic alterations. Besides the scientific challenge to understand how sleep impairs patients' quality of life, the other challenge is how to educate the health professionals, promoting strategies to provide a better sleep quality in the general population. In this sense, the present lecture aims to discuss about the importance of sleep education in the curriculum of health professionals. For this purpose, the experience of the Sleep Institute, the main diagnostic and research center in Brazil, in the qualification of health professionals, researchers training, and scientific production will illustrate the rationale of the talk. In addition, the political and social applicability of sleep knowledge will be highlighted.
Acknowledgements: Associação Fundo de Incentivo à Pesquisa (AFIP) and São Paulo Research Foundation (FAPESP) [#2013/14420-1].

03.11.2015 - 11:00-13:00
Sleep and Mental Health

383 - **Poor sleep quality and depressive disorders in adolescents and young adults: a focus on inhibitory control ability**
Presented by: Mark Lawrence Wong

M.L. Wong[1], E.Y.Y. Lau[1], Y.K. Wing[2]
[1]Department of Psychology, University of Hong Kong, [2]Department of Psychiatry, Chinese University of Hong Kong, Hong Kong, Hong Kong

Objectives: Recent studies showed that sleep disturbances predicted depression prospectively while the underlying mechanisms were not well-studied. Neuroscience literature showed that sleep loss and sleep physiology were related to individual's prefrontal cortex activity and inhibitory control ability. We investigated if sleep disturbances predicted depressive disorders though its impact on lowering individual's inhibitory control ability.
Methods and materials: Participants (n=166, 17-24 years, 66% female) completed the Structured Clinical Interview for DSM-IV Disorders, Affective Go/No-Go task for inhibitory control ability, Pittsburgh Sleep Quality Index, PSQI, and wore an actigraph-watch for 7 days for two assessment time-points separated by 12 months. Structural equation modeling was used to test if poor sleep quality predicted depressive disorders and whether the effect was mediated by inhibitory control ability.
Results: Results from structural equation modeling showed that after adjusting for the effect of depressive disorders at the first assessment time-point, poor sleep quality (PSQI>5) had a significant direct effect on the development of depressive disorders at follow-up, *OR*=4.60, estimate=1.54, standard error=.62, *p*=.019, and also indirectly predicted depressive disorders through lower inhibitory control ability, *OR* =1.14, estimate=1.14, standard error=.11, *p*=.038, and the model achieved good fit index, $x^2(4)=27.32$, *p*=.0006.
Conclusion: While adolescence and young adulthood were the sensitive periods for the neurodevelopment of the prefrontal cortex, sleep problems and depressive disorders were also highly prevalent. We provided empirical evidences to explain that poor sleep predicted depressive disorders through lowering inhibitory control ability. Sleep problems and inhibitory control ability were potential targets for prevention and treatment of depressive disorders among adolescents and young adults.
Acknowledgement: This study is funded by the Health and Medical Research Fund (#11122051), Food and Health Bureau, HKSAR

193 - **Cordance and REM density derived from REM sleep as biomarker for treatment response in depression after antidepressant medication - a follow-up study**
Presented by: Axel Steiger

M. Pawlowski[1], M. Adamczyk[1], M. Gazea[1], M. Dresler[1,2], A. Steiger[1]
[1]Max Planck Institute of Psychiatry, Munich, Germany, [2]Donders Institute, Nijmegen, The Netherlands

Objectives: Cordance is known as a biomarker of treatment outcome in depression , invented for resting-state EEG and based on minimum 19 EEG channels. REM densitiy (REMd) is based on EOG channels during REM sleep only and showed likewise predictive potential . A combination of cordance and REMd is not known yet. Our aim was to evaluate whether prefrontal cordance in theta frequency band derived from REM sleep EEG and/or REMd derived from REM sleep EOG after the first week of antidepressant medication predicts the treatment response after 4 weeks of drug therapy in depressed patients.
Methods: 33 in-patients (22 females, 13 males) with a depressive episode were recruited. Patients were treated with various antidepressants at doctor´s choice. Response to treatment was defined as a ≥ 50% reduction of HAM-D score at the end of four weeks of active medication. Sleep EEG of patients was recorded after the first and the fourth week of medication. Cordance was computed for prefrontal EEG channels in theta frequency band during tonic REM sleep. REMd was calculated as an index regarding EOG channels during REM sleep reflecting rapid eye movement intensity.
Results: This follow-up study corroborates our previous findings (Adamczyk et al 2015). The group of 14 responders had significantly higher prefrontal theta cordance in relation to the group of 21 non-responders after the first week of antidepressant medication (P< .001). Furthermore, prefrontal cordance of all patients showed significant positive correlation (r=.55; P< .001) with the improvement of HAM-D score between the inclusion week and fourth week of medication. REMd alone showed no

significant difference between responders and non-responders (P=.013), whereas the combination of cordance and REMd showed a better positive predictive value of therapy response (93 %) than cordance alone.
Conclusions: Our results suggest that prefrontal cordance alone or combined with REM density provides a biomarker for the response to antidepressant treatment.

343 - **A randomised controlled trial evaluating the effect of adjunctive internet-delivered cognitive behavioural therapy insomnia program (CBTi) in older men with comorbid depression and insomnia**
Presented by: Nick Glozier

N. Glozier[1], H. Christensen[2], F. Thorndike[3], K. Griffiths[4], S. Naismith[5], I. Hickie[5], L. Ritterband[3]
[1]BMRI, University of Sydney, [2]Black Dog Institute, Sydney, NSW, Australia, [3]University of Virginia, Charlottesville, VA, United States, [4]Australian National University, Canberra, ACT, [5]University of Sydney, Sydney, NSW, Australia

Objective: Internet based treatments for psychological and behavioural conditions are currently viewed as either an alternative to care or as the first stage in a stepped care approach. This is the first study to evaluate a systematic integration of an adjunctive internet based treatment with psychiatric care.
Method: A pilot randomised controlled trial (RCT) of adjunctive internet based treatment for insomnia (SHUTi) vs an attention control of internet delivered sleep health information in older men with comorbid mood disorders and insomnia all of whom were commencing guideline based treatment for depression.
Results: We recruited 87 older men with, predominantly chronic, Major Depression or Dysthymia, and comorbid insomniain commencing psychiatrist coordinated treatment for depression. Over the three month treatment period self reported depression and insomnia improved in the participants in both arms. In LOCF analysis adjunctive SHUTi resulted in a small, but not statistically significant, greater improvement on depressive symptoms compared to the control condition (CESD between group difference 3.8 (95%CI 1.3 - 8.8), but a significant effect on insomnia (ISI between group difference of 2.6 (95%CI 0.3 -5.0)). There was a clinically significant 15% absolute increase in the likelihood of recovery from depression with SHUTi. Recovery rate in the active arm (56% recovered) vs. the control arm (41% recovered) (OR 1.75 (95%CI 0.75 - 4.5)). Participants who completed the program experienced a large treatment effect on depressive symptoms compared to both partial-adherers and the control group
(Effect sizes c0.7).
Conclusions: Internet delivered CBTi shows promise as an adjunctive treament for depression in older men with comorbid insomnia and depression. Depression did not limit the efficacy of SHTUi on insomnia. A larger trial is warranted to defintively demonstrate mood outcomes . As programme completion led to large and significant improvement, increasing adherence must be an important goal in implementation.

123 - **Are we overestimating the prevalence of depression in obstructive sleep apnoea? Meta-analytic evidence from questionnaire studies**
Presented by: Shenooka Nanthakumar

S. Nanthakumar[1], R.S. Bucks[1], T.C. Skinner[2]
[1]University of Western Australia, Perth, WA, [2]Charles Darwin University, Darwin, NT, Australia

Objectives: Depression is common in Obstructive Sleep Apnoea (OSA), albeit prevalence can be highly variable. This variability may be a function of symptom overlap between depression and chronic illness. This meta-analysis explored whether the proportion of overlapping symptoms between OSA and depression, within different depression questionnaires, moderates prevalence estimates.
Methods and materials: An extensive systematic search of published and unpublished materials identified 13 studies that met eligibility criteria.
Results: Based on depression questionnaires, the prevalence of depression in OSA ranged from 8% - 68%, reflecting marked heterogeneity. Prevalence estimates based on questionnaires with greater symptom overlap between OSA and depression were higher (see figure 1), whilst questionnaires with a higher proportion of anhedonia symptoms were associated with lower prevalence estimates.

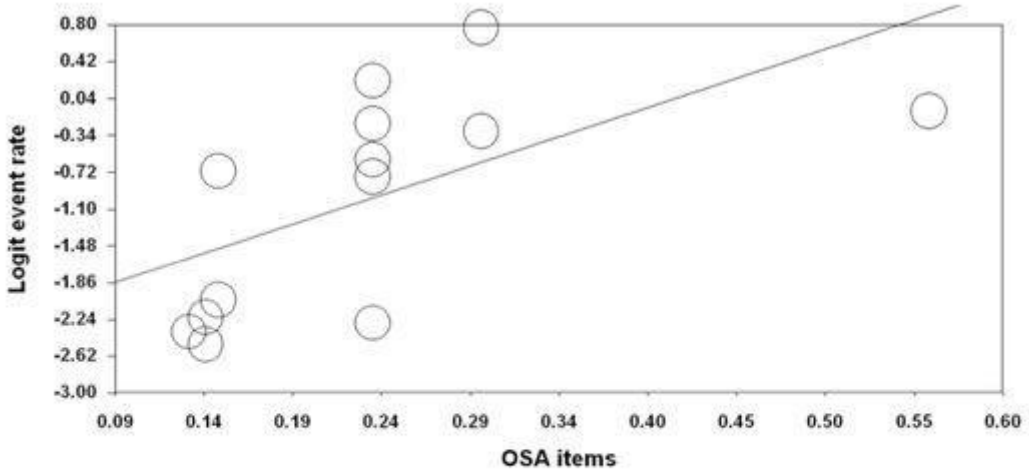

Figure 1. Moderated Regression plot of OSA items (proportion of depression questionnaire items which are also OSA symptoms) against the prevalence of depression (as a logit event rate; larger logit event rate indicates higher prevalence of depression).

[Figure 1]

Conclusions: Overall, these data suggest that depression questionnaires with high degrees of symptom overlap with OSA may overestimate the prevalence of depression in OSA. This study has implications for other sleep disorders with symptom overlap with depression, for example insomnia or restless legs syndrome, as well as suggesting that depression questionnaires are not equally appropriate for assessing depression symptomatology in sleep disorders.

288 - **Sleepiness, ADHD symptoms and accidental risk in 36140 regular registered highway drivers**

Presented by: Pierre Philip

P. Philip[1], J.-A. Micoulaud Franchi[1], E. Lagarde[2], J. Taillard[1], A. Canel[3], P. Sagaspe[1], S. Bioulac[1]
[1]USR CNRS 3413 SANPSY, [2]INSERM U897, ISPED, Université de Bordeaux, Bordeaux, [3]AFSA, Paris, France

Introduction: Attention Deficit Hyperactivity Disorder (ADHD) is a developmental disorder that can impair driving ability and increase accidental risk. Studies showed that ADHD patients can also suffer from excessive daytime sleepiness but there are no data on complaints of sleepiness at the wheel among drivers reporting ADHD symptoms. Because ADHD per se and sleepiness at the wheel are both severe risk factors for driving accidents we decided to conduct an epidemiological study to explore sleep complaints, inattention and driving risks among a large sample of automobile drivers.
Method: From August to September 2014, 491 186 subscribers received a newsletter proposing to participate to an Internet survey. 36140 drivers answered a questionnaire exploring driving accidents, sleep complaints (e.g. Epworth Sleepiness Scale, ESS), sleepiness at the wheel, inattention (e.g. Adult ADHD Self-Report Scale) and distraction at the wheel.
Results: 1.7% of the total drivers reported inattention-related driving accidents (n=598) and 0.3% (n=125) sleep-related driving accidents in the last year. 1543 drivers (4.3%) reported ADHD symptoms. 14.2% of drivers with ADHD symptoms reported severe excessive daytime sleepiness at the ESS>15 (versus 3.2% of drivers without ADHD symptom), 20.5% reported severe sleepiness at the wheel (versus 7.3%) and 59.8% reported distraction at the wheel (versus 39.2%). Drivers with ADHD symptoms reported significantly more sleep-related (OR=1.4, [1.21-1.60], p< .0001) and inattention (OR=1.9, [1.71-2.14], p< 0001) near misses than drivers without ADHD symptoms and reported significantly more driving accident (OR=1.24, [1.03-1.51], p< .021).
Conclusion: The present study shows the high prevalence of inattention-related driving accidents compared to sleep-related driving accidents. It also highlights the clinical importance of exploring both attentional deficits and sleepiness in drivers with complaints of ADHD symptoms in particular regarding the risk of driving accidents.

601 - **Adult ADHD symptomatology in an Irish-Romanian sample: the role of chronotype, social jet-lag, and sleep quality**
Presented by: Bogdan Voinescu

N. McGowan[1], B. Voinescu[2], A. Coogan[1]
[1]Department of Psychology, Maynooth University, Maynooth, Ireland, [2]Department of Clinical Psychology and Psychotherapy, Babes-Bolyai University, Cluj-Napoca, Romania

Objectives: To explore the impact of social jet-lag and sleep quality on symptoms of ADHD in adults.
Methods and materials: A study sample of 335 participants (74.1% female) were recruited among university students from Ireland and Romania. Participants had a mean age of 24.67±7.53 (range 18-58) and were absent of any physiological/ psychological illness or engaged in shift-work. We measured chronotype parameters (MSFsc, social jet-lag in hours) using the Munich Chronotype Questionnaire (MCTQ) and sleep quality using the Pittsburgh Sleep Quality Inventory (PSQI). Participants also completed the adult ADHD Self-Report Scale (ASRS). Partial correlations with controlling for age and gender were calculated. Based on ASRS scores we identified subjects that were high or low-risk for ADHD. Analysis of covariance in SPSS 22 was used to assess differences between high and low-risk groups on measures applied using age and gender as covariates.
Results: MSFsc and sleep quality were linked weakly (ρ=.16, p< .05), as were were jet-lag and sleep quality to symptoms of ADHD (ρ=.14, P< .05; ρ=.28, P< .001 respectively). We found that high-risk respondents accumulated more social jet-lag (1.88±1.13 h) compared to low-risk respondents (1.45±1.0), F(1, 333)=7.66, P< 0.05, $\eta p2$ =.02, and also reported poorer sleep quality (7.71±2.83 versus 6.42±3.0), F(1, 333)=13.82, P< .001, $\eta p2$=.04. We did not find any between groups differences in chronotype.
Conclusions: While previously attempts to quantify circadian typology in ADHD have focused on psychological preference and report a propensity towards eveningness, our results suggest that social jet-lag and sleep quality might have a mediating role between chronotype and the disorder.

219 - **Objective level of alertness and inhibitory control predict independently driving impairment in adults with attention deficit/hyperactivity disorder**
Presented by: Stéphanie Bioulac

S. Bioulac, P. Sagaspe, J.-A. Micoulaud, E. Altena, J. Taillard, C. Fabrigoule, P. Philip
CHU Pellegrin, USR CNRS 3413 SANPSY, Bordeaux, France

Objectives: Attention Deficit/Hyperactivity Disorder (ADHD) patients suffer from cognitive deficits which impact on daytime functioning and accidental risk. Recent studies show that ADHD patients report excessive daytime sleepiness and present pathological level of alertness at objective electrophysiological test.
Up to now, it remains unclear whether daytime functioning impairment in ADHD patients is better explained by an altered level of alertness and/or by cognitive deficits. We conducted a new study to determine the respective contribution of these factors on driving performance in ADHD adults.
Methods and materials: Adult patients with ADHD (N=39) and matched healthy control participants (N=18) were recruited. Participants underwent a nocturnal polysomnography followed by the Maintenance of Wakefulness Test (MWT) the following day, with simulated highway driving and neuropsychological evaluation (attention and executive functions) performed between MWT trials.
Results: Patients with ADHD present altered simulated driving performance compared to controls. Moreover, they globally exhibited worse results than controls with slower performance and more errors on attention and executive functioning tests, and shorter mean sleep latency on the MWT. A logistic regression analysis reveals that only objective daytime sleepiness measured by the MWT (OR 1.12, 95% CI, 1.02-1.22, P< 0.05) and inhibition deficit measured by Stroop interference (OR 3.45, 95% CI, 1.34-8.89, P< 0.01) remain independent predictive factors of driving performance in ADHD.
Conclusions: Our study for the first time shows that not only inhibitory control deficit but also pathological level of alertness contribute independently to driving impairment in adults with ADHD. These results provide a better understanding of pathophysiological mechanisms involved in ADHD patients' daytime functioning.

285 - **Reduced sleep spindles as a mechanism of impaired sleep-related memory consolidation**

in schizophrenia
Presented by: Robert Göder

R. Göder[1], P.C. Baier[2], S.L. Weinhold[2]
[1]Psychiatry and Psychotherapy, [2]University Hospital Schleswig-Holstein, Kiel, Germany

Objectives: The importance of sleep for memory consolidation is widely accepted and sleep spindles seem to play an important role in these processes. Recently it was described that patients with schizophrenia have a marked decrease in sleep spindles compared to healthy controls. The aim of this study was to test associations of sleep spindles and memory consolidation in schizophrenia patients and healthy controls.
Methods: We studied 16 patients with schizophrenia (mean age 29 ± 6 years) on stable antipsychotic medication and 16 healthy controls (28 ± 6 years). We performed a picture recognition paradigm and used neutral and emotional pictures and compared recognition performance in a sleep and wake condition.
Results: The memory promoting effect of sleep was significantly lower in patients with schizophrenia and these patients showed a marked decrease of sleep spindles. Significant correlations between sleep spindle density and sleep-dependent facilitation of memory performance were seen in both healthy controls and patients.
Conclusions: We found further indications of reduced sleep spindles as a biomarker and a mechanism for decreased sleep-related memory consolidation in schizophrenia. Because deficits in declarative memory predict functional long-term outcome in schizophrenia, compensation of such deficits should be an important goal of clinical efforts. Sleep spindles offer a promising potential target for novel treatments.

293 - **Markers of mental health: the role of sleep disruption as an antecedent to psychosis**
Presented by: Ross Purple

R. Purple, J. Cosgrave, K. Porcheret, R. Foster, K. Wulff
Nuffield Department of Clinical Neurosciences, University of Oxford, Oxford, United Kingdom

Objectives: Sleep disruption is a common feature of many psychiatric problems including psychosis, but is largely unstudied in sub-clinical samples. This research aims to profile the general population in terms of risk factors associated with the development of psychosis, psychotic-like symptomatology, and sleep.
Methods and materials: A systematic literature search was used to identify the most salient risk factors for developing psychosis. Based on 74 articles, an online survey was created with 29 identified risk factor components in addition to a measure of psychotic-like experiences (Prodromal Questionnaire-16) and sleep quality (Pittsburgh Sleep Quality Index). For each risk factor component assessed on the survey a binary score was calculated and summed to provide a total risk score.
Results: This is an ongoing study. From a sample of 1132 individuals, results have revealed that an accumulating number of risk factors are associated with increased psychotic-like experiences with comorbid anxiety, stress symptoms, and cannabis use currently presenting the strongest association. A greater number of risk factors and increased psychotic-like experiences were both associated with decreased overall sleep quality (figure 1). This corresponded to significantly longer sleep onset latency, increased sleep disturbances, daytime dysfunction due to sleepiness and use of sleep medication. No differences were found in sleep duration or sleep efficiency.
Conclusions: To our knowledge, this is the first study to holistically assess psychosis risk based upon collated risk factors; contrary to the current trend based primarily upon symptomatology. Our preliminary data suggest that the number of risk factors present and the nature of the risk is related to the degree of psychotic-like symptomatology which may provide valuable implications for earlier identification and aetiological understanding. This data also suggests specific sleep phenotypes occur with sub-clinical psychotic symptoms. A sample of individuals presenting the highest risk from this survey (top 15%) are now being phenotyped further using cognitive, endocrinological, and quantitative sleep and circadian measurements.

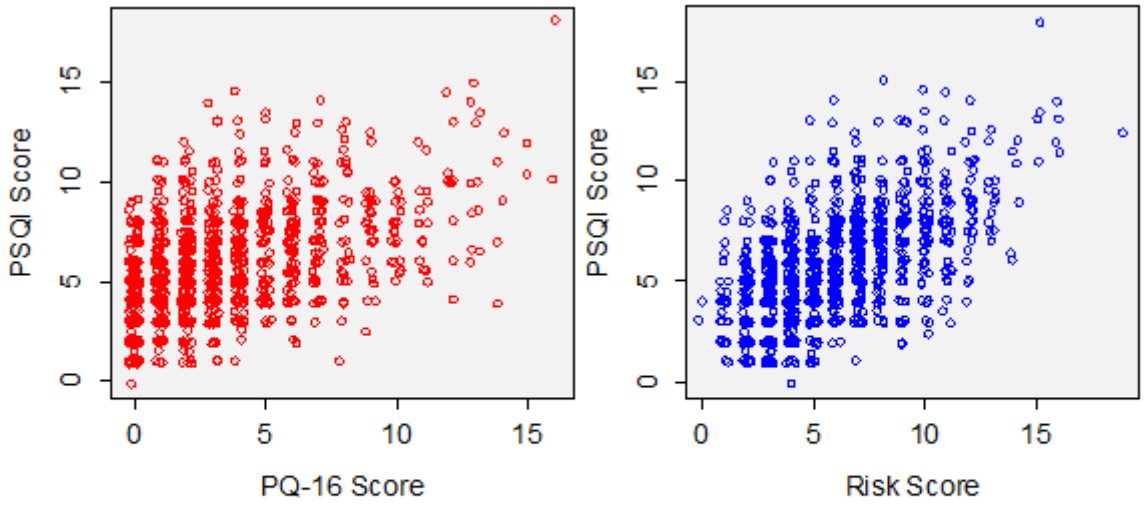

Figure 1: Relationship between psychotic-like experiences (PQ-16 Score), sleep quality (PSQI Score) and the presence of risk factors for developing psychosis (Risk Score). Higher scores correspond to increased psychotic-like experiences, poorer subjective sleep quality and having more risk factors, respectively. N=1132.

[Figure 1]

478 - **Genetic risk for psychosis is associated with nightly awakenings at 8 months in girls**
Presented by: Katri Kantojärvi

J. Liuhanen[1], O.A. Saarenpää-Heikkilä[2], K. Kantojärvi[1], J. Paavonen[1], A. Kylliäinen[3], P. Pölkki[4], A.-L. Satomaa[5], S.-L. Himanen[5], J. Jaatela[1], J. Suvisaari[1], T. Paunio[1,6]
[1]National Institute of Health and Welfare, Helsinki, [2]Pediatrics, Tampere University Hospital, [3]University of Tampere, Tampere, [4]University of Eastern Finland, Kuopio, [5]Clinical Neurophysiology, Tampere University Hospital, Tampere, [6]University of Helsinki, Helsinki, Finland

Objectives: Consolidation of sleep is an essential feature of early neurological development. We hypothesized that sleep consolidation may have connection even to more sever disturbances in brain development and mental health. The objective of the current study was to examine for association between a polygenic risk score for schizophrenia, neurodevelopmental disorder, and early development and sleep in babies at 8 months of age.
Methods and materials: The Finnish Child Sleep birth cohort was gathered in Tampere University Hospital, Finland. Health nurses in maternity clinics recruited totally 2244 mothers to approve a prenatal questionnaire during pregnancy. DNA samples were collected from 1501 babies at time of birth and genotyped with Infinium PsychArray BeadChip, Illumina. The polygenic risk score for schizophrenia was composed of 108 genotyped variants, each representing one of the 108 genomic areas associated with schizophrenia (Schizophrenia Working Group of the Psychiatric Genomics Consortium, 2014). Questionnaire-based data included characteristics of sleep (sleep length and nightly awakenings), socioemotional development and motor development at the age of 8 months. In addition, data from polysomnography registration was available for a subset of babies. Home atmosphere, babies' illnesses and breastfeeding were also reported by the parents and used as covariates in our analyses.
Results: The polygenic risk score for schizophrenia was associated with parent-reported nightly awakenings in girls (n=464, $p < 0.05$ after correction for multiple testing), but not in boys (n=501, $p>0.2$). In boys, the risk score showed trend for association to sleep efficiency, measured by PSG (n=26, P=0.05, Spearman correlation). There were no associations between the genetic risk and other developmental measures.
Conclusion: The polygenic risk score for schizophrenia was associated with parent-reported nightly awakenings in girls. Since sleep in early childhood is considered to mark development and maturation of brain, our study suggests that genetic risk for schizophrenia manifests already early in life. The difference between boys and girls needs further examination.

03.11.2015 - 11:00-12:00
Pathophysiological Aspects of Sleep Disordered Breathing

633 - **Respiratory sensation during wakefulness relates to the respiratory arousal threshold during sleep in obstructive sleep apnoea patients**
Presented by: Danny Eckert

J.C. Carberry[1], L. Fisher[2], S. Carter[3], J.E. Butler[1], D. Mc Kenzie[4], D.J. Eckert[1]
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Objectives: Premature arousal from sleep during airway narrowing (a low respiratory arousal threshold) is believed to contribute to obstructive sleep apnoea (OSA) pathogenesis in ~30% of all OSA patients. Sleep promotion aids (i.e. sedatives) can promote breathing stability in OSA patients with a low arousal threshold (0 to -15cmH_2O epiglottic pressure). However, many OSA patients have high respiratory arousal thresholds (< -25cmH_2O epiglottic pressure) in whom sedatives may worsen hypoxemia. Similar to the respiratory arousal threshold during sleep, respiratory sensation measured awake varies considerably between individuals. Whether respiratory sensation awake corresponds with an individual´s arousal threshold during sleep is unknown. If so, simple respiratory sensation measures during wakefulness may help inform which patients may benefit from sedatives versus those in whom they should be avoided. The aim of the study was to determine if respiratory sensation during wakefulness corresponds to the respiratory arousal threshold during sleep.
Methods: 31 OSA patients were instructed to breathe comfortably through a nasal mask and breathing tube. Five inspiratory resistive loads were added at random to the breathing circuit for a single breath. Each load was presented 3 times. Participants rated their respiratory sensation each load using a Borg scale. Load magnitude was quantified as the slope of the relationship between mask pressure (Pmask) and Borg score. Prior to sleep participants were instrumented with EEG electrodes and an epiglottic catheter to measure the arousal threshold during sleep. Arousal threshold was quantified as the nadir epiglottic pressure immediately prior to cortical arousal during respiratory events.
Results: Patients with a high (n=9 -35±3cm$H_2$0) arousal threshold had significantly lower respiratory sensation to inspiratory resistive loads during wakefulness compared to patients with low/moderate (n=22,-16±1cm$H_2$0) arousal thresholds (slope of Pmask vs. Borg scale, 0.79 compared to 0.45 a.u, P=0.006).
Conclusion: These findings indicate that wakefulness measures of respiratory sensation correspond with the propensity to arouse to airway narrowing during sleep. These simple assessment tools may be useful clinically to determine which OSA patients may be amenable to therapies to increase the arousal threshold versus those in whom they should be avoided without having to undergo an overnight sleep study with an epiglottic catheter.

631 - **Relationship between respiratory-related arousal intensity and physiological parameters**
Presented by: Jason Amatoury

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Objectives: Cortical arousals are currently quantified as an all or none phenomenon. However, not all cortical arousals are the same. Arousals vary in duration and in the extent to which electroencephalogram (EEG) changes occur. Accordingly, the physiological consequences of different types of arousals may also vary. Therefore, we recently developed an automated method to quantify arousal intensity (AI). In the current study, we aimed to determine the relationship between respiratory-related AI and the respiratory arousal threshold (ArTh; propensity to arouse from sleep). We also explored relationships between AI and other physiological and anthropometric characteristics.
Methods and materials: Data were acquired in 72 subjects [17 control, 55 OSA; age: 45 ± 12

(mean±SD) yrs, BMI: 32.9 ± 6.8 kg/m^2; AHI: 0-112 events/h] who undertook a standard sleep study and a detailed upper airway physiology study involving transient CPAP reductions (ΔCPAP) from a holding pressure to induce cortical arousals. Epiglottic pressure was measured using a transducer-tipped pressure catheter and ArTH determined as the nadir epiglottic pressure preceding an arousal (post ΔCPAP). The corresponding AI was quantified on a scale between 0 and 9 (most intense). Arousal duration (AD), time to arousal (TTA; following ΔCPAP) and average respiratory rate (RR; ΔCPAP to arousal) were also determined.
Results: A total of 496 CPAP drops were analysed across all subjects [6(3-9), median(IQR), per subject]. ΔCPAP for controls vs OSA were similar (6.0 ± 1.8 vs 7.3 ± 2.5 cmH_2O; P > 0.05). AI did not differ between groups or between NREM and REM sleep (both P > 0.16). The mean AI for the group was 5.4 ± 1.5. AI was not correlated with ArTh (r = -0.02, P = 0.8). However, there were significant correlations between AI and AD (r = 0.40), TTA (r = 0.39) and RR (r = -0.31) (all P < 0.009). AI was also associated with BMI (r = -0.31, P = 0.009).
Conclusion: These findings demonstrate that the nadir epiglottic pressure preceding a respiratory-induced arousal is not associated with arousal intensity. However, the time to arousal, arousal duration and respiratory parameters, in addition to body size, are associated with arousal intensity. Determination of the consequences and mechanisms mediating differences in arousal intensity independent of other measures of sleep disturbance requires further investigation.

Supported by NeuroSleep NHMRC Centre of Research Excellence and NIH.

162 - **The effect of acute morphine on awake ventilatory chemoreflexes in obstructive sleep apnea patients - a randomized double-blind crossover placebo-controlled trial**
Presented by: David Wang

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[1]Woolcock Institute of Medical Research, Sydney University, Sydney, [2]Royal Prince Alfred Hospital, Camperdown, [3]Neuroscience Research Australia (NeuRA), Ranwick, NSW, Australia

Objectives: There has been a striking increase in opioid prescription and opioid-related deaths around the world. Obstructive sleep apnea (OSA) has been listed as a major risk factor for opioid-related respiratory arrests and deaths. However, the effect of morphine on awake ventilatory control and the relevance to sleep-disordered breathing in obstructive sleep apnea patients is not known. The present study is aiming to explore the relevant mechanisms using a randomized controlled trial (RCT) design.
Methods: 60 male OSA patients attended 2 overnight visits with at least 1-week interval. Under a randomized crossover design, single dose of slow release oral morphine (40 mg MS Contin) or placebo was administered at 5:30 PM. Awake ventilatory chemoreflex tests using Duffin's modified rebreathing method were performed at 9 pm prior to overnight polysomnography (PSG) monitoring.
Results: The 60 patients had a mean age of 44.4 yrs and body mass index (BMI) of 29.3 kg/m^2. Table 1 shows effects of morphine vs placebo on key ventilatory chemoreflex parameters. The clinical dose of morphine significantly increased CO2 ventilatory response threshold (VRT) and decreased both ventilatory response to hypercapnia and hypoxia (slopes). The change of awake ventilatory response to hypercapnia positively correlated with the change of apnea hypopnea index (AHI) during sleep (r=0.26, p < 0.05). Baseline (measured under placebo) VRT (hyperoxia) moderately correlated with the change in AHI (r=-0.25, p=0.05) with morphine use.
Conclusions: Our clinical dose of oral morphine significantly decreased awake ventilatory chemosensitivity and increased CO2 ventilatory response threshold in OSA patients. The change in awake ventilatory chemosensitivity positively correlated with the change in OSA severity during sleep. Baseline awake CO2 response threshold has potential to predict the change in OSA severity with morphine use.

	Placebo mean(SD)	Morphine mean(SD)	Paired t-test p
VRT (hyperoxia), mmHg	54.13(7.06)	55.74(7.80)	0.017
Ventilatory response to hypercapnia, L/min/mmHg	1.68(0.80)	1.33(0.73)	0.005
VRT (hypoxia), mmHg	48.71(5.51)	50.77(7.09)	0.0006

Ventilatory response to hypoxia, L/min/mmHg	1.32(1.34)	0.93(0.99)	0.02

[Table 1.]

207 - **Demonstration of autonomic dysfunction in obstructive sleep apnea syndrome by measuring sympathetic skin responses from neck area**
Presented by: Gulcin Benbir Senel

B. Korkmaz, G. Benbir Senel, M.E. Kiziltan, D. Karadeniz
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Objective: Sympathetic nervous system activity is known to be dominant during wakefulness, while parasympathetic activity becomes predominantly active during sleep. Here we investigated the imbalance in autonomic dysfunction in obstructive sleep apnea syndrome (OSAS) and the effects of non-invasive positive airway pressure (PAP) treatment.
Methods: Twenty patients with OSAS demonstrated by polysomnography and ten healthy individuals were prospectively enrolled. None of the participants had any disease or drug/substance use that affect autonomic nervous system. The sympathetic skin responses (SSR) were measured from bilateral hands and from bilateral neck area.
Results: SSRs recorded from hands were not obtained in two patients with OSAS (10%), and in one subject in control group (10%, p=0.733). SSRs recorded from neck were not obtained in 15 patients with OSAS (75%), and in one healthy subject (10%, p=0.001). The mean amplitudes of SSRs recorded from neck were significantly lower in patients with OSAS than in controls (p=0.001); the mean latencies were longer but not significantly (p=0.260). After treatment, SSRs recorded from hands were obtained in all patients; and SSRs recorded from neck were obtained in 16 patients (80%) with OSAS. In compared to pretreatment data, SSRs were normalized, which was highly significant for those recorded from bilateral neck area (p=0.002). Demographical data including gender, age, body mass index, or polysomnographical data such as apnea-hypopnea index or oxygen saturation values were not correlated with SSRs values.
Discussion: We demonstrated that autonomic dysfunction in patients with OSAS and its normalization by effective PAP treatment could be detected by measuring SSRs from neck area.

169 - **Neuropathy and myopathy of upper airway in snorers and obstructive sleep apnea patients correlates with pharyngeal dysfunction**
Presented by: Farhan Shah

F. Shah[1], D. Berggren[2], E.L. Jäghagen[3], T. Holmlund[2], K. Franklin[4], P. Stål[1]
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Objectives: Several factors can predispose an individual to obstructive sleep apnea (OSA) such as obesity and anatomical abnormalities. However, individuals without these recognized traits and conditions also develop OSA making the etiology and pathophysiology unclear. We hypothesize that snoring vibrations and recurrent stretch of the upper airway tissue cause injury and disrupt neuromuscular function of the dilator muscles that maintain the patency of the upper airways during sleep.
Methods and material: Twenty five snoring/OSA patients and 10 healthy controls were included in the study. The total apnea hyponea index (AHI) in patients was ranged from mild (>5) to severe (>30). Only two of the patients were obese according to body mass index (BMI>30). All snoring/OSA and control subjects were examined by video-fluoroscopy for detection of swallowing dysfunction. Soft palate tissue biopsies were taken from all subjects. The tissue was analyzed with enzyme- and immunohistochemical techniques to detect neuromuscular changes. The degree of changes was compared with level of pharyngeal dysfunction. In addition, 10 muscle samples from patients with hand and arm vibration syndrome (HAVS) and 5 samples from limb muscles of healthy subjects were used as reference.
Results: The samples from both healthy and snoring/OSA patients differed from limb muscles by

having an atypical expression of cytoskeletal proteins desmin and the dystrophin associated protein complex. All the tissue samples from OSA patients had severe histopathological alterations including signs of neuropathy, myopathy and disturbed neuromuscular regeneration. Changes characteristic for vibratory damage were found in both the soft palate of snoring/OSA and the HAVS subjects, although the changes were more extensive in the soft palate. All subjects, except three, had a mild to moderate swallowing dysfunction. The degree of swallowing dysfunction correlated largely with the degree of neuromuscular changes.
Conclusions: We show here that long-term snorers and patients with mild to moderate OSA have neuromuscular changes that correspond to the extent of swallowing dysfunction. These finding support our hypothesis of traumatic snoring vibrations and tissue stretch as a cause for OSA. Further, this is the first study to show that normal human palate muscles have a unique cytoarchitecture compared to limb muscles.

03.11.2015 - 12:00-13:00
Medical Disorders and Sleep

344 - **Shape analysis of subcortical structures in idiopathic rapid eye movement sleep behavior disorder**
Presented by: Shady Rahayel

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Idiopathic rapid eye movement sleep behavior disorder (iRBD) is considered as a risk factor for the development of synucleinopathies such as Parkinson´s disease. Gray matter abnormalities in iRBD patients involve both volume and cortical thickness. Another technique, vertex-based shape analysis, allows for quantification of surface differences in subcortical structures and overcomes some limitations of voxel-based quantification. No study has yet studied shape of subcortical structures involved in cortico-subcortical loops in iRBD patients in comparison to other volume-based techniques. Forty-one patients with a PSG-confirmed diagnosis of iRBD (mean age, 65.2 ± 6.4; 33 men) and 41 controls (mean age, 63.4 ± 9.0; 26 men) matched for age and sex underwent MRI examination. Voxel-based morphometry (VBM) was used to investigate gray matter volume at a whole-brain level. Subcortical structures (i.e., putamen, caudate nucleus, globus pallidus, and thalamus) were studied for volume and surface displacement, the latter quantified through vertex-based shape analysis. Voxel- and vertex-wise generalized linear model analyses were performed using permutation-based non-parametric testing (using 10,000 permutations). For VBM analysis, absolute total intracranial volume and age were used as covariates. No covariates were used in structure-based volumetric analyses since analyses were done on volumes normalized for brain size. Shape analysis was done in the MNI152 standard space, thus normalizing for differences in brain size. VBM reveals reductions in gray matter volume in the frontal lobes (ventromedial, dorsolateral, and motor cortices) and the basal ganglia. Surface-based volumetric analyses show reduced volume of the right putamen and the left globus pallidus. Studied through shape analysis, 3 clusters of abnormal surface displacement in the left putamen (medial and lateral surfaces) and 1 cluster in the left globus pallidus were identified. Patients with iRBD present with both global volume and shape abnormalities in the putamen and globus pallidus, along with reductions of gray matter local volume in the frontal lobes. However, although volumetric and shape analyses converge on showing abnormalities in the left globus pallidus, both techniques seem complementary in showing abnormalities in the putamina. This study was supported by grants from the Canadian Institutes of Health Research, the Fonds de Recherche du Québec - Santé, and the W. Garfield Weston Foundation.

459 - **Prevalence of restless legs syndrome in patients with resistant hypertension: a cross-sectional, bi-centric cohort study**
Presented by: Rosa Maria Bruno

R.M. Bruno[1], *M.F. Pengo*[2,3], *E. Di Coscio*[4], *L. Carnicelli*[4], *M. Maestri*[4], *U. Faraguna*[4,5], *M. Di Galante*[5], *M. Cargiolli*[4], *L. Ghiadoni*[4], *C. Ratneswaran*[3], *G.D. Leschziner*[3], *G.P. Rossi*[2], *E. Bonanni*[4], *S. Taddei*[4]
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Background: Though obstructive sleep apnea syndrome (OSAS) is common in patients with resistant hypertension (RH), the prevalence of other sleep disorders, such as restless legs syndrome (RLS) is unknown. Aim of the study was to investigate the prevalence of OSAS and RLS in a cohort of patients with RH recruited in two centres.
Methods: By using the ESC/ESH definition (failure to reach BP target in spite of treatment with 3 or more BP-lowering drugs, including a diuretic) we consecutively recruited 63 patients with RH (age 63±12 years, BMI 32± 6 kg/mq, 24% women, 31% patients with previous CV events, 31% diabetic), undergoing a polysomnographic study. RLS rating scale, Epworth Sleepiness Scale (ESS), medical history and office BP were obtained. Sleep stages were scored according to 2007 AASM modified criteria.
Results: Moderate-severe OSAS (AHI>15/h) was diagnosed in 34 RH patients (54%), RLS in 26 (41%): 13 patients presented both conditions (OSAS+RLS+). Only 16 patients (25%) had neither OSAS nor RLS (OSAS-RLS-). OSAS+RLS- and OSAS+RLS+ patients were older than OSAS-RLS- and OSAS-RLS+, while ESS score and BMI were similar in the 4 groups. OSAS+RLS- patients had a reduced total sleep time (290±82 vs 372±73min, p< 0.05), sleep latency (73±91 vs 21±28min, p< 0.05) and sleep efficiency (58±16 vs 73±9%, p< 0.05) in comparison to OSAS-RLS-. Conversely, slow wave sleep was reduced only in OSAS+RLS+ (40±26 vs 75±35min, p< 0.05).
Conclusions: OSAS and RLS are common in RH patients, often co-occurring. BMI or daily sleepiness are not useful to identify RH patients with sleep disorders, suggesting that all RH patients should undergo polisomnography. The presence of OSAS together with RLS is associated with shorter slow wave sleep, a phenomenon that can possibly lead to severe cardiovascular and cognitive complications.

482 - **Self-reported nocturnal gastroesophageal reflux predicts the presence of obstructive sleep apnea syndrome**
Presented by: Silvia Dumitru

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Objectives: It is known that nocturnal gastroesophageal reflux (N-GERD) is strongly associated to obstructive sleep apnea syndrome (OSAS), however it is not included in any of the screening questionnaires (such as Berlin, STOP-Bang etc). The purpose of this study was to assess the predictive value of self-reported frequent (> 5 times monthly) N-GERD with respect to the diagnosis of OSAS.
Methods: We performed full-night polysomnography (PSG) in 284 outpatients with symptoms suggestive of OSAS referred to our laboratory during the period 2013-2014. Prior to PSG, all subjects were asked about N-GERD and its estimated frequency per month.
Results: OSAS was diagnosed in 223 patients (75% males, age 49±12 years old; apnea-hypopnea index (AHI) 29±12 events/hour). Frequent N-GERD was reported in 115 of the 223 OSAS patients (prevalence 52%), but in only 8 of the 61 non-apneic patients (13%), with a group-wise odds ratio (OR) of 7.25. When patients are classified as those with severe (77 patients with AHI ³ 30 events/hr) and those with mild-to-moderate OSAS (146 patients with AHI 5-29 events/hr), frequent N-GERD was reported in 52 (67%) and in 63 (43%) patients respectively, the group-wise OR being 2.69. Furthermore, N-GERD was not associated with age or gender.
Conclusions: Self-reported frequent (> 5 times monthly) gastroesophageal reflux is a strong predictor of OSAS irrespective of age or gender. It should be therefore considered as a useful question in sleep apnea screening questionnaires.

673 - **Quality of sleep, night respiration and chronotype in patients with Bardet-Biedl syndrome**
Presented by: Elisabeth Ruppert

R. Velizarova[1,2], E. Ruppert[1,2], C. Schroder[2,3], U. Kilic-Huck[1,2], L. Hugueny[1,2], L. Robin-Choteau[1,2], H. Dollfus[4], P. Bourgin[1,2]
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Objectives: Bardet-Biedl syndrome (BBS) is a rare autosomal recessive ciliopathy affecting different systems with high phenotypic and genetic heterogeneity. Some of the main clinical features such as obesity or metabolic syndrome could lead to sleep disordered breathing while blindness could affect circadian rhythms. We investigated in a large cohort of BBS patients sleep disordered breathing, sleep quality, daytime sleepiness, and circadian chronotype.
Methods and materials: 32 patients (13 males, 19 females; aged 17 to 59 years) with genetically verified BBS were referred to our Sleep Centre between 2009 and 2013. Either an ambulatory respiratory polygraphy or a polysomnography were performed in all patients (records were not interpretable for two). 19 patients were analyzed for subjective ratings of sleep quality, daytime sleepiness and circadian chronotype using: Pittsburgh Sleep Quality Index (PSQI), sleep diary, Epworth Sleepiness Scale (ESS), Horne and Ostberg Morningness-Eveningness Questionnaire.
Results: 21 patients (70%) had a normal apnea-hypopnea index (AHI < 5/h) and 9 patients presented an AHI >5/h. Severe obstructive sleep apnea syndrome (AHI >30/h) was diagnosed in 3 patients (9%), all of them had a BMI >30 kg/m². 17 patients estimated their sleep quality as satisfying (global PSQI score < 7/21), 13 patients as very good (global PSQI score ≤ 3/21) and 4 as good (global PSQI score between 3 and 7/21). One patient with severe diabetes and high blood pressure had the most severe score evaluated at 13/21. Sleep efficacy was evaluated from sleep log as superior to 90% in the same 17 patients without sleep complaints. The ESS score was: normal (≤ 10/24) in 10 patients, between 11 and 17/24 in 8 patients and at 18/24 in 1patient. The prevalence of intermediate chronotype was 58% (11 patients), of morning chronotype 31% (6 patients) and of evening chronotype 11% (2 patients).
Conclusions: The prevalence of obstructive sleep apnea syndrome in our cohort of BBS patients corresponded to that observed in the general population and seems related to obesity. Subjective sleep quality was rather satisfying with a normal or a slightly increased daytime sleepiness and a predominance of an intermediate chronotype. These results suggest that retinal ciliopathy due to BBS does not affect synchronization of circadian rhythms, mainly by light though intrinsically photosensitive melanopsin- containing retinal ganglion cells.

676 - **Objective and subjective sleep comparisons in patients with fibromyalgia syndrome, osteoarthritis and healthy controls**
Presented by: Wai Kent Yeung

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Introduction: Fibromyalgia (FMS) is a chronic non-inflammatory syndrome characterised by *musculoskeletal pain, fatigue* and severe sleep disturbances (including non-restorative sleep, altered sleep architecture and alpha-delta sleep anomalies). However, the relationship between sleep structure, sleep anomalies and pain in FMS is under-researched. To date, no electrophysiological sleep study has evaluated newly diagnosed FMS patients alongside appropriate pain/non-pain comparator groups. This study compared the structural and spectral properties of polysomnography in patients with FMS, osteoarthritis (OA) and healthy controls.
Methods: 20 newly diagnosed female FMS patients (Mean age = 40.74, SD = 11.45) and 17 female patients with OA (Mean age = 46.47, SD = 11.61) exhibiting localized joint pain and sleep disturbance were recruited from a single rheumatology facility. 10 healthy controls (HC) were also recruited (Mean age = 38.40, SD = 13.79) from the community. All participants completed a self-reported sleep measure (PSQI), fatigue measure (FSS) and domiciliary polysomnography (PSG). PSG was scored and spectrally analysed according to standardised criterion.
Results: FMS (Mean PSQI = 13.89) and OA (Mean PSQI = 10.88) groups had significantly greater sleep disturbance than healthy controls (Mean PSQI = 3.70, [p=0.001]). Additionally FMS (Mean FSS = 52.47) patients were significantly more fatigued than OA (Mean FSS = 38.06) and both clinical groups were more fatigued than healthy controls (Mean FSS = 22.60, [p=0.001]). Objectively groups showed no significantly differences in terms of total sleep time, sleep latency, percentages of N1, N2, N3 or REM and wake after sleep onset (all = n.s.). Similarly, spectral analysis of the first cycle of N3

sleep in the alpha frequency, calculated for both absolute and relative amplitude, showed no significant differences between the groups (all = n.s.)
Conclusion: In this patient series, FMS appears more associated with the subjective experience of sleep than with sleep's electrophysiological structure.

03.11.2015 - 13:30-14:15
Keynote Lecture: Nicholas P. Franks

682 - **Mechanisms of general anaesthesia and overlap with natural sleep**
Presented by: Nicholas P. Franks

N.P. Franks
Life Sciences, Imperial College, London, United Kingdom

How general anaesthetics produce reversible loss of consciousness remains a mystery, although considerable progress has been made in recent years.
The apparent lack of specificity of general anaesthetics plus the observation that potency correlates with solubility in fat-like solvents (the Meyer-Overton Rule), caused early workers to suppose that anaesthetics act directly on lipids. However, it is now accepted that general anaesthetics produce their effects at surgical levels by binding directly to a small number of protein targets rather than to lipids. Very recently, the molecular binding sites for some anaesthetics have been identified.
Current evidence points towards three different ion channels and receptors as playing the most important roles in anaesthetic-induced loss of consciousness. These are the inhibitory neurotransmitter receptor, the $GABA_A$ receptor, the excitatory glutamate receptor, the NMDA receptor, and some members of an inhibitory potassium channel, the two-pore domain potassium channels. Attention is now turning towards the possibility that the selectivity shown at the molecular level may extend to the level of neuronal networks, with some pathways being much more sensitive than others. Putting a patient to sleep with general anaesthetics has been used as a metaphor ever since their first clinical use, and as the mechanisms underlying natural sleep become better understood, the similarities between natural sleep and anaesthetic mechanisms have become more evident. The transitions between waking and sleeping and transitions between the conscious and anaesthetised states may involve overlapping neuronal networks. I will describe recent work showing that overlapping ensembles of neurons in the pre-optic hypothalamus are involved in both deep sleep and drug-induced sedation.

03.11.2015 - 14:30-16:30
Symposium: Nonapneic snoring and adverse health effects

690 - **Snoring during pregnancy. Increased risk for pre-eclampsia, restless legs and depressed mood?**
Presented by: Eva Svanborg

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Departments of Clinical Neurophysiology and Obstetrics and Gynecology, Linköping University and University Hospital, Linköping, Sweden

Objective: In previous studies women have been asked about snoring during pregnancy after their deliveries, and it has then been suggested that snoring may be a sign of increased risk for adverse outcomes such as hypertension, pre-eclampsia and depression. We aimed at prospectively study how snoring develops during pregnancy, and whether this is related to occurrence of hypertension/pre-eclampsia, restless legs syndrome (RLS) and post-partum depression.
Methods and material: 500 women who visited one antenatal care clinic during the first, second and third trimester of pregnancy at all occasions were asked to answer questionnaires concerning snoring (rarely-seldom, sometimes, often, always), subjective fatigue and sleepiness, Epworth Sleepiness Scale (ESS), edemas and witnessed apneas. RLS was diagnosed from 4 questions (unpleasant feelings from the legs at rest causing urge to move, relief from symptoms when moving, worsening of symptoms in the evenings, symptoms more than once per month). 293 women also completed the Edinburgh Postnatal Depression Scale (EPDS) 4-10 weeks postpartum.

Results: The frequency of snoring was 8% in the first trimester and increased to 21% in the third. The women who became habitual snorers had significantly higher ESS scores and more edemas. However, there was no statistically significant risk for hypertension/pre-eclampsia Of the 20 women who developed this, 9 became snorers during pregnancy but 9 did not. There was no increased risk of adverse outcomes for the babies.
Restless legs symptoms also increased during pregnancy; from 17% in the first trimester to 30% in the third. Snoring in the first trimester was significantly correlated to RLS in all three trimesters.
29 women with postpartum depressive symptoms had higher prevalence of disturbed sleep with resulting daytime sleepiness and also RLS in the last trimester of pregnancy, but snoring was not associated.
Conclusions: Snoring is very common during pregnancy and shows a marked progression. Women who snored had an increased prevalence of RLS and daytime sleepiness compared to non-snorers. However, development of snoring during pregnancy was not associated to postpartum depression or other adverse obstetric outcomes.

03.11.2015 - 14:30-16:30
Memory/Cognition and Sleep in Humans: What's Up?

229 - **Emotion matters! effects of emotional prosody on stimulus processing across consciousness states**
Presented by: Christine Blume

C. Blume[1,2,3], R. del Giudice[1,2,3], M. Wislowska[1,3], J. Lechinger[1,2,3], D.P. Heib[1,2,3], D. Koerner[1,3], M.-T. Gnjezda[1,3], K. Hoedlmoser[1,2,3], M. Schabus[1,2,3]
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One of the strongest stimuli to automatically catch attention is a person's own name (ON). Auditory presentation of the ON has been shown to evoke electrophysiological markers of attention-orienting that even persist in states of diminished consciousness such as sleep (Perrin et al., 1999). Likewise, the emotional content such as familiarity of voice (del Giudice et al., 2014) or emotional prosody (Wambacq et al., 2004) has been shown to capture attention during wakefulness. Here, we investigated effects of self-relevance (ON vs. unfamiliar name (UN)) and emotional prosody (angry vs. neutral voice (AV and NV)) on cognitive processing of stimuli across different consciousness states (wakefulness, N1/N2 sleep). Since links between theta ERS, alpha ERD and attention and memory processes are well-established (e.g. Klimesch, 1999), we investigated stimulus processing by means of event-related de-/synchronization (ERD/ERS) in the theta (4-7Hz), lower (8-10Hz) and upper alpha (11-12Hz) bands of the EEG.
EEG recordings were obtained from 21 healthy individuals while they passively listened to the stimuli during wakefulness and a two hour nap. For data analysis, sleep was scored automatically according to standard criteria. Following preprocessing, data was segmented, wavelet-transformed (Morlet Complex, c=8) and averaged. Subsequently, ERD/ERS was calculated above frontal and parietal electrodes for theta and alpha bands, respectively. ERD/ERS was calculated for four time windows (T1-4) of equal length from 0-800ms relative to stimulus onset with a pre-stimulus baseline from -700 to -100ms.
Only theta ERS differed between stimuli in the wake state. Surprisingly, there was no effect of name. However, AV led to stronger ERS in T1 and T2 compared to NV with ERS generally peaking in T2. This suggests that AV engaged more attentional or working memory resources irrespective of the name presented. In N2 sleep the peak response was delayed with ERS to AV and NV peaking in T3/4 and T3, respectively, probably reflecting decreased processing speed. Moreover, the response to AV compared to NV during N2 was longer-lasting, again suggesting that more processing resources were allocated to AV stimuli. In conclusion, results support the notion that emotional prosody does not only draw attention during wakefulness, but also during states of diminished consciousness such as N2 sleep.
Research was funded by the Austrian Science Fund FWF (project Y-777&Doctoral College W1233).

456 - **Targeted memory reactivation: the effects of cue type and acoustic match**
Presented by: Justyna M. Sobczak

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Objectives: While the memory benefits of targeted memory reactivation (TMR)—replaying learning-associated environmental sound cues in slow-wave sleep (SWS)—are well established, recent findings have demonstrated that spoken word cues can also facilitate retention. However, the relative effectiveness of these types of cue in TMR has yet to be examined. Moreover, we do not know whether spoken reactivation cues during sleep need to be a veridical acoustic match to the original cue for successful TMR, or whether a more abstract cueing process takes place (e.g., insensitive to speaker identity).
Methods and materials: Participants were trained to associate environmental sounds (e.g. a dog barking) and spoken words (e.g. “table”) with unrelated visually presented words (e.g. 'boat'). During the first half of subsequent overnight sleep, the sounds and words associated with half of the items correctly recalled in a pre-sleep cued recall test were replayed throughout SWS. Importantly, the words replayed in sleep were acoustically identical to those heard at training in Experiments 1 (female speaker) and 2 (male speaker). Experiment 3 used the male speaker at training, but the female for TMR. Performance was assessed by the proportion of correctly recalled words in the pre-sleep test that were forgotten at the post-sleep test.
Results: In Experiment 1 (female), a 2 (TMR: On/Off) x 2 (Cue Type: Sound/Word) repeated measures ANOVA revealed less forgetting for cued items relative to non-cued items (TMR main effect: $F(1,13) = 7.81$, $p = 0.015$). There was no main effect of Cue Type ($F(1,13) = 0.92$, $p = 0.35$) and no interaction between factors ($F(1,13) = 0.07$, $p = 0.80$), suggesting that the TMR benefit was equivalent for sounds and words. No significant effects were observed in Experiment 2 (male, all $p > 0.3$). Data analyses for Experiment 3 (switch) are ongoing.
Conclusions: The findings of Experiment 1 provide further indication that TMR facilitates consolidation processes in the sleeping brain, with an equivalent benefit for environmental sound and spoken word cues. Because auditory stimuli were embedded in background noise during sleep (i.e. to prevent auditory-evoked arousals), it is possible that the acoustic properties of the male spoken cues made them less effective in Experiment 2. Experiment 3 will provide insight to the mechanism underlying TMR in sleep by determining the degree of abstraction of the matching process between memory trace and auditory cue.

249 - **Sleep fosters encoding and consolidation of emotional memories regardless of REM presence**
Presented by: Nicola Cellini

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Objectives: Sleep seems to play a key role in consolidating emotional memories. Nevertheless, most studies have focused on REM sleep and targeted only negative vs. neutral memories, reporting inconsistent results. Here, we further explore the role of REM, NREM and sleep spindles in the encoding and consolidation of pleasant, unpleasant and neutral memories.
Methods and materials: Forty-seven (33 F) healthy university students were exposed to a first set of 40 pleasant, 40 unpleasant and 40 neutral pictures at 1:00PM and to a second equivalent set at 5:00 PM. During a later recognition test (5.15 PM), participants saw the previous 240 pictures intermixed with 120 novel stimuli. They had to decide whether they had seen the picture before. In the Nap group (N=31), participants took a 120-min nap after the first set presentation, while in the No-Nap group (N=16), participants remained awake. Based on polysomnographic recording, participants were segregated into REM (N=14) and NoREM groups (N=17). Memory discrimination for picture seen 4h before the recognition test was considered a measure of memory consolidation (*d'-4h*), whether discrimination of picture seen 15-min was considered a measure of encoding capabilities (*d'-15m*).
Results: Memory consolidation did not differ between the NoREM and REM groups, but No-Nap group showed a reduced consolidation compared to REM group only. Neutral pictures were better consolidated than pleasant stimuli, with no differences with unpleasant pictures. No differences were observed in the encoding between NoREM and REM groups, with No-Nap showing again a reduced ability compared to the REM group. Arousal and valence ratings did not differ between the groups. We also observed an association between N2 sleep spindles and *d'-4h* specific for negative stimuli.
Conclusions: Our results indicate that a daytime nap, regardless of the presence of REM sleep, fosters both the consolidation and the post-sleep encoding of declarative memories irrespective of their valence. We suggest that sleep promotes the formation of new emotional memories and that

sleep spindles may critically affect their subsequent consolidation.

277 - **Evidence for material-specific memory reprocessing during sleep in humans**
Presented by: Monika Schönauer

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Objectives: Sleep strengthens new memories. We assume that a reactivation of newly formed memory traces in the sleeping brain is one mechanism that mediates this effect. Replay of neuronal activity patterns has been found in single cell recordings of the hippocampus and neocortex in animals, where it has been shown to promote neuronal plasticity. The dynamics of this memory trace reactivation in humans, however, are still poorly understood. Activity on the level of brain areas suggests reactivation during sleep. Whether brain activity in human sleep actually reflects processing of previous learning episodes remains unclear.
Materials: To detect such replay activity, we developed a multivariate pattern classification (MVPC) algorithm that can determine based on electrical brain activity during sleep what type of images participants had viewed in a preceding learning session. 32 subjects learned pictures of either faces or houses before an 8-h period of nighttime sleep. Brain activity was recorded with high-density electroencephalogram (EEG) during the whole night. We employed MVPC methods to test whether electrical brain activity contains information specific to the previously learned material. If MVPC can determine from the sleep recording which type of visual stimulus a subject has learned before sleep, this implies that stimulus-specific reprocessing of the learned material takes place during sleep.
Results: We find significant patterns of learning-related processing in the EEG of rapid eye movement (REM) and non-REM (NREM) sleep, which are generalizable across subjects. This processing occurs in a cyclic fashion during specific time windows, which are congruous to critical periods of synaptic plasticity. Its spatial distribution over the scalp and its frequency composition differ between NREM and REM sleep. Moreover, only the strength of reprocessing in NREM sleep predicted later memory performance, speaking for at least two distinct mechanisms underlying memory reprocessing in these states.
Conclusions: We demonstrate that memory reprocessing occurs in both NREM and REM sleep in humans, but that it pertains to different aspects of the memory consolidation process. By linking brain activity during sleep with the content of previous learning, our findings bridge studies from multicell recordings in animals, showing learning-related reactivation, to human imaging studies, showing reactivation of brain regions during sleep.

318 - **Sleep spindles and intelligence: an update on the basis of large sample size studies**
Presented by: Martin Dresler

M. Dresler[1,2], P.P. Ujma[3], A. Steiger[2], R. Bódizs[3,4]
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Objectives: Sleep spindles are thalamocortical oscillations in nonrapid eye movement sleep, which play an important role in sleep-related neuroplasticity and offline information processing. Sleep spindles have further been associated with learning potential and intelligence; however, studies so far compared a large number of spindle and intelligence variables on the basis of comparably low sample sizes, potentially leading to false positive findings. In a literature review, we identified many null findings regarding the spindle-intelligence association that were not reported prominently and are thus largely neglected in the field. We therefore aimed to clarify the association between spindles and intelligence in studies with comparably large sample sizes while statistically controlling for multiple comparisons.
Methods: We investigated night sleep in a sample of 72 female and 88 male subjects, and afternoon nap sleep in a sample of 86 male subjects. N2 and N3 sleep epochs were subjected to automated sleep spindle analysis using the Individual Adjustment Method. Mean length and mean amplitude as well as sleep spindle density were computed for each subject and for each derivation for both slow and fast spindles, and were compared with performance in standardized fluid intelligence tests.
Results: In the night sleep of females, we found a positive association between intelligence and slow

sleep spindle duration in all except one derivation and between intelligence and fast sleep spindle amplitude in central and frontal derivations. In the night sleep of males, no association was found with the exception of a negative correlation between intelligence and fast spindle density in posterior regions. In contrast for afternoon nap sleep, we found a significant positive association between intelligence and slow spindle duration in all derivations also for males, however again no association with any of the other spindle parameters. The negative findings were comparably robust, i.e. did not change substantially without correction for multiple comparisons.
Conclusions: Our results demonstrate that, although there is an association between sleep spindle parameters and intellectual performance, these effects are more modest than previously reported and predominantly present in females. This supports the view that intelligence does not rely on a single neural framework, and that the intelligence-sleep spindle association is more complex than assumed.

323 - **Sleep deprivation impairs decision making in dynamically changing settings due to failure to process feedback information**
Presented by: Hans P.A. Van Dongen

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Objectives: We aimed to clarify the effect of total sleep deprivation (TSD) on decision making, specifically the updating of decision-relevant feedback information.
Methods and materials: N=26 healthy subjects (22-40y; 10 women) completed a laboratory study involving 2 baseline days, randomization to 62h TSD (n=13) or control (n=13), and 2 recovery days. A reversal learning decision task was administered at 48h intervals: during baseline, after 51h TSD (or well-rested control), and after recovery. The task required subjects to make a keyboard response to 4 numeric stimuli and to withhold the keyboard response to 4 other numeric stimuli, with a 750 ms deadline on each trial. Subjects were required to learn which stimuli were in the go (response) and no-go (withhold) sets based on feedback given after each response. Following a random number of trials, about halfway through the task, the mapping of go and no-go stimuli was reversed without warning, and this new mapping was in effect for the remainder of the task. Skin conductance response (SCR) amplitude was recorded to provide an index of affective reactions to choice outcome feedback. Statistical analyses employed repeated-measures ANOVA (type I error threshold: 0.05).
Results: At baseline, pre-reversal hits increased and false alarms (FAs) decreased as subjects acquired the mapping of go and no-go stimuli. Reversal of the mapping of go and no-go stimuli produced a transitory disruption in performance, followed by increased hits and decreased FAs. After 51h TSD, pre-reversal performance improved less than in well-rested controls. After reversal, the TSD group no longer differentiated the go and no-go stimuli. After recovery sleep, performance in the TSD group improved, but not to the level of controls. Sleep loss-induced deficits in task performance were associated with blunted affective reaction to choice outcome feedback, as indicated by reduced SCR amplitude.
Conclusions: Sleep deprivation was associated with blunted affective reactions to feedback and degraded ability to utilize feedback to guide decision making. Sleep deprivation may lead to poor decision making by causing failure to tag feedback information as salient. In real-world, dynamically changing settings that require adjustment of actions based on outcome feedback, the novel mechanism of feedback blunting may explain how sleep loss can lead to catastrophic decision outcomes. Research supported by NIH grants HL105768 and CA167691.

308 - **Auditory closed-loop stimulation of sleep slow oscillations in the middle-aged: investigating effects on associated memory functions**
Presented by: Jules Schneider

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The ~1 Hz slow oscillation (SO) which hallmarks slow wave sleep (SWS) has been implicated a major role in facilitating healthy cognitive functioning, particularly for the consolidation of sleep-dependent

memory and the ability to encode novel information post-sleep. This deep sleep however wanes throughout the middle and later years in life: SWS decreases steadily in proportion to total sleep time, is more fragmented by arousals and shows decreased SO amplitude. Concurrently, human cognitive abilities, most notably memory performance, deteriorate with increasing age. Correspondingly, previous research in the middle-aged and elderly has demonstrated a reduced benefit from the overnight consolidation effects found in younger adults and has been linked to the amount and quality of SWS obtained.
In this study, we examine the possibility of using benevolent sleep manipulation to improve SWS in the middle-aged and effects of such on memory consolidation and encoding abilities. In a within-subject design, 10 healthy adults (6 female) between the ages of 49 and 63 (*mean*=55, *SD*=4.96) participated. Using an established closed-loop stimulation method, we delivered short auditory stimuli consisting of 50ms pink noise in phase with endogenous slow oscillatory activity during SWS. To test memory, participants were taught word-pairs and trained on a finger-tapping task prior to sleep and re-tested on both as well as performing a picture-encoding and recognition test the following morning.
Stimulation did not affect sleep stages, word-pair recall or finger tapping performance when compared to a sham condition, but it significantly improved recollection (d') of pictures encoded post-sleep ($p < 0.05$), suggesting that our auditory stimulation protocol facilitates subsequent encoding and retrieval. These findings suggest that selective memory functions can be boosted by the application of auditory closed-loop stimulation in the middle-aged, but mechanisms may underlie a different interplay in the ageing brain, and therefore require more extensive investigation in the light of this promising stimulation technique.
Acknowledgements: This work was funded by the Deutsche Forschungsgemeinschaft (TR-SFB 654) and the University of Manchester. J.S. was supported by a BBSRC DTP studentship. The authors declare no competing financial interests.

492 - **Consistency of sleep effects on declarative and procedural memory performance in primary insomnia patients and ´insomnia mispercepts´**
Presented by: Daniel Johannes Körner

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Numerous studies (e.g. Diekelmann et al., 2010) have found a positive impact of sleep on memory by facilitating memory performance and/or stabilizing memory traces thereby rendering them less susceptible to interference. Griessenberger et al. (2013), moreover, found that susceptibility to interference is pronounced in insomniacs in the declarative memory domain only as compared to the procedural domain. However, it is still unclear how stable these findings are in the long term. In a long-term study (i.e. four visits during several weeks, we investigated the temporal stability of declarative and procedural memory abilities as well as susceptibility to interference.
We compared the stability of the effects in two groups, insomnia patients (IP) and patients, who misperceive their sleep quality, but show sleep efficiency comparable to healthy controls (insomnia misperceivers, IM). Each visit to the lab comprised two nights with full polysomnography (PSG) and a declarative memory task (DMT, word-pair association) or a procedural memory task (PMT, finger tapping). Following the encoding (ENC) session in the evening, they were tested during a retrieval session (RET1) the following morning. After learning an interfering fingertapping sequence or list of word pairs, they were tested again on the initially learned material (RET2) and then again during a follow-up test six days later (RET3).
As expected, IPs and IMs differed regarding their sleep architecture (wake after sleep onset, sleep efficiency, total sleep time). There were no differences between the two groups regarding performance on the PMT. This is well in line with previous findings (Griessenberger et al., 2013). Moreover, this finding was stable across the four visits. In the DMT, IPs and IMs differed regarding their performance on RET2 and RET3, the postinterference and follow-up sessions, respectively. Misperceivers always exhibited better performance than insomniacs, which is in accordance with previous results. Interestingly, a comparison of the RET2 results across the four visits to the lab revealed a general increase of performance across visits in both groups. Besides this, IPs were more susceptible to interference than IMs on the DMT. This effect was even evident as a trend in the delayed recall (RET3). Interestingly, both groups became less susceptible to interference with each visit to the lab, which could indicate a task-specific training effect.

265 - **How to become an expert: a new perspective on the role of sleep in the mastery of procedural skills**

Presented by: Stuart Fogel

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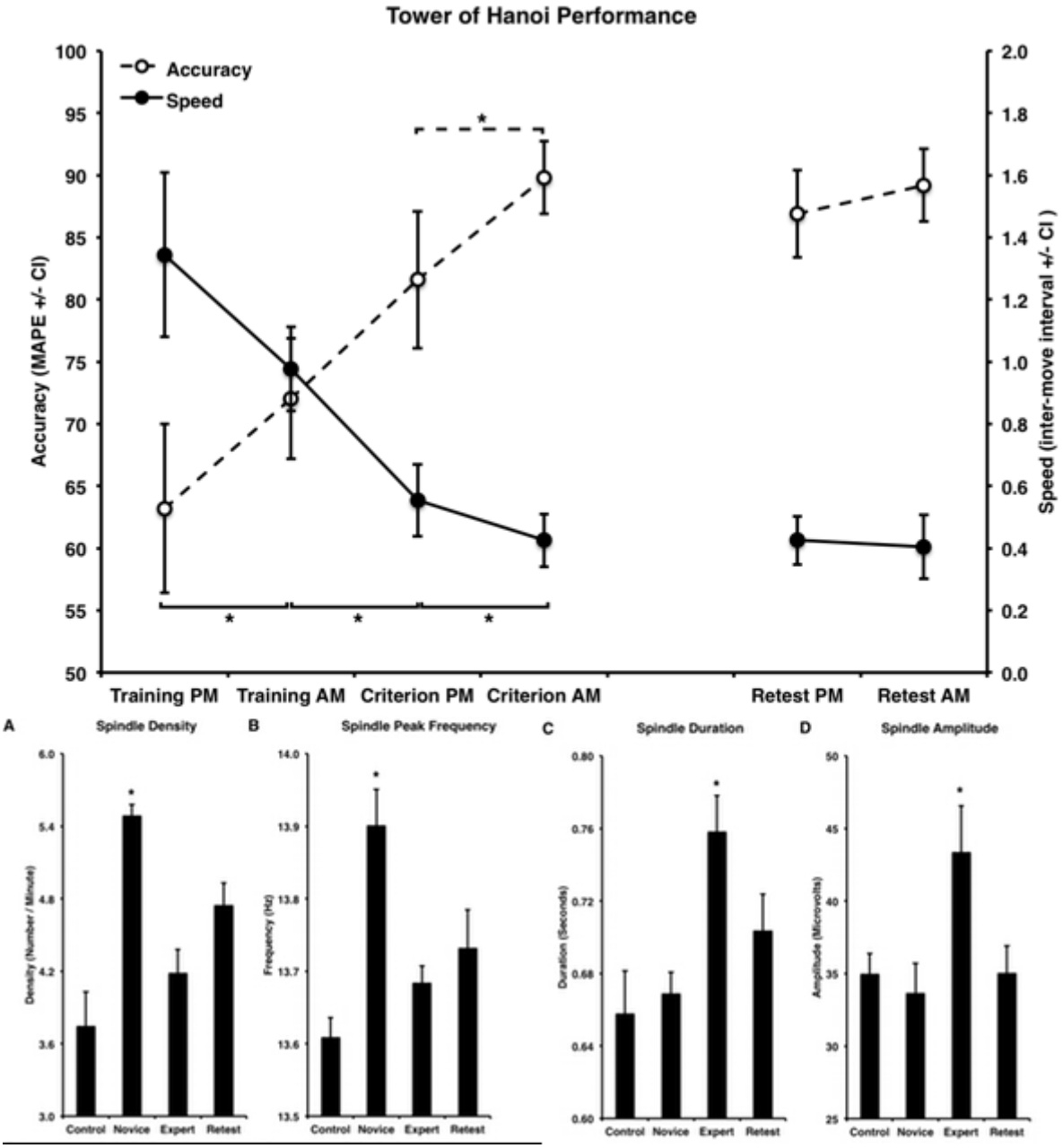
Brain & Mind Institute, Department of Psychology, Western University, London, ON, Canada

Objectives: What is required to master a new skill? With enough practice - and sleep - we adopt strategies that become automatic and subsequently refine to become an “expert”. It is not known whether sleep is involved in the mastery of new skills, nor is it known whether this may be dependent on rapid eye movement (REM) or non-REM (NREM) sleep. Here, we sought to identify the post-learning changes in sleep as individuals progress from “Novice” to “Experts” on a cognitive procedural task (e.g., the Tower of Hanoi task; ToH) that can be mastered over several nights, and requires the use of implicitly acquired recursive logic to arrive at the optimal solution.
Methods and materials: Fifteen healthy young adults underwent several nights of post-training polysomnographic recording where subjects performed the ToH task to arrive at an optimal solution (2^N-1=31; where N=5 disks). Implicit acquisition of recursive logic results in an identical and optimal pattern of movements, learned through trial-and-error. On the Control night, subjects performed a modified ToH task using only two disks where legal moves were randomly prompted, thereby having the same visual and motor experience, but eliminating the procedural learning component.
Results: When the task was novel, and only speed ($t(11)=2.55, p=0.027$; Fig.1 top) but not accuracy increased, post-training spindle density ($t(11)=3.52, p=0.005$) for fast spindles ($t(11)=4.24, p< 0.001$) increased significantly (Fig.1a-b). On the night where subjects became Experts and had a significant increase in accuracy on the ToH ($t(11)=2.60, p=0.025$; Fig.1 top), REM sleep increased vs. Control ($t(11=3.40, p=0.006$), where spindles in NREM2 became larger (Fig.1c-d) in terms of amplitude ($t(11)=2.32, p=0.041$) and duration ($t(11)=3.18, p=0.009$) which was correlated with overnight improvement in accuracy ($r(10)=0.63, p=0.039$). Re-exposure to the task one-week after the task had been mastered, resulted in increased NREM sleep vs. Control ($t(11)=2.21, p=0.049$).
Conclusions: These results will help to elucidate how REM and NREM sleep are involved in memory consolidation, and may help resolve controversies regarding the role of REM sleep in memory consolidation in humans, for which consistent evidence is currently lacking. This study identifies, for the first time that both increased REM sleep and spindles are involved in the acquisition of expertise of a new skill, but NREM sleep is involved in the refinement of an already mastered skill.



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03.11.2015 - 16:30-18:00
Poster Session 3

489 - **Adolescents' sleep habits and brain gray matter volumes**
Presented by: Anna S. Urrila

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Objectives: Adolescents today sleep less and experience more daytime sleepiness symptoms as

compared to previous generations. Important developmental changes occur during adolescence in both brain and sleep structure. The objective of this study was to assess the correlations between adolescents' sleep habits and brain gray matter volumes (GMVs). We hypothesized that poor sleeping habits would be associated with regional brain GMV abnormalities during adolescence.
Materials and methods: The sample comprised of n=177 (52 % girls) 14-year-old French adolescents from the general population recruited from schools. All adolescents underwent MRI examination on a Siemens Trio 3 Tesla scanner, including high-resolution structural T1-weighed images to investigate GM. Whole-brain voxel-based morphometry (VBM) was performed using statistical parametric mapping software (SPM8). Sleep habits and sleepiness symptoms were assessed with self-report questionnaires, and neuropsychological performance using the Cambridge Automated Neuropsychological Test Battery (CANTAB).
Results: Bedtimes and wake up times during weekends were inversely correlated with GMVs of several frontal and medial cortical regions. Further, smaller GMV in the medial frontal cortical areas was associated with poorer spatial working memory performance. Wake up times during weekends correlated with daytime sleepiness scores. Sleep habits during weekdays did not correlate with brain GMVs.
Conclusions: Our results provide evidence that later weekend sleeping hours correlate with smaller brain gray matter volumes in brain areas critical for working memory, attentive, and affective functions among adolescents of the general population. The results suggest that late-prone sleep may interfere with brain development, and highlight the importance of paying attention to sleep habits during adolescence.

266 - **Sleep/wake cycle patterns and 24-h feeding schedules in 5- to 7-month-old infants**
Presented by: Eva Steinkoler

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Objective: To evaluate the association between sleep/wake cycle (SWC) patterns and feeding schedules in healthy infants.
Participants and methods: We studied 980 infants between 5 and 7 months of age who participated in an iron deficiency anemia preventive trial. 24-h SWC patterns and feeding schedules were collected by survey, without change in the usual SWC or feeding pattern. Data were assessed for daytime (DTP) and nighttime (NTP) periods.
Results: There was a positive association between the duration of waking in the NTP and the number of feedings during the DTP (r=0.10, p=0.02). Most infants (87%) woke up and were fed during the NTP. Relative to infants who woke up and were not fed, those who woke up and were fed had shorter duration of night-time sleep (8.9 vs. 9.8 h, p=0.005), more night awakenings (1.7 vs. 1.1, p=0.003), shorter night-time sleep episodes (4.7 vs. 9.5 h, p< 0.001), and shorter duration of daytime waking (7.7 vs. 9.4 h, p=0.02). Furthermore, among infants who woke up more than 4 times at night, 55% was fed over 6 times during DTP. In contrast, among infants who maintained uninterrupted sleep, 76% ate less than 6 times during the day.
Conclusion: Several associations between SWC patterns and feeding schedule were apparent around 6 months of age. Infants who were fed when they woke up in the NTP had reduced and/or fragmented nocturnal sleep and daytime wakefulness. These results provide further support of the value of avoiding night-time feeding for SWC consolidation in infancy.

74 - **Possible predicting factors of adenotonsillectomy for pediatric OSAS**
Presented by: Rayleigh Ping-Ying Chiang

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Adenotonsillectomy is the treatment of choice for pediatric obstructive sleep apnea syndrome (OSAS). The successful rate of adenotonsillectomy varies according to individuals. This article aims to evaluate

possible factors influencing the successful rate of adenotonsillectomy for pediatric obstructive sleep apnea syndrome.
Retrospectively, 63 pediatric patients ranged from 2 to 16 years old were included. Syndromics and patients who had received orthodontic treatment or orthognathic surgery were excluded. All patients received pre-operative and post-operative polysomnography and pre-operative cephalometry. All patients received adenotonsillectomy by single surgeon.
The surgical successful rate (defined as improvement of AHI value >50% or post-operative AHI< 5) is not statistically significant related to pre-operative cephalometric parameters, age, gender, body mass index (BMI) and adenoid size. However, the surgical successful rate is significantly related to pre-op AHI and size of palatine tonsils . In addition, all patients who received adenotonsillectomy showed improved polysomnography parameters which reach statistically significant difference.
Although adenotonsillectomy cannot cure all pediatric OSAS in our research, all patients showed significant improvement of polysomnography parameters. Besides, pre-op AHI and tonsil size may be the possible predicting factors for surgical successful of adenotonsillectomy for pediatric OSAS.

218 - **Perioperative complications following single or combination upper airway surgery for obstructive sleep apnea**
Presented by: Zamzil Amin Ashaari

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Objective: To assess the relationship between perioperative complications and upper airway surgery for obstructive sleep apnea (OSA).
Methods: The records of 128 adult patients, diagnosed with obstructive sleep apnea (apnea-hypopnea index (AHI) >5), who underwent upper airway surgery at a single tertiary referral hospital from 2007 to 2014 were reviewed. Pulmonary, surgical, and cardiovascular complications within the first 30 postoperative days were analysed according to types of upper airway surgery. Upper airway surgery types were single surgery or combinations of surgery to the tonsils, pharyngeal adenoids, soft palate, tongue base and nose. Logistic regression was used to assess the multivariable association of age, sex, BMI, OSA severity, medical comorbidity, and types of upper airway surgery with postoperative complications.
Results: At least one perioperative complications occurred in 48 of 128 patients (37.5%). In a multivariable model, the overall complication rate was increased with the age, obesity, smoking and underlying comorbid medical problems. Complication rates were not associated with OSA severity, types of procedures performed and whether the surgery was a single or combination surgery.
Conclusion: In OSA patients undergoing upper airway surgery, the severity of OSA as assessed by the AHI, and the sites and numbers of concurrent surgery performed were not associated with the rate of perioperative complications.

408 - **EEG spectral changes associated with spontaneous arousals in NREM sleep in children with upper airway obstruction correlate with neurocognitive performance**
Presented by: Alex Chatburn

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Objectives: Children with upper airway obstruction (UAO) have fragmented sleep due to the occurrence of abnormal respiratory events that are often accompanied by arousal. Sleep fragmentation in adults has been shown to contribute to the negative consequences of UAO, particularly neurobehavioural deficits. However, children with UAO do not demonstrate the same degree of sleep fragmentation as seen in adults with UAO. It has been postulated that sleep integrity in children may be preserved despite frequent arousal through the modification of arousal response. This change in arousal response may be reflected by arousal number, arousal length or EEG spectral power associated with arousal.
Methods: 87 pre-pubertal children aged 3.0 to 12.9 years underwent two sessions of overnight polysomnography and neurocognitive testing, 6 months apart. Children with a clinical diagnosis of UAO were given adenotonsilectomy following the first PSG. Subjects were divided into three groups

for analysis: non-snoring controls (RDI = 0; n = 45), primary snorers (RDI < 1; n = 23) and children with obstructive sleep apnoea (RDI > 1; n = 19). Fast Fourier Transform (FFT) was performed over three time periods: during spontaneous arousal as well as the 10 seconds prior to and following each arousal. Mean relative power was calculated for: delta (0.5-4.5 Hz); theta (4.5-9Hz); alpha (9-12 Hz); sigma (12- 15 Hz) and beta (15-30Hz) frequency bands. Power was compared between groups and correlated with neurocognitive performance.
Results: There was no difference in spontaneous arousal frequency between groups but children with UAO had arousals of shorter duration ($p < 0.01$). Children with UAO displayed lower power in the alpha band pre- and post-arousal, and lower sigma power pre- and post-arousal compared to control children
($p < 0.05$). This difference was still present but reduced 6 months post treatment. For children with UAO, the reduction in power in these bands correlated with reduced neurocognitive performance.
Conclusion: Children with UAO showed altered neural activity during spontaneous arousal, in particular a decrease in higher frequency EEG power. This power decrease suggests a blunted arousal response for the purposes of preserving sleep macrostructure in the context of increased sleep disturbing events, but may itself come at the cost of reduced daytime neurocognitive function.

224 - **Clinical audit study of home-based initiation of CPAP in children**
Presented by: Arthur Y. Teng

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Introduction: Obstructive Sleep Apnoea (OSA) is a serious cause of morbidity during childhood. The mainstay of treatment of OSA in children is adenotonsillectomy. CPAP is the second line of treatment for children with residual OSA after adenotonsillectomy and in children with other risk factors for OSA. This study compiles the experience of the CAPAC (Community Acute Post-Acute Care or “Hospital in the Home”) under the Respiratory Team of a tertiary Paediatric Hospital, on home-based CPAP initiation in children.
Methods: A retrospective clinical audit was undertaken with review of the electronic medical records (EMR) of all the patients with OSA admitted to CAPAC for home-based CPAP initiation from April 2010 to September 2013.
Results: Over a period of 3 years and 5 months, the CAPAC Unit initiated CPAP at home for 115 patients with obstructive sleep apnoea. The youngest child in the study group was 0.1 year and the oldest was 17.8 years (mean age 7.3 years). On analyzing the aetiology and predisposing conditions of OSA, 91 patients (79%) had adenotonsillar hypertrophy of which 88 (97%) underwent adenotonsillectomy. Postoperatively, 61 children out of 88 (69%) could cease CPAP. Other predisposing conditions to obstructive sleep apnoea included obesity (24%), neuro-muscular disorders, Down syndrome, prematurity < 30 weeks, cleft palate, choanal atresia, achondroplasia, cerebral palsy, Treacher-Collins Syndrome and other syndromes. As per the CAPAC documentation based on parental history, during the CPAP initiation period, the use of CPAP ranged from 0.5 hours to 11 hours with a mean of 7 hours. The age of tonsillectomy ranged from 1.3 years to 17.9 years with a mean of 6.5 years.
Conclusion: This audit demonstrates the success, safety and acceptance of a community-based service in the initiation of CPAP at home for children with OSA, with the potential of significant savings on bed-days needed in hospital.

155 - **Observable movement patterns and sensorimotor sensations of paediatric patients/parents with familial Willis Ekbom disease (WED) during the suggested *clinical* immobilization test (SCIT)**
Presented by: Osman Ipsiroglu

N. Beyzaei[1], A. Wagner[1], M. Berger[1], R. Milner[2], S. Stockler[3,4], O. Ipsiroglu[1,4]
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Objectives: Diagnosis of WED is challenging in children with neurodevelopmental conditions (NDCs).

To overcome current diagnostic challenges, we investigated an office-based clinical test, the SCIT, to gain a better understanding of described *sensorimotor sensations* and *observable movement patterns* of patients and attending family members with a history of WED.
Methods and materials: *Patients:* 31 paediatric patients with chronic early-onset insomnia and NDCs were seen together with their mothers, who presented with history of WED, iron deficiency and/or anaemia. WED was diagnosed clinically by sleep and family history, and observable movement patterns during the SCIT. *SCIT:* Clients get up, shake out, sit bare-foot on an appropriately sized chair, and try to remain relaxed and motionless. Observable movement patterns accompany descriptions of sensorimotor sensations.
Results: *SCIT of mothers:* 26/31 (84%) could participate actively: 100% described an urge to move and 53% had sensorimotor symptoms in their legs/toes/feet, the remaining 47% could not specify; 69% had observable movement patterns (twitching; raising heels; rubbing/clenching; repetitive stereotypical limb movements), the remaining 31% suppressed observable movement patterns by increasing tension. *SCIT of the children:* 17/31 (55%) could participate actively: 82% described an urge to move and 47% had sensorimotor sensations in their legs/toes/feet, the remaining could not specify; 76% had observable movement patterns (see above). Out of this group, only 10/17 (59%) described sensorimotor sensations going along with the urge to move and had, in addition, observable movement patterns; the remaining could either describe sensorimotor sensations (4/17) *or* had observable movement patterns (3/17).
Conclusions: Aside from descriptions of sensorimotor sensations, the SCIT captures observable movement patterns as a new structured diagnostic criterion. This test initiated collaborative discussions about sensorimotor sensations that result in an urge to move, and observable/non-observable movement patterns for being able to sit still, but need electrophysiological validation.

152 - **Overmedication and poly-pharmacy in children and youth with fetal alcohol spectrum disorders (FASDs) and/or prenatal substance exposure (PSE)**
Presented by: Osman Ipsiroglu

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Objectives: In children and youth with FASDs and/or PSE who face multiple challenges, sleep problems often remain unrecognized. Given the complex course of their lives and mental health co-morbidities, current clinical explanatory models are often daytime focused and may not acknowledge sleep problems. Therefore, we prospectively investigated challenging/disruptive sleep/wake behaviours in children and youth with FASDs/PSE.
Methods and materials: After analysing previous assessments, diagnoses and therapeutic suggestions, we conducted functional ´Sleep/Wake-Behaviour Assessments´ of the patient and if applicable, birth parents/siblings. This is a clinical practice strategy based on narrative schema and therapeutic emplotment, utilizing qualitative interviews and incorporating caregivers´ contributions and if possible, conducted videosomnography at home, the natural setting where sleep occurs.
Results: Familial Wills Ekbom disease (WED) and sleep disordered breathing (SDB) were the most frequent causes for sleep problems (WED: n=37/37; SDB: n=14/37). The majority of patients had been previously medicated for daytime problems. Consequently, sleep problems were also targeted with (up to 18) medications without investigating the underlying cause. Use of psychostimulants started < 6yrs (youngest patient: 2.5yrs), frequently leading to neurologic/behavioural, and antipsychotics to metabolic Adverse Drug Reactions. Medication indices vary from 2 (< 6yrs) to 5.2 (> 10yrs). Treating the underlying sleep problem helped to reduce and/or wean off antipsychotics/psychostimulants in all cases.
Conclusions: Deficits in the diagnostic recognition of chronic sleep problems among children with FASDs/PSE result in psychotropic substances as the mainstay of therapeutic interventions, and thus fragment care. We propose a clinical practice strategy acknowledging exploration of challenging sleep/wake behaviours and a database for exploring the dimension of the problem.

642 - **Early sleep features determine the neurocognitive development at 36 months old: the AuBE study**

Presented by: Michel Lecendreux

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Background: Sleep quantity and quality were associated in school-aged children to cognitive development measured by the executive functioning, school performance, intelligence quotient (IQ), and language development. Few studies were conducted among preschoolers from healthy general population and usually focused on one aspect. We aimed at identifying, among 36 months old children, factors associated with IQ estimated through WPPSI-III and its indicators: full-scale (FSIQ), verbal (VIQ) and performance (PIQ) and their sub-scale scores.
Methods: We included 194 children from the French birth-cohort AuBE with both available WPSSI-III scores at 3 and sleep data. Mothers and children's information were collected through self-questionnaires at birth, 6, 12, 18, and 24 months. Sleep duration, snoring and night-awakenings were also collected at each age. A day/night sleep ratio (DNR) was calculated.
Results: Mean scores were 106 (range: 62-138), 92 (61-140) and 99 (61-138) for VIQ, PIQ and FSIQ, respectively. In multivariate models, being a ≥3 born-child, and watching TV ≥1 hour/day at 24 months were negatively associated with all IQ scores while collective care arrangement was positively associated. Night-wakening at 6 and frequent snoring at 18 months were negatively associated with PIQ, some subscales and FSIQ contrary to DNR at 12 months. No association was observed between early sleep characteristics and VIQ.
Conclusions: We confirmed the negative effect of television viewing on IQ scores and the positive effect of early collective childcare arrangement among French preschool children. Moreover, we showed that early sleep characteristics specifically influenced IQs and subscales scores at 36 months old.

29 - **Effect of sleep hygiene education program on sleep problems in shift work nurses**
Presented by: Zohreh Yazdi

Z. Yazdi[1], S. Jalilolghadr[2], F. Tootoonchian[3]
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Objectives: Sleep Condition of Nurses is important because it could effect on providing health care services by them .The purpose of this study was to evaluate the effect of sleep hygiene education program on insomnia, daytime sleepiness and sleep quality in shift work nurses.
Methods: This study was conducted on nurses working in university-related hospitals of Qazvin, during 2013. Demographic variables including age, sex, education level, weight, height, work experience, shift numbers, shift hours were collected. Information about insomnia, daytime sleepiness and sleep quality were gathered by standardized questionnaire. One hundred nurses with insomnia were chosen. Sleep hygiene education program (4 hours of education) was conducted for 50 nurses, randomly. After one month sleep questionnaires completed from nurses again and compared with basement data. Also, comparison was conducted between intervention and control groups by student t-test, SPSS software version 19.
Results: Mean age of nurses was 29.8±3.2. Mean hours of work per month was 237.2±12.9. Comparison between intervention and control groups displayed significant improvement of insomnia, daytime sleepiness and sleep quality after sleep hygiene education in intervention group (P-value< 0.05).
Conclusions: According to this study, sleep hygiene education could improve shift work sleep disorders in shift work nurses.

76 - **Association between sleep disorders and severity of burnout syndrome in firefighters**
Presented by: Zohreh Yazdi

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Objective: Job burnout is a response to high workload and excessive demands in the workplace. It induces many adverse health outcome and job dissatisfaction. The aim of this study was assessment frequency of sleep disorders and its relation with severity of burnout syndrome in firefighters.
Methods: This study was designed as a cross-sectional study. The data was collected by using a comprehensive questionnaire including Pittsburg Sleep Quality Index, Insomnia Severity Index and Maslach burnout index. Participants were asked questions about their personal information. These questionnaires were then filled in by 120 firefighters.
Results: Mean age of participants was 32.6±4.7 years. Prevalence of poor quality of sleep and insomnia were 42 (35%) and 27 (22.5%), respectively. 86 (71.6%) of firefighters suffering from mild burnout, while 34 (28.3%) of them suffering from moderate and severe burnout. There was significant association between burnout and severity of insomnia (rho=0.3, p=0.01). We could not find significant association between poor quality of sleep and burnout (P>0.05).
Conclusion: The results of the present study provide support for a relationship between burnout and disturbed sleep, as shown by the high prevalence of insomnia among firefighters with high levels of burnout.

220 - **Effects of nocturnal shift work on sleep pattern, leukocytes and circulating antibodies in protection against meningococcal group C vaccine**
Presented by: Francieli S. Ruiz

F.S. Ruiz[1], D.S. Rosa[2], I.Z. Zimberg[1], M.V. Santos[1], J. Nunes[2], J.S. Apostolico[2], L.Y. Weckx[3], A.R. Souza[3], L.R. Bittencourt[1], S. Tufik[1], M.T. de Mello[1]
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Objective: To assess the sleep pattern and the antibody response against meningococcal group C (MenC) vaccine in shiftworkers.
Methods and materials: The current study comprised 35 workers aged 22-59 (22 females), working in nocturnal and diurnal shifts of different job segments in the city of Sao Paulo, Brazil. The night workers were on this schedule for at least 6 months. The sleep pattern was evaluated by one night polysomnography (PSG) exam and by Epworth Sleepiness Scale (ESS) on the night off work. After PSG, each participant in both groups received a MenC vaccine. The blood was collected in 3 time points: just before vaccine (baseline), 28 and 56 days after vaccination. Hematological analysis of venous blood was carried out for the assessment of the serogroup-specific IgG total concentration (ELISA), leucogram and cortisol analysis. Data were presented as mean±S.D. T-test and repeated measures ANOVA were used to compare the groups. The significance level was set at $p< 0.05$.
Results: The mean age of the nigh workers was 36.4±8.5 years (day workers: 37.3±10.6) and the body mass index was 27.8±7.1 kg/m2 (day workers: 25.4±2.7). There were no significant differences between night workers and day workers regarding the somnolence: night workers 11.7±3.9 vs. day workers 9.6±4.5. However, night workers showed decreased N3 stage (65.68±20.33 min vs. 89.88±25.9 min; p=0.005) and REM sleep (70.64±17.97 min vs. 95.47±22.8 min; p=0.02) compared to day workers. There was no difference between the groups in the cortisol levels. We observed an increased total lymphocytes number (cells number x 103/µL) in the night workers (2.6±0.53 vs. 2.0.4±0.56; p=0.005), even considering the gender factor as a covariate. No significant difference in the IgG levels at 28 and 56 days after vaccination were found between the groups. Both groups showed a significant increase in this immune parameter regarding baseline levels. However, night workers demonstrated the double of the amount of IgG at baseline concentrations regarding day workers.
Conclusion: Nocturnal shiftwork was associated with reduction in N3 and REM sleep stages, increase in total numbers of peripheral blood lymphocytes and an increased antibody levels against meningococcal group C vaccine before the vaccination.
Financial support: FAPESP (#2011/20316-7 FSR; 2012/09700-2 MTM), CNPq (401823/2012-1; LRB) and Associação Fundo de Incentivo à Pesquisa (AFIP).

225 - **Factors that influence nurses´ job satisfaction: exploring about nurses´ chronotype**

Presented by: Zohreh Yazdi

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Objective: Nurses job satisfaction is important in Iran because Iran´s hospital suffering from nursing shortage and nurses´ high turnover from many years ago. Also, recent studies suggested that nurses´ dissatisfaction may contribute to the increasing medical errors. This study aims to determine association between different chronotype in registered nurses and their job satisfaction.
Methods: This study was conducted on 202 registered nurses working in university hospitals of Qazvin, during July and August 2014. Demographic variables including age, sex, education level (bachelor and master of sciences), marital status, salary, and work experience were collected. Chronotype trait was assessed by Horne-Ostberg questionnaire. Also, nurses´ job satisfaction was determined by using Job Satisfaction Questionnaire developed by Smith, Kendall.
Results: Totally, 202 nurses were participated in this study and all of them were female. Mean age of participants was 31.9±6.5 years, with a range between 22 to 51 years. Mean years of work experience was 8.1±6.2, with a range of 4-18 years. Mean nurse´s salary per month was 1554000.87±158.8 tomans. Of the total participants, 182 nurses (90.1%) had bachelor degree, and 20 nurses (9.9%) had master of sciences. In all participants, 136 (67.4%), 12 (5.9%), and 54 (26.7%) of nurses had indentified as intermediate, evening, and morning type, respectively. There was not significant association between different chronotype and total job satisfaction in our participants (P>0.05). There was significant correlation between different chronotype and nuses´ salary (P< 0.05).
Conclusion: This study revealed that chronotype could not affect on nurses´ job satisfaction. More research is required to understand mast important factors that relate to job satisfaction of hospital nurse.

348 - **Light exposure during sleeping time affects sleep in nurses under shift work**
Presented by: Wen-Chun Liao

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Introduction: Light is an important zeitgeber for the circadian system. This study investigated light exposure during sleeping time and sleep patterns for consecutive 6 days in nurses under fixed shifts.
Methods: One hundred and twenty-two nurses (day shift DS=39, evening shift ES=45, night shift NS=38) with a mean age of 30.2±5.5 years completed sleep diary and actigraphy with light meter for 6 days. Mean acitgraphic sleep with light exposure during sleeping time was calculated for working and off days, respectively. Standard shiftwork index chronic fatigue scale and Pittsburg Sleep Quality Index were filed.
Results: 79.5% of nurses complained poor sleep (PSQI >=5) with the worse sleep reported from NS nurses (mean PSQI=7.9±2.8, F=3.632, p=.029). Light exposure during sleeping time (LEST) was higher in NS (47.0±110 lux, F=3.05, p=.053) than in DS (7.5±10.7 lux) and in ES (12.6±22.4 lux) during off days. No differences were found in chronic fatigue among nurses under three shifts. Compare their actigraphic sleep between working and off days, NS nurses spent less time in sleep during working days (5.5 hrs vs. 6.1 hrs in DS and 6.5 hrs in ES; F=4.149 p=.019) but slept more during off days (7.0 hrs, paired t=3.40, p=.002). More LEST in working days was associated with less total time in bed (r=-0.266, p=.013) and less total sleeping time (r=-0.247, p=.021).
Conclusion: Nurses under night shift sleep more during off days to compensate their less sleep during working days and to maintain their energy. However, light exposure during sleeping time is too bright (>30 lux) in NS nurses. Light exposure during sleeping time affects nurses' sleep under night shift.

440 - **Effect of sleepiness in night worker's postural and psychomotor performance**
Presented by: Fernanda V Narciso

F.V. Narciso[1], J.A. Barela[2], S.A. Aguiar[2], F.S. Ruiz[3], A.N.S. Carvalho[4], L.S. Castro[3], S. Tufik[3], M.T. de

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Objective: The objective of this study was to investigate changes in postural control and psychomotor performance of night workers after night shift.
Methods and materials: Twenty night workers were included: 20 polysomnography technicians (35±7y) who worked in a 12x36h night-system, that is, 12 hours working and 36 hours off. All participants wore wrist actigraphs for four days. Before and after night shift (fourth and fifth days - 21:00 p.m. and 09:00 a.m.), the participants were evaluated with: (a) subjective sleepiness recordings by means of the Karolinska Sleepiness Scale (KSS: 1-“extremely alert”, 9-“extremely sleepy-fighting sleep”); (b) postural control recordings by means of force platform in which the participants had to stand as still as possible for 30 seconds with eyes-opened; and (c) psychomotor performance recordings by means of 10-minute Psychomotor Vigilance Task (PVT). Analyzes of Variance were used to compare means, and statistical significance set at 5%.
Results: It was observed a significant increase of 2.05±1.82 points in the KSS (before shift: 3,45±1,63; after shift: 5,50±1,91; p< 0,001), as well as an increase of 125,94±180.72cm in mean total sway path of center of pressure (COP sway path) (before shift: 929,98±268,07cm; after shift: 1055,92±296,75cm; p=0,006) and 31,43±0.03ms in mean reaction time of PVT (before shift: 250,02±7,12ms; after shift: 281,45±13,62ms; p=0,006) were observed after night shift. ROC curve analysis evidenced that an increase of at least 893,94cm in COP sway path, 248,73ms in mean reaction time discriminates sleepy and non-sleepy workers (scores greater than 7 in the KSS) with 77% sensitivity and 71% specificity, 84% sensitivity and 72% specificity, respectively.
Conclusion: Our data suggest that longer working hours, night work system (12x36 hours) and sleepiness may have a greater impact in postural control and psychomotor vigilance performance of workers.
Financial Support: CAPES, FAPEMIG.

30 - **Association between sleep hygiene practices and sleep quality in medical students**
Presented by: Zohreh Yazdi

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Objectives: Poor quality of sleep is a distressing and worrying condition that can disturb academic performance of medical students. Sleep hygiene practices is one of the important variables that affects sleep quality. The objective of this study was to assess association between sleep hygiene practices and sleep quality of medical students in Qazvin University of medical sciences**.**
Methods: In this descriptive study, a total of 285 medical students completed a self-administered questionnaire. Demographic data, sleep-wake schedule in weekday and weekday, and sleep duration were collected. Students´ sleep quality was assessed by Pittsburg Sleep Quality Index (PSQI). Data were entered on SPSS software version 17.
Results: Of the total study population, 150 were female (52.6%). Mean age of students was 22.8 ± 1.74 years**.** Overall, 164 (57.5%) of students had poor sleep quality. Mean global PSQI score and average score of four its subscales were significantly higher in male than female. Regression analysis showed that boys, students at senior level, married students, and those with six improper sleep hygiene practices slept worse.
Conclusion: The findings of this study showed that the prevalence of poor sleep quality in medical students is high. Improper sleep hygiene behaviors might be a reason for poor quality of sleep in medical students.

72 - **Prevalence of eye strain and its relation with insomnia in daily VDT users**
Presented by: Zohreh Yazdi

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[1]Social Determinants of Health Research Center, [2]Qazvin University of Medical Sciences, [3]Metabolic Disease Research Center, Qazvin University of Medical Sciences, Qazvin, Islamic Republic of Iran

Objective: Visual display terminal (VDT) work has become a major part of operation in majority of

workplace. Many studies showed that use of VDT is associated with a variety of physical and psychological symptoms. This study evaluates prevalence of eye strain and its relation with insomnia in office workers.
Methods: This cross sectional study was done on 209 computer users who work more than one year in this field. All participants completed a questionnaire about their age, sex, BMI, years of experience, and hours of daily computer use. A standardized questionnaire was used for detection presence and severity of eye strain. This questionnaire contains 15 questions and four component including eye strain, visual impairment and the surface impairment of the eye and the out of eye problems. Insomnia was assessed by Insomnia Severity Index.
Results: Among all participants, 180 (86.1%) were female and 29 (13.9%) were male. Mean age was 31.6±7, with a range from 22 to 54 years. Mean BMI and years of experience were 23.1±3.3 and 6.2±8.1, respectively. The most common eye symptoms including: eye fatigue (76.6%), eyelid heaviness sensation (73.2%), eye irritation (71.3%), blurred vision (61.2%), and tearing (55.5%). There was a significant correlation between scores of eye fatigue and insomnia severity (Rho=0.32, P<0.05)
Conclusion: According to these results, prevalence of eye symptoms was high and relate to insomnia severity in our participants. Therefore, it is needed to protect computer users from the adverse effects of VDT. Implementing proper ergonomic programs to the workplace are important for achievement to good physical and mental health among VDT users.

159 - **The effects of delaying school start time on sleep and emotion of Korean adolescents**
Presented by: Tae Won Kim

T.W. Kim, S.C. Hong, H.K. Lim, H.J. Seo, J.H. Jeong, J.H. Han
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Introductions: Recently, middle schools and high schools of Gyounggyi province in Korea delayed the school start time. Delayed times were 40 minutes for middle school and 60 minutes for high school. The aim of this study is to investigate the effects of delaying school start time on sleep, emotion and behaviors of middle school students.
Methods: 144 middle school students aged 14 through 15 were recruited from one middle school located in Suwon city of Gyounggyi province. All subjects fulfilled the questionnaires about demographic data, sleep quality, daytime sleepiness, overall mood and behaviors in school. We used Pittsburgh Sleep Quality Index, Daytime Sleepiness Scale modified for middle school students, and questions about overall mood and behaviors in school answered on 10 point visual analog scale basis.
Results: Results indicated that average bed time was 23:58, average wake up time was 7:24. Average wake up time was delayed about 40 minutes compared to previous studies. Average total sleep time was 6 hours 54 minutes. Subjects reported 0.9 in sleep quality and 2.14 in daytime dysfunction based on PSQI. There were significant improvements in subjective happiness, numbers of taking breakfast, number of being late for school, concentration on class, overall peer relationship, vitality, and degree of wishing to go to school.
Conclusions: Middle school Students wake up later, feel happier, take breakfast more frequently, get less late for school, more concentrate on class, improve peer relationship, and feel more vital. Delaying school start time might have positive impacts on their sleep quality and school life quality.

311 - **A disposable, strapless & adhesive eye-covering sleep mask: effects on subjective sleep, alertness & mood**
Presented by: Lawrence Scrima

L. Scrima
Sleep Expert Consultants, LLC, Sleep-Alertness Disorders Center, Inc., Aurora, CO, United States

Objectives: To test the Instant Eclipse Sleep Strips® acceptability-utility, in healthy adults (experienced using eye-covering sleep masks).
Method: *Given negative effects of light exposure on sleep, there is need for a light-blocking, inexpensive, disposable, strapless, eye-covering sleep mask that remains in place like an adhesive bandage, as a general use sleep aid.* Subjects were recruited by advertising and invited to participate in this study, after reading and signing an informed consent. Of 22 enrolled (ages 19-52), 20 completed all study requirements. Participants kept a daily log of their subjective: sleep, daytime alertness, and mood, for: 1 week without using, and 1 week using this mask. At the end of each week,

they had a visit with investigators, to hand in their logs and complete assessment questionnaires.
Results: 2 primary measures:
1. "Overall Product Interest" (would use this mask if available) was excellent: 19 of 20 participants (95%).
2. "Overall Sleep Rating" (overall subjective perception of sleep quality indicators) was significantly improved (paired-t, two-tailed test: $p< 0.01$, n:20,t:2.92), using this mask.
All participants noted this mask efficiently blocked ambient light and stayed in place all night. Participants' daily log entries were evaluated using Willcoxin non-parametric, z-value, two-tailed test, comparing means from 1 week of no use to 1 week of using this mask on several measures. The results revealed statistically significant ($p< 0.05$) improvements using this mask for: subjective overall "Alertness AM" interval (Stanford Sleepiness Scale); subjective overall "Mood PM" interval (self- rated mood scale, range: -10/+10); and overall "Alertness PM" interval ($p < 0.01$). Additional positive trends ($p< 0.10$) for this mask were found for: “Alertness after Awakening”; and overall “Mood AM” interval.
Conclusion: These results support proof of concept for this eye mask in healthy adults as a general use sleep aid, and potential for improving subjective: sleep quality, daytime alertness and mood.

594 - **Sexomnia in a mild REM-related OSA patient succesfully controlled with mandibular advancement device**
Presented by: Miguel Meira e Cruz

M. Meira e Cruz[1,2], M. Drummond[3]
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Introduction: Abnormal sexual behaviour occurring during sleep, also known as sexomnia, is considered a particular, rather uncommon case of parasomnia with important societal and medicolegal aspects. Some cases described in association with obstructive sleep apnea (OSA) and responding to positive pressure (PAP) therapy has been published. However, to our knowledge, there is no notice of well succeeded treatment of sexomnia associated to OSA with mandibular advancement devices.
Case report: A 28 year-old men with mild REM sleep-related OSA presented to our center with complaints of snoring and excessive diurnal sleepiness (ESS=12). On the clinical interview he´s girlfriend referred that he has somewhat common unconsciousness sexual assaults to her which occur while asleep without any recolection of the events after awakening. While there was no history of witnessed respiratory events, the PSG study documented clinically significant mild OSA (AHI_{NREM}=6,9/h; AHI_{REM}=16,1/h; ODI=4,1%), without any other changes suggesting the existence of some comorbid condition. REM atonia was preserved and no REM associated abnormalities were registered. There was no history of diurnal or nocturnal seizure disorder that would raise suspicion of epileptic related event. Patient was adressed with a titratable custom-made mandibular advancement device (MAD) at 50% of tested maximal protrusion which succesfully controlled his sleep related breathing disorder (AHI=1,2/h; ODI=1,4%) as well as associated sleepiness (ESS=8). Furthermore, sexomnia episodes ceased and did not recurred after 2 years of follow up.
Conclusion: A titratable custom-made mandibular advancement device showed to control both mild REM-related obstructive sleep apnea and associated Sexomnia. This is the first report of a patient with sexomnia and OSA successfully treated with MAD.

360 - **Actions used by healthcare personnel to improve adherence to CPAP treatment**
Presented by: Martin Ulander

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Objectives: Continuous Positive Airway Pressure (CPAP) adherence is known to be rather poor, and several interventions have been designed to address it. However, most interventions compare an active program to ´standard care´, but standard care is often poorly described. There is a lack of systematic knowledge about what behavioural interventions CPAP nurses actually use and find useful in their day-to-day practice. Our aims were to describe standard CPAP initiation procedures in Sweden

and Norway, to explore underlying assumptions about CPAP adherence among healthcare personnel and to examine associations between them.
Methods: A questionnaire was mailed to all personnel working with CPAP initiation in Sweden and Norway. The respondents were asked to grade the importance of various factors for CPAP adherence, the suitability of different methods to increase adherence and how frequently they applied those methods on a five-point Likert-type scale.
Results: Presently, 55 respondents (87% females), mean age 49 years (SD 10 years) have replied. The factors with the highest rated importance for CPAP adherence were a motivated patient, a patient with a positive attitude towards CPAP and positive physical effects of CPAP. The factors rated least important were absence of negative social effects, anxiety of comorbidities and access to social support. The most frequently used interventions were practical training with the CPAP, adaptation of the CPAP and education about the use and effects of CPAP. The least used interventions were adaptation of the bedroom, treatment of anxiety and creating fear of negative physical effects if CPAP was not used. The interventions deemed most suitable were practical training with the CPAP, adaptation of the CPAP and education about the use and effects of CPAP. The interventions deemed the least suitable were adaptation of the bedroom, creating fear of negative physical effects if CPAP was not used and creating fear of negative social effects if CPAP was not used.
Conclusions: The perceived suitability of an intervention is often a relatively poor predictor of its actual use. The findings can be used to improve our understanding of what various interventions in RCTs are actually compared to.

580 - **Effect of nasal continuous positive airway pressure (CPAP) therapy on sleep architecture in patients with sleep apnea**
Presented by: Aleksi Chikadze

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Introduction: The syndrome of sleep apnea appears to be one of the most prevalent forms of sleep disorders. The goal of the research was to study the peculiarities of sleep architecture in patients with the e of sleep apnea syndrome (SAS) before CPAP therapy and at the background of CPAP.
Materials and methods: A total of 25 patients, ages 28-65, with SAS were examined, including 21 men and 4 women. In all patients was determined BMI and Excessive daytime sleepiness (EDS) by Epworth Sleepiness Scale scores (ESSS). For differential diagnostics of sleep apnea a PSG was carried out using Dr.Sagura Medizintechnik P59 polygraph accompanied by full video synchronized recording. Nasal CPAP was applied by using AutoAdjust Travel CPAP Machine with SmartFlex.
Results: According to the questionnaire all the patients have a high rate of night sleep disorders. Epworth Sleepness Score (20-22, maximum 24) and body mass index BMI in 2 patients 20-30 and in 23 patients 30-45. The all patients were characterized by night sleep disorder, loud snoring, headache, apathy, problems concentrating, excess daytime sleep. PSG investigation has shown that the patients with both obstructive sleep apnea (22) and central sleep apnea (3) are characterized by significant decrease in sleep architecture, which results in full absence of the II stage of sleep (superficial sleep), the increase of REM stage, frequent EEG and EMG awakenings, and by the fragmentation of sleep as a whole. It should be noted that a separate part of OSA patients (both women and men) was characterized by clearly expressed REM behavioral disorders. Central sleep apnea was characterized by relatively low index of snoring (SI: 80-120) and relatively high indices of the saturation (SP02) (87-93) in cases of obstructive sleep apnea (SI>200, SP02-(36-91). At the background of CPAP therapy the first significant effect was received after 2 h resulting in the regulation of respiration and snore index. The progressive increase of SP02 was within the limits of 92-95%. Sleep architecture considerably changed, EEG and EMG awakenings sharply decreased, NREM stages increased, in rare cases when NREM3 stage was noted, sleep fragmentation significantly decreased.
Conclusion: Thus, SAs (both CSA and OSA) is characterized by significant disorder of sleep architecture. At the background of CPAP therapy a significant improvement of sleep architecture and the regulation of symptomocomplex characteristics of sleep apnea take place.

577 - **Therapeutic trends of sleep apnea in ENT sleep lab**
Presented by: Jaroslav Kraus

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Introduction: Sleep medicine is a multidisciplinary field, rapidly developing also in otorhinolaryngology. Somnology as a single discipline was established in some countries, while it is divided among several departments in others - such as in the Czech Republic. Usual participating departments besides ENT are neurology, pneumology, cardiology, maxillofacial surgery and psychiatry. Otorhinolaryngology focusses mainly on surgical therapy of SAS (Sleep Apnea Syndrom). The current gold standard of treatment - non-invasive ventilation by CPAP (Continuous Positive Airway Pressure) is provided mostly by pneumologists and neurologists. The Sleep laboratory Benešov was founded in 2006. It is actually the only sleep laboratory in the Czech Republic involved in routine, surgical and also ventilation therapy.
Methods: The group of patients with SAS verified by sleep study in period 2008-2014 was reviewed. The number of patients investigated in the sleep lab, the sleep studies performed and specific indications to single therapeutic modalities was analysed.
Results: The number of consultations and polysomnographies increases every subsequent year of the study period. The part of surgical therapy followed increasing quantity of patients in the first years. After changing of indication criteria of health insurance company non-invasive ventilation therapy have grown rapidly to the detriment of surgery. The number of expended PAP devices increased and more complex systems are increasingly being used.
Conclusion: The field of sleep medicine has quickly extended into the realms of otorhinolaryngology. An ENT sleep lab can successfully provide not only the basic diagnostics and surgical interventions necessary but also provide and assess non-invasive ventilation therapy. Though the part of surgery as the main therapy of SAS decreases, it has an important role in the facilitating of CPAP use, apart from the simple snoring therapy.

477 - **Surgical planning after DISE versus Muller´s maneuver in OSAS patients - a literature review**
Presented by: Ivo Miguel Moura

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Introduction: The standard diagnostic method of OSAS is polysomnography. This method evaluates, however, the consequence and not the source of the problem - the obstruction. The muller maneuver (MM) is the most widely used method to diagnose the location of upper airway obstruction, but lacks objectivity and does not reflect the true state of sleep. To overcome this flaw, Croft and Pringle developed the sleep endoscopy (DISE) induced by drugs. This work is a review of the available literature on this topic, in particular the comparison between Muller maneuver findings compared to sleep endoscopy.
Methods: Review of open access literature in online databases, in English. Key Word Search: "sleep endoscopy", "Muller". The authors found a total of 61 articles. After exclusion of those who did not meet the authors´ criteria, 8 articles remained for analysis.
Results: There was a complete mismatch between MM and DISE between 38% and 76%. The oropharynx was the less discordant. At the level of the palate, the disagreement reached 50%. On the tongue base, the discrepancy between the two methods ranged from 13.7% to 51.2%. Only 2 studies specified the observation of the hypopharynx, with similar results: 59% and 61.7% of disagreement between methods. The epiglottis was the location that most diagnostic changes suffered after the DISE, reaching 71.6% of disagreement between the two methods.
Conclusion: A regular use of DISE in clinical practice is an asset in the topographic diagnosis of obstruction of the upper airway. This advantage is even more important when referring to the observation of the larynx by this method. However, prospective studies with greater and more homogeneous samples are desired, as well as a standartization of the findings.

313 - **Tiotropium respimat vs HandiHaler to improve sleeping oxygen saturation and sleep quality**
Presented by: Sophia E. Schiza

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Objectives: Patients with chronic obstructive pulmonary disease (COPD) have poor sleep quality as a result of various alterations in oxygenation parameters and sleep macro- and micro-architecture. There is a shortage of data to support the efficacy of long-acting inhaled anticholinergic agents in improving these adverse effects, which are known to have a negative impact on clinical outcomes. We aimed to compare the tiotropium Respimat Soft Mist Inhaler and the HandiHaler in terms of their effects on sleeping oxygen saturation (SaO_2) and sleep quality in patients with COPD.
Methods and materials: In a randomized, parallel-group trial involving 200 patients with mild to moderate COPD (resting arterial oxygen tension >60 mmHg while awake), we compared the effects of 6 months' treatment with the two devices on sleeping SaO_2 and sleep quality. Overnight polysomnography and pulmonary function testing were performed at baseline and after 6 months' treatment.
Results: A total of 188 patients completed the trial. Both groups showed significant improvement in minimum sleep SaO_2 and time of sleep spent with SaO_2 below 90 (TST90) compared to baseline. The patients using the Respimat had significantly better TST90 than did those using the HandiHaler. Sleep disturbance was highly variable in these patients, but the sleep stage durations were significantly better in the Respimat group.
Conclusions: Sleeping SaO_2 can be improved by tiotropium delivered using either the HandiHaler device or the Respimat Soft Mist Inhaler. However, the patients who used the Respimat device had significantly better TST90 and sleep architecture parameters.

258 - **OSAS and CPAP-therapy - necessary extension of the control criteria in the CPAP-setting**
Presented by: Wilfried Boehning

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Introduction: With moderate and severe OSAS cardiovascular sequelae are known, which could be avoided with regular effective CPAP-therapy (1) The adjustment to the CPAP-therapy requires careful monitoring and review of the effective pressure level. Nevertheless, the therapy adherence is very different and this is to a large extent dependent on the quality of the first setting (2) In an observational study, we identified patients with CPAP-adjustment problems as breathing anxiety and high arousal index. Hypercapnia is known as an independent arousal trigger (3).
Methods: From January to March 2015, a total of 260 patients with moderate or severe OSAS were adjusted to the necessary CPAP-therapy with polysomnographic control, after the day the different types of ventilation were practiced. Pulmonary or cardiac preexisting conditions were not known. The subsequent extensive lung function tests including the measurement of the respiratory muscle strength (P 01-technique) were normal.
Results: In12 patients n CPAP was subjectively not tolerated. although an optimal suppression of all respiratory events was achieved with normal oxygen saturationThe blood gas analysis showed a significant increase in PCO2 - regardless of the current pressure level. The BGA output measurement was each normal.The change to BiPAP resulted in a normalization of BGA in good subjective tolerance of ventilationFig 1 Pat T.W. 41y,m, BMI 36, weight loss the last year 15kg! SaO2 traces and BGATab 1 Demographic and respiratory data.
Conclusions: In the CPAP-therapy setting the control of nocturnal PCO2 should be mandatory. The SaO2 control is not enough. The capnography can recognize the trend, the BGA confirms the values definitely. The proven PCO2 increase with resulting arousals could be another explanation for lack of acceptance of CPAP-therapy and persistent day time sleepiness despite temporally approbiate therapy adherence.
Literature: 1 Campos-Rodriguez,F. et al (2005) Mortality in Obstructive Sleep ApneaHypopnea Patients Chest 128, 624-6332 Sauter, J. Dissertation 2011 Freiburg/Breisgau Subjektive und objektive Nutzungszeit der CPAP-Therapie in verschiedenen Patienten-Subgruppen3 Najib, T. et al (2000) Hypercapnia Can Induce Arousal from Sleep in the Absence of Altered Respiratory Mechanoreception.

608 - **Use of spirometry to predict oral appliance treatment outcome in obstructive sleep apnea**
Presented by: Pedro Mayoral

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Background: It has been recognized that mandibular advancement splint (MAS) treatment is effective in some, but not all, patients with obstructive sleep apnea (OSA). Hence there is a need for a simple and reliable clinical tool to assist in the differentiation of treatment responses. We hypothesized that abnormalities of spirometric flow-volume curves, together with other clinical variables, may have clinical utility in the prediction of MAS treatment outcome.
Methods: Fifty-four patients with known OSA underwent MAS treatment. Spirometric expiratory and inspiratory flow-volume curves were measured in the erect and supine positions to derive midinspiratory flow (MIF_{50}) and the ratio of expiratory to inspiratory flow at 50% of vital capacity (MEF_{50}:MIF_{50}). Multivariable logistic regression was performed to identify additional significant clinical variables in the prediction of treatment outcome.
Results: The mean (± SD) apnea-hypopnea index (AHI) in 35 responders was significantly reduced from 28.9 ± 13.7 to 6.7 ± 5.8/hour ($p < 0.001$). In 19 nonresponders there was no significant change in AHI. MIF_{50} was lower (6.04 ± 1.80 vs. 6.88 ± 1.08 L/second; $p = 0.035$) and the MEF_{50}:MIF_{50} ratio was higher (0.82 ± 0.23 vs. 0.61 ± 0.15; $p = 0.001$) in responders than nonresponders. Logistic regression analysis revealed that the MEF_{50}:MIF_{50} ratio was the most important predictive factor for MAS treatment outcome, but that body mass index, age, and baseline AHI were also contributory.
Conclusions: These data suggest that spirometric flow-volume curves, in combination with other factors such as body mass index, age, and baseline AHI, may have a useful clinical role in the prediction of treatment outcome with MAS.

626 - **Do Greek OSAS patients lose weight under CPAP treatment?**
Presented by: Pavlos Michailopoulos

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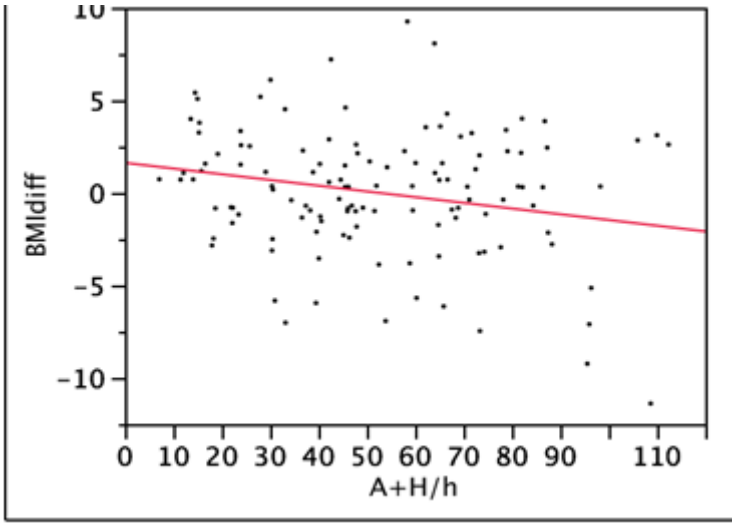
There is a great controversy concerning weight fluctuation after therapy with continuous positive airway pressure (CPAP) in patients with obstructive sleep apnea syndrome (OSAS). In our study we tried to determine the impact of age, sex, education level, familial status, OSAS severity, hypertension and diabetes on the change of body-mass index (BMI) in OSAS patients after CPAP use.
We randomly selected from the archives of the Sleep Laboratory of Agios Pavlos Hospital 130 patients with OSA who were set on treatment with CPAP. They were regularly monitored at annual visits for their BMI among other parameters. We calculated patients' BMI both at the start and the end of the study and then correlated patients' BMI change after 2 years of CPAP use with the above mentioned parameters as independent variables using Excel and Statistical Package for the Social Sciences (SPSS) 13.
There was no statistically significant difference between the initial BMI and the BMI after 2 years of CPAP treatment (p: 0.995). Also there was no statistically significant difference in BMI change between patients who had hypertension and diabetes and those who did not have (p: 0.06 and 0.941 respectively). There was no correlation between BMI change and the other studied parameters. However there was a statistically significant correlation (p: 0.013) between BMI reduction through the years of follow up and the initial AHI.
Our study in accordance with recent meta-analysis shows that Greek patients with diagnosed OSAS treated with CPAP had no difference in their weight as expressed by BMI after 2years. Age, co-existing hypertension and diabetes are factors that do not correlate with BMI change. CPAP as treatment for OSAS proved more effective in losing weight for those patients with a higher AHI at the beginning.



[BMI dif related to AHI]

400 - **"Wake up for the importance of sleep": the experience of the world sleep day in Sao Paulo, Brazil**
Presented by: Paula Araujo

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Objective: To increase public awareness about the importance of a good night of sleep for health and the physiological, behavioural and social consequences of sleep disturbances.
Methods and materials: With the theme "Wake up for the importance of sleep", several activities were conducted for the public of all ages present in the Paulista Avenue, the main financial center of Sao Paulo. Computerized questionnaire was applied to collect information about sleep schedules to estimate the current sleep duration and the desired sleep time. Interactive questionnaire, illustrative panel and handouts were distributed to increase awareness of the population about the impact of life habits on sleep quality. The epidemiology, physiopathology and main outcomes arising from sleep disorders and sleep deprivation were explored in illustrative panels. Models and panels were used to inform about the main diagnosis methods for sleep disorders and sleep pattern evaluation: polysomnography (full-night, split night, continuous positive airway pressure titration), actigraphy and subjective tools. Interactive activities about sleep hygiene were organized for children. In all activities, the initial approach was to ask people about their sleep routine, and after the established dialogue, they were invited to participate.
Results: The event reached about 3,000 people (number of handouts distributed). We generated self-informative plots from 33 individuals that fully completed the computerized questionnaire and explained the concept of sleep debt, phase delay, and phase advance. Most of the people who participated in the activities had at least one sleep complaint and had great interest to understand the consequences of them in their health. The experience to talk about sleep in a non-scientific language, to learn the society needs and curiosities about sleep, and the possibility to contribute to public awareness were the gains of the organizers. The event was covered by the main Brazilian TV channels, reaching an estimate of 1.1 million spectators (according to audience index).
Conclusion: The population was unaware of the individual sleep need, sleep habits and the importance of treating the sleep disorders mainly due to the lack of information. The recognition of the society about the effect of sleep for their lives and the importance of the sleep research highlighted the need for a close dialogue between science and society.
Financial support: ABS, AFIP, CNPq, CAPES.

314 - **Psychometric properties of epworth sleepiness scale (ESS) in Indian population of poor sleepers**

Presented by: Zubia Veqar

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Background: Epworth Sleepiness Scale(ESS) is one of the most commonly used scale for detecting daytime sleepiness. It is self administered questionnaire with eight questions. The psychometric properties of the scale are are well established on a number of populations but the the same has not been done for Indian population.
Aims: The aim of the current study was to establish the test- retest reliability and internal consistency of Epworth Sleepiness Scale(ESS) in Indian Population of Poor Sleepers.
Materials and methods: University students were randomly recruited for the study by means of flyers, website and word of mouth. These students were admiistered Pittsburgh Sleep Quality Index(PSQI) to identify poor sleepers. Twenty five poor sleepers were then randomly chosen and recruited from these university population of poor sleepers. All the subjects were administered the ESS on the test day and the same was repeated after one week which was the retest.
Results: Seventeen females and eight males were recruited. There was no significant difference in the test scores of the test and t he retest, hence the results were comparable.The test retest reliability for Epworth Sleepiness Scale displayed good reliability (ICC $_{2,1}$-0.86). These results were further supported by the Bland Altman graph which had only one outlier. The scatter plot between the test and retest scores was fairly linear too. Internal consistency for the test was excellent (Cronbach's alpha- 0.86).
Conclusion: The results of this study suggest that the said scale has good internal consistency and test-retest reliability for university population of poor sleepers in India. Therefore it is a good measure o assess the daytime sleepiness in the said population..

57 - **Screening for sleeping problems: comparison of an innovative smartphone-based sleep log APP test and traditional two week sleep diary**
Presented by: Cheng Jung Wu

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Objectives： Information collected in daily sleep diary can provide doctors a more comprehensive picture of patient's recent sleep patterns and make a better arrangement. We wanted to evaluate the **smartphone-based sleep log APP** and **traditional two week sleep diary** as a test for screening sleeping problems in the adult male patients.
Methods and materials： A total of 10 participants were recruited. All patients completed smartphone-based sleep log APP test and traditional two week sleep diary at the same time for 14 nights. The smartphone has an accelerometer sensor build-in and it could receive a record of body movement overnight. Besides, the smartphone has a build-in microphone sound receiver and it could record significant noises during sleep including, sleep talking, cough and snoring. Three sleep specialists, doctor A, B and C, reviewed the smartphone-based sleep log's clinical data and made a first comment. Three sleep specialists then reviewed the two week sleep diary and made a second comment. The agreement was defined as the concurrence between the first comments and second comments.
Results： Laboratory-based polysomnography is the most commonly used test in the diagnosis of sleep disorder syndrome. Unfortunately, growing interest in this diagnosis has resulted in increased waiting times for polysomnography, as well as a delay in diagnosis and treatment. Due to medical supplies being scarce, primary health care faces difficult triage decisions such as “Who gets to receive polysomnography at first priority?” Clinical information collected in daily sleep diary can provide doctors a more comprehensive picture of patient's recent sleep patterns and make a better arrangement. Three sleep specialists A, B and C were enrolled to read the report of smartphone-based sleep log APP test and two week sleep diary. When compared to the first comments, which was made via a smartphone-based sleep log APP and the second comments, which was made via two week sleep diary, the three sleep specialists obtained diagnostic agreement of 100%, 100% and 100%, respectively. The results of the study showed that the smartphone-based sleep log APP is a

reasonable screening tool.
Conclusions： The smartphone-based sleep log APP is a reasonable screening test to be utilized to rule out sleeping problems in the patient with abnormal ESS scores. More signals, including oximetry, blood pressure and heart rates will be enrolled in our further smartphone-based sleep log APP studies.

39 - **Translation procedure and content validity of the Athlete Sleep Screening Questionnaire into Arabic language: preliminary investigation**
Presented by: Karim Khalladi

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Aspetar, Doha, Qatar

Objective: We aimed to translate the Athlete Sleep Screening Questionnaire (ASSQ) into Arabic language following adequate translation procedures and to test the logical validity through content analysis procedure.
Method: The Athlete Sleep Screening Questionnaire was translated into Arabic language by a committee of six sport and exercise professionals. After the translations, a concensus on the most appropriate version was made.
The ASSQ's content validity was examined by 11 judges familiarized with the factors' content (total sleep time, sleep quality, insomnia, chronotype, travel disturbance, sleep disordered sleeping). The factor's definition was provided to the judges who were instructed to match each of the 15 items to one of the 6 factors and rate the degree to which the content of the item matched the content of the factor selected. A five-point scale was used ranging from 1 (poor match) to 5 (excellent match). The judge's written evaluations, on the quantitative item, contained a variety of statistical analyses (e.g., content-validity index, instrument content-validity index; Delgado-Rico, Caretero-Dios & Ruch, 2012; Polit & Beck, 2006).
Results: A content-validity index value was computed for each item in the ASSQ indicating a high content validity index for all items (above .80), while the average instrument content validity index was .88.
Conclusion: Further research is needed to examinine the ASSQ's concurrent and discriminant validity into athletes' sample.

647 - **Efficacy of commercial activity monitor as a sleep detection system: pros and cons comparing to research-level sleep recorder**
Presented by: Masahiro Matsuo

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Objectives: Activity based sleep detection is widely used method to estimate sleep in naturalistic life. However, device for such activity based sleep detection tends to be expensive. Recent advance in wearable devices have drastically reduced the prices of such sensors, and now numbers devices are commercially available.
Methods and materials: We tested reliability of newly developed activity recorder, MTN-210, as an affordable device to detect sleep / wake. MTN-210 is a commercially available activity monitor, and thus it is affordable than research targeted activity monitors. To test reliability of MTN-210, we compared its efficacy to detect sleep using Actiwatch as a benchmark. 20 healthy volunteers participated in this examination. And polysominography defined sleep data were compared to sleep/wake detection produced by either MTN-210 and Actiwatch.
Results: We found that MTN-210 produced comparable sleep/wake detection as Actiwatch, when Actiwatch threshold was set to 20. At threshold of 80, Actiwath had superior ability to detect sleep duration. However, better estimation of sleep duration was not result of better epoch-by-epoch accuracy to detect sleep and wake. In terms of epoch-by-epoch accuracy to detect sleep and wake MTN-210 on waist was superior than any other conditions tested.
Conclusions: Our result showed that even an affordable device could be used as reliable sleep/wake detectors. However, we should be aware that advances and drawbacks of each condition/devices. For example, wrist-worn Actiwatch set to high threshold gives best sleep duration estimation, although best epoch by epoch accuracy of sleep detection was found in body-placed MTN-210.

510 - **Transcriptomics and metabolomics in epidemiological sleep insufficiency**
Presented by: Vilma Aho

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Objectives: Short or insufficient sleep has been associated to increased risk for cardiometabolic diseases. To elucidate pathways mediating the effect of sleep loss on the disease risk, we studied two epidemiological samples using transcriptomics and NMR metabolomics.
Methods and materials: Subjective sleep insufficiency (SSI) was estimated using questionnaires in a subsample of the Finnish population sample FINRISK2007 (N=518, SSI 18%) and in a replication sample Young Finns Study (YFS, N=2221, SSI 16%). Whole-genome expression profiles were assessed from peripheral blood leukocytes with RNA microarrays and lipoprotein profiles from serum with NMR metabolomics.
Results: Immune response-related pathways were enriched among transcripts with lower expression in subjects with SSI ($P< 0.05$). Pathways involved in reverse cholesterol transport (RCT) were down-regulated ($P< 0.05$). Concentration of large high density lipoprotein (L HDL) particles was lower in subjects with SSI ($P< 0.05$).
Conclusions: Up-regulation of low-grade inflammation-related pathways, and down-regulation of RCT-related pathways with decreased serum L HDL in chronic sleep loss may participate in the development of cardiovascular diseases, such as atherosclerosis.

45 - **Women with obesity hypoventilation syndrome starting long term home mechanical ventilation are older, more obese and have worse arterial blood gases than men**
Presented by: Andreas Palm

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Objectives: Parallel with the worldwide obesity pandemic, obesity related diseases increase. The aim of this study was to study how prescription of Long Term Mechanical Ventilation (LTMV) due to Obesity Hypoventilation Syndrome (OHS) has changed over time and to analyze gender differences in patients with OHS treated with LTMV.
Material and methods: Data about patients on LTMV due to OHS between 1996 and 2012 were obtained from Swedevox, a population-based health quality register of patients on LTMV in Sweden.
Results: During the study time, 1.119 patients (53.0% men, $p=0.048$) with OHS initiated LTMV. The annual fraction of OHS patients has increased from 13.8% to 43.4% of all patients starting LTMV and OHS is from 2001 the major indication for LTMV in Sweden.
At time for start of LTMV, women were in general older (age 63.7±11.1 vs 59.7±11.7 years, $p< 0.001$), were more obese (BMI 43.3±8.3 vs 41.3±7.8 kg/m^2, $p< 0.001$), were more hypoxic (pO_2 7.6±1.5 vs 8.0±1.6 kPa, $p< 0.001$), had more hypercapnia (pCO2 7.1±1.3 vs 6.9±1.3 kPa, $p=0.003$) and had higher Base Excess (6.7±4.0 vs 5.6±4.9 kPa, $p< 0.001$) compared to men. Women also had more co-morbidity with pulmonary disease (28.5% vs 20.5%, $p=0.003$) and more frequently started LTMV in an acute, non-elective situation (40.7% vs 34.4%, $p=0.033$).
Conclusion: The prevalence of OHS treated with LTMV is increasing but women are diagnosed later than men and have a more severe disease at diagnosis.

645 - **Survival of patients with obesity hypoventilation syndrome**
Presented by: Kristina Ziherl

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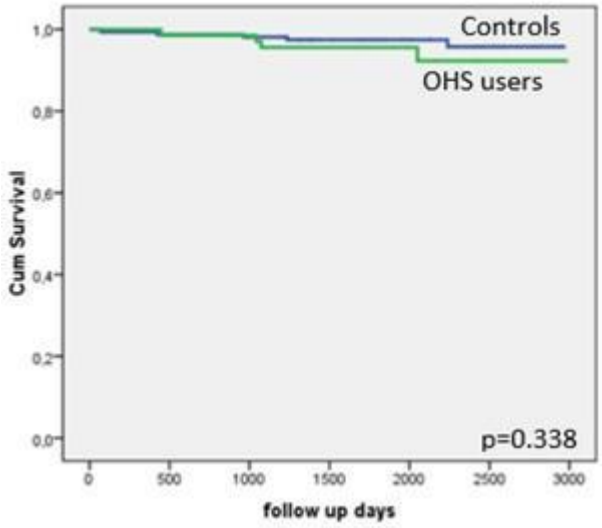
Objectives: The prevalence of obesity hypoventilation syndrome (OHS) is increasing. OHS is associated with considerable comorbidity, morbidity, and health costs. Data on mortality in OHS patients and survival benefit of positive airway pressure therapy (PAP) are lacking.
Methods: Medical records of all patients discharged with OHS diagnosis between 2005 and 2010 from Laboratory for sleep-related breathing disorders, University Clinic Golnik, were reviewed. Patients admitted to the Laboratory in the same time frame, but who were not diagnosed with sleep disordered breathing served as controls. Prescription of PAP and adherence to treatment was recorded. OHS patients were divided in two groups: users (use of PAP for at least 4 hours per night on more than 70% of days) and non-users (non-adherent and non-prescribed with PAP). Vital status was obtained from Central Population Registry.
Results: Final sample consisted of 116 OHS patients and 160 controls. Patients with OHS were older (56.7 ± 9.7 vs. 49.7 ± 12.9 years, p< 0.01), more often female (37.1% vs. 27.5%, p< 0.01), had higher BMI (41.8±8 vs. 29.5 ± 5.8, p< 0.01), more often had heart failure (25.8% vs 3.1%, p< 0.01), arterial hypertension (73.3% vs. 27.5%, p< 0.01), pulmonary hypertension (5.1% vs. 0.6%, p< 0.01), diabetes mellitus (24.1% vs. 6.3%, p< 0.01). 102 (88%) of OHS patients were prescribed with PAP therapy, 68 (59%) were users and 48 (41%) non-users. In a mean follow-up of 5.0 ± 1.9 years 14 (12.1%) OHS patients and 4 (2.5%) controls died (log rank p< 0.01). On Kaplan-Meier analysis, 1-,2-,3-, and 5-year survival probabilities were 100%, 99%, 96%, and 96% for OHS users group and 96%, 88%, 83%, and 81% for OHS non-users, respectively (log rank p=0.009). 1-,2-,3-, and 5-year survival probabilities for controls were 99%, 99%, 98%, 97.5%, respectively. There was no difference in survival between OHS users of PAP therapy and controls - Graph 1, p=0.338.
Conclusions: We found significant difference in mortality rates between OHS patients who use PAP therapy and those who do not use it. Survival of OHS patients who use PAP therapy is similar to control group - patients without sleep disordered breathing.



[Survival of OHS users of PAP therapy and controls]

475 - **Self-reported sleep characteristics and incidence of obesity: data from the cohort population study ESSE-RF (Russia)**
Presented by: Mikhail Bochkarev

M. Bochkarev[1], L. Korostovtseva[1], O. Rotar[1], Y. Sviryaev[1], Y. Balanova[2], Y. Zhernakova[2], S. Shalnova[2], A. Konradi[1], S. Boytsov[2], E. Shlyakhto[1]
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Objectives: To evaluate association between self-reported sleep characteristics and obesity in respondents from different regions of the Russian Federation.
Methods and materials: Participants of the cohort study Epidemiology of cardiovascular disease in various regions of the Russian Federation - ESSE-RF (Russian) population aged 25-64 years from 13 regions of the Russian Federation had anthropometric measurements with calculation of body mass index (BMI) and were interviewed about average duration of sleep, difficulty falling asleep, and maintaining sleep, sleepiness, snoring and apnea during sleep. Variables related to trouble falling asleep and night awakenings were defined as a “frequent” when answered “≥3 times a week”. BMI≥30kg/m^2 was defined as obesity.
Results: Were obtained for 21,969 participants, mean age 49 (25; 65) years including 8385 males and 13584 females. Obesity prevalence was 33%. Subjects were divided into groups with sleep duration ≤ 6h (short-sleepers), 6-7h, 7-8h (reference duration), 8-9h, ≥9 h (long-sleepers). Incidence of obesity for short-sleepers was 1.1 (95% CI 0.9; 1.3) $\chi 2 = 33$, $p < 0,001$. Subject with frequent difficulties falling asleep and maintaining sleep had obesity incidence 1.4 (95% CI 1.3; 1.5) $\chi 2 = 78$, $p < 0,001$ and 1.5 (95% CI 1.4; 1.7) $\chi 2 = 111$, $p < 0,001$.
Conclusions: Short sleep duration and low quality of sleep are associated with increased incidence of obesity in study ESSE-RF. Subjects with insomnia symptoms have higher obesity incidence than short-sleepers.
Funding: Study was supported by Russian Humanitarian Fund grant #14-06-00219.

107 - **Subjective and objective assessment of sleep disorders in chronic kidney disease and hemodialysis patients**
Presented by: Lamia Afifi

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Objectives: Sleep complaints are frequent in chronic kidney disease (CKD) patients. We aimed to subjectively and objectively assess sleep disturbances in CKD patients and compare them between those who undergo hemodialysis (HD) and those not undergoing HD.
Methods: The study was conducted on 40 CKD patients who were subdivided into two groups; group I included patients not undergoing HD (n=20), and group II included patients on regular HD (n=20). Twenty matched healthy volunteers participated as controls. Patients completed Epworth sleepiness scale (ESS), a sleep questionnaire and underwent an attended polysomnography.
Results: All patients had sleep complaints in the form of excessive daytime sleepiness, difficulty falling asleep, early morning awakening, jerking leg movements and fragmented sleep. CKD patients had lower total sleep time (TST), sleep efficiency, slow wave sleep percentage, oxygen desaturation and higher respiratory distress and periodic limb movement (PLM) indices compared to controls. Group II patients showed a higher ESS and more frequent leg jerks complaints. Furthermore, group II patients showed higher sleep efficiency and PLM compared to group I. Patients' age positively correlated with respiratory distress index and negatively correlated with TST and oxygen saturation. The duration of illness and duration of dialysis positively correlated with number of awakenings.
Conclusion: There is a high prevalence of sleep disorders in CKD patients whether they are on regular PLMs. Achieving a more complete understanding of sleep problems experienced by these patients can improve quality of life and patient survival.

75 - **Prediction of 10-year cardiovascular morbidity risk in newly diagnosed patients with obstructive sleep apnea syndrome**
Presented by: Paschalis Steiropoulos

E. Nena[1], P. Karailidou[1], M. Strempela[1], M. Xanthoudaki[1], D. Tsavlis[1], P. Michailopoulos[2], G.

Kouliatsis[3], T.C. Constantinidis[1], M.E. Froudarakis[1,3], P. Steiropoulos[1,3]
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Objectives: Cardiovascular Disease is the leading cause of death worldwide. Obstructive Sleep Apnea Syndrome (OSAS) is associated with increased cardiovascular morbidity and mortality. The aim of this study was to estimate the 10-year risk for cardiovascular disease in newly diagnosed patients with OSAS.
Materials and methods: Included were consecutive patients, recently diagnosed with OSAS, with the use of polysomnography. The 10-year risk for cardiovascular disease was estimated with two different scores:
1) Systematic Coronary Risk Evaluation (SCORE) and
2) Framingham Risk Score (FRS).
Results: OSAS patients (n=347; 77.5% males) were included in the study. Mean age of the study population was 51.3 years (± 11.2). Mild OSAS (AHI 5.1-15/hour) was diagnosed in 98 patients (28.2 %), moderate OSAS (AHI 15.1-30/hour) was diagnosed in 60 patients and severe OSAS (AHI>30 /hour) was diagnosed in the majority (n=189 patients, 54.5%). For the whole study population, mean SCORE value was 1.8% (±1.6) and mean FRS value was 9.6% (±7.2). Increased OSAS severity was associated with increased SCORE and FRS vales (p=0.001 και p< 0.001, respectively). More specifically, a statistically significant correlation was observed between AHI and SCORE values (r=0.0112, p=0.037) and between AHI and FRS values (r=0.160, p=0.003) as well. Furthermore, a negative correlation was found between FRS values and sleep efficiency (r=-0,163, p=0,037).
Conclusions: The 10-year risk for cardiovascular morbidity in OSAS patients, deriving from a low risk general population, increases along with the severity of the syndrome. Sleep physicians should bear this finding in mind, in order to seek for and eliminate risk factors for cardiovascular disease and prevent future cardiovascular events in patients with OSAS.

361 - **Screening of the population for sleep disordered breathing and risk of traffic accidents? Experiences from the akershus sleep apnoea project (ASAP)**
Presented by: Harald Hrubos-Strøm

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A recent EU traffic directive relies on the “McNicholas rapport” from 2013 that recommends the use of questionnaire-based screening for obstructive sleep apnoea (OSA) in the general population. To our knowledge, the proposed questionnaire is not validated. Hence, we present screening properties of all but one of the proposed questions when distributed to a general, Norwegian population.
The current study comprised 30 000 questionnaires distributed to random selected males and females aged 30-65. 16302 questionnaires were returned (55.7%) and high quality polysomnography data was available from 518 persons. The following questions were similar or almost similar to questions proposed in the “McNicholas rapport”: Gender, age, body mass index (BMI), dozing off while driving, loud snoring, breathing stops, unrefreshed awakening, hypertension and the Epworth Sleepiness Scale (ESS). Cut-off values on q 7-9 were based on the Berlin Questionnaire and ESS scoring manuals respectively.
The sample consisted of 46.8% males, age 47.8 (10.7) and BMI 26.0 (4.3). 15.1% reported dozing off while driving, 10.8% loud snoring, 6.3% breathing stops, 31.0% unrefreshed awakening and 14.1% hypertension. Mean ESS score was 6.9 (4.0). Areas under the Receiver Operator Curve (AUC) when OSA was defined as an apnea hypopnea index ≥15 were 62.8% for male gender, 62.7% for BMI ≥ 30, 52.8% for dozing off while driving, 63.8% for loud snoring, 55.7% for breathing stops, 47.1% for unrefreshed awakening, 59.6% for hypertension and 52.1% for ESS ≥ 11.
In conclusion, none of the proposed items gave an AUC of more than 64% alone. Dozing off while driving, breathing stops, unrefreshed awakenings and self-reported hypertension had AUC close to 50%.

63 - **Knowledge and attitude of primary care physicians about obstructive sleep apnea in Qazvin, Iran**
Presented by: Zohreh Yazdi

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Qazvin University of Medical Sciences, Qazvin, Islamic Republic of Iran

Objectives: Despite the fact that sleep disturbances marked as a common problem, but due to lack of necessary training about sleep disorders for general physicians in Iran, it can not be detected correctly by many doctors. The aim of this study was assessment of knowledge and attitude of general practitioners (GP) about obstructive sleep apnea (OSA) and its related factors in Qazvin, Iran.
Methods: This cross sectional study was conducted among 243 general physicians who were employed in private clinics. All participants were completed a questionnaire about their demographic variables including age, sex, years of experience and type of university which they had graduated from it (quality level of universities from type one to type three). Also, Farsi version of Obstructive Sleep Apnea Knowledge and Attitude (OSAKA) were completed by all participants.
Results: Among 243 general physicians, 131 (54.6%) were male and 112 (45.4%) were female. Mean age of participants was 35.9±9.6, and mean years of experience at work was 8.7±6.4. 81 subjects (33.8%), 146 subjects (60.8%), and 16 subjects (5.4%) were graduated from type one (high level) to type three (low level) of university, respectively. Mean total knowledge for OSA in our GP was 52%. Majority of respondent (91.7%) believed that proper diagnosis and management OSA is important and very important. There was not significant association between age, sex, years of experience, and level of university with GP´s knowledge and attitudes.
Conclusion: We concluded that our general practitioners don´t have enough knowledge about OSA. Teaching in the field of sleep medicine is necessary for medical training course and continuing medical education.

561 - **Risk assessment of sleep apnea in professional drivers in Republic of Moldova**
Presented by: Alexandru Corlateanu

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Respiratory Medicine, State University of Medicine and Pharmacy 'Nicolae Testemitanu', Chisinau, Republic of Moldova

Introduction: Sleepiness at the wheel is a serious social problem having many causes. Obstructive sleep apnea Syndrome (OSAS) increases the risk of accidents.
Objectives: To evaluate excessive sleepiness in bus drivers, and correlate the risk of sleep apnea with traffic accidents.
Methods and materials: The study evaluated 77 consecutive drivers. Age, anthropometric data, AER score and Stop-Bang questionnaire have been analyzed. Daytime sleepiness in drivers was assessed by Epworth scale.
Results: The average age of drivers was 45.8 ± 10.7 years. Average body mass index was 28.8 ± 4 kg / m2, systolic blood pressure 147.9 ± 21 mm Hg and diastolic 93.4 ± 12.5 mm Hg; neck circumference 41.9 ± 3.6 cm; abdominal circumference was 100.7 ± 17.5 cm; Epworth Scale 4.4 ± 2.37 points. According to AER score 3% (2 drivers) had very high risk of apnea, 20% (20 drivers) had high risk of sleep apnea, and only 40% (31 drivers) had low risk.
Conclusions: Sleepiness at the wheel, caused by unrecognized OSAS is a significant risk factor for road accidents. The development of detection system and screening for obstructive sleep apnea syndrome in drivers, who will be diagnosed and treated in time, can considerably reduce the risk of accidents.

349 - **Association between severity of sleep-disordered breathing and traffic accidents among truck drivers in Japan**
Presented by: Eri Eguchi

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[1]Public Health, Okayama University Graduate School of Medicine, Okayama, [2]Juntendo University Graduate School of Medicine, Tokyo, [3]Ehime University Graduate School of Medicine, Toon, [4]National Institute of Occupational Safety and Health, Tokyo, [5]Tenri Health Care University, Tenri, Japan

Introduction: The purpose of this study is to investigate the association between severity of sleep-disordered breathing (SDB) and occurrence of traffic accidents among truck drivers in Japan.
Materials and methods: Participants of this study is 479 track drivers aged 23-70 in Ehime and Nara prefecture. Severity of SDB was measured by flow-respiratory disturbance index (flow-RDI) and

graded according to normal to mild (0-9.9), moderate (10.0-19.9), and severe (≥20.0). Epworth Sleepiness Scale (ESS) was used to evaluate the sleepiness and graded; non-sleepiness (0-6), moderate sleepiness (7-10), and severe sleepiness (≥11). Experiences of traffic accidents and other lifestyles were asked by a questionnaire. We also evaluated the autonomic functions by hart rate variability and log High Frequency (HF) < 5 was defined as lower HF.
Results: Age adjusted severity of sleep disordered breathing were associated with age, body mass index, snoring every day, and cessation of breathing during sleep. There was no association between severity of SDB and ESS, sleepiness in daytime, and subjective lack of sleep. Among the subjects who had severe sleep-disordered breathing (RDI ≥ 20), ESS score of non-sleepiness and moderate sleepiness was 58.1% and 32.7% respectively. Age adjusted severity of SDB were associated with experience of traffic accidents. Respective prevalence of accidents for those with mild, moderate, and severe SDB were 8.5, 10.5 and 16.0% (p for trend=0.05). This trend was found only for drivers with lower HF drivers.
Conclusion: There were associations between severity of SDB and experience of traffic accidents and the association was tended to be stronger for those with lower HF.

230 - **The interface of sleep spindle dynamics and neurocognitive performance in obstructive sleep apnea syndrome**
Presented by: Mohammad Torabi-Nami

M. Torabi-Nami[1,2,3], S. Mehrabi[2,4], S. Derman[5], S. Ribeiro[6]
[1]Department of Neuroscience, School of Advanced Medical Sciences and Technologies, [2]Sleep Disorders Laboratory, Namazi Hospital, [3]Brain and Cognition Study Group (BCSG), Shiraz Neuroscience Research Center, [4]Division of Pulmonology, Department of Internal Medicine, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Islamic Republic of Iran, [5]Sleep Disorders Unit, American Hospital, Koc Foundation, Istanbul, Turkey, [6]Brain Institute, Universidade Federal do Rio Grande do Norte, Natal, Brazil

Objective: Neurocognitive decline has been considered as a potential consequence of obstructive sleep apnea syndrome (OSAS). Sleep apnea is shown to affect thalamo-cortical network integrity and hence alter the frequency of sleep spindles. Meanwhile, much has remained unanswered in terms of the correlation between sleep spindle dynamics and neurocognitive decline in OSAS patients. We investigated sleep spindle frequency distribution and neurocognitive profile in adult OSAS and control subjects.
Method: Eleven moderate-to-severe OSAS patients (apnea-hypopnea index of 15-25) with age- and sex-matched control subjects were evaluated in a hospital-based sleep laboratory through an overnight full polysomnographic study. Sleep spindles were visually scored and their frequency was determined by spectral analysis using FFT. Fast (≥ 13 Hz) spindle percentage (FSP) and slow (< 13 Hz) spindles percentage (SSP) were measured in frontal, central and occipital sleep EEG recordings during the stage N2 in all OSAS and control subjects. The Addenbrook's Cognitive Examination tool (ACE-Persian version) was employed to rate attention, orientation, memory, learning and language capacity, collectively as global cognitive function (GCF) score. One way analysis of variance (ANOVA) and post-hoc Tukey's test were used in statistical analyses.
Results: Compared to non-OSAS controls, patients demonstrated lower mean GCF scores ($p < 0.01$). The distribution of FSP was not found significantly different across OSAS and control subject ($P=0.09$).This trend may however become significant with a larger number of subjects. SSP were more abundant in frontal rather than central and occipital regions in OSAS patients as compared to controls. In addition, there was diminished central and occipital SSP in OSAS patients in the second half of recording time while the frontal SSP remained abundant in this period.
Conclusion: The occurrence of SSP in OSAS patients predominantly in frontal cortical regions suggests an imbalance between frontal and non-frontal thalamo-cortical pathways. Despite this, central and occipital regions were found to retain the physiological range of spindle frequencies during sleep. To what extent the loss of slow spindles can be regarded as a sensitive electrophysiological marker of brain dysfunction in OSAS, and whether such decrease is correlated with diminished cognitive performance in specific domains, will be the forthcoming focus of our study group.

263 - **The predictors of cognitive dysfunction in obstructive sleep apnea syndrome**
Presented by: Behice Bircan Kurşun

B. Bircan Kurşun[1], D. Yerlikaya[2], B. Çavuşoğlu[2], G. Özmüş[2], D.D. Emek Savaş[2], N. Demir[2,3], B.

Baklan[2,3], E. Ada[4], G. Yener[1,2], I. Öztura[2,3]
[1]Neurology, [2]Brain Dynamics Multidisciplinary Research Center, Dokuz Eylül University, [3]Sleep Medicine, Neurology, [4]Radiology, Dokuz Eylül University Medical School, Izmir, Turkey

Objectives: Obstructive sleep apnea syndrome (OSAS), a common sleep disorder, is related to the risks of cardiovascular diseases, neuropsychiatric abnormalities, occupational/traffic accidents and decrease in occupational/school performance. Neurocognitive impairment, associated especially with executive functions, attention and memory, can be measured objectively by the combination of visual evoked event related potentials (ERPs) neuropsychological tests and volumetric analysis of cranial MRI. In this study, we aimed to detect the cognitive effects of severe OSAS on academically active population, and to detect the role of cognitive dysfunction on treatment decision and follow up of treatment efficacy and thus to higlight the importance of early recognition.
Methods and materials: 25 well educated and treatment-naive male patients with severe OSAS below 50 years of age were recruited. All subjects underwent ERP, neuropsychological tests, Epworth sleepiness scale (ESS) and cranial MRI. The polysomnographic, neuropsychological, and P300 variables, ESS scores and volumetric analysis of cranial MRI were compared by Pearson correlation analysis. Also subjects divided in two groups based on mean apnea- hypopnea index (AHI), that was 54.2, were compared by the t-Student test.
Results: There was no difference in demographic properties and patient numbers (13/12), in whole brain, grey and white matter volumes (GMV/WMV), and also P300 amplitude and latency components between groups. Location difference was detected in P300 latencies regardless of groups. P300 latency was longer at parietal and central locations compared with frontal location. No difference was detected between occipital and parietal, frontal, central locations and also between central and parietal locations. The comparison of P300 amplitude components with various neuropsychological tests, and also with whole brain volume (WBV), showed correlation. ESS score showed negative correlation with GMV and WBV. AHI was correlated with neuropsychological tests. GMV was negatively correlated with BMI, mean apnea duration and desaturation below 90%.
Conclusion: Combination of neuropsychological, electrophysiological and cranial MRI findings suggested that severe OSAS is associated with cognitive impairment. A new classification criteria of severe OSAS with cognitive dysfunction might be taken into consideration. Further research is needed to clarify the mechanism cognitive impairment and tretement success.

609 - **Chronic high fat diet increases rapid eye movement sleep in mice**
Presented by: Maria Panagiotou

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Molecular Cell Biology, Leiden University Medical Centre, Leiden, The Netherlands

Consumption of high caloric food has increased in societies around the world and part of this increase has been attributed to a decrease in amount and quality of sleep. Many studies have investigated the influence of disturbed sleep on food intake and development of weight and metabolic syndrome. However, not many studies have investigated the influence of increased caloric intake on sleep. In this study we investigated the effect of chronic high fat diet on sleep and electroencephalogram (EEG) characteristics in mice.
Male C57BL/6 mice were kept under 12h:12h light-dark conditions with normal chow (Control, n=8) or high fat chow (HF, n=9) for at least 3 months. At the age of six months (Control: 28.7±0.7 g, HF: 47.6 ±0.8 g, mean ±SEM) EEG and the electromyogram were recorded for 48 hours. On the second day a 6h sleep deprivation (SD) was performed starting at light onset.
Rapid eye movement (REM) sleep in the light period was increased from 6.8 ±1.1% in control to 13.7 ±1.3% in the HF group ($p < 0.005$, unpaired t-test). This was mainly caused by an increase in the episode frequency (Control 5.3 ±1.4/h, HF 12.5 ±1.4/h, $p < 0.005$) while episode duration remained unchanged. No large changes were seen in the amount of NonREM sleep and waking. EEG activity between 8-11 Hz was significantly increased in both sleep states in the HF group ($p < 0.05$, unpaired t-test) and during the sleep deprivation this frequency range was increased more in the HF group in waking.
The increase in REM sleep frequency in the HF group may be caused by changes in mono-amine balance and are in accordance with reduced serotonin plasma levels published previously. The data show that changes in food consumption and caloric intake can influence sleep architecture and the sleep EEG.

250 - **Effects of long-term caffeine consumption on the adenosine A_1 receptor in the rat brain: an in vivo PET study with [^{18}F]CPFPX**
Presented by: Danje Nabbi

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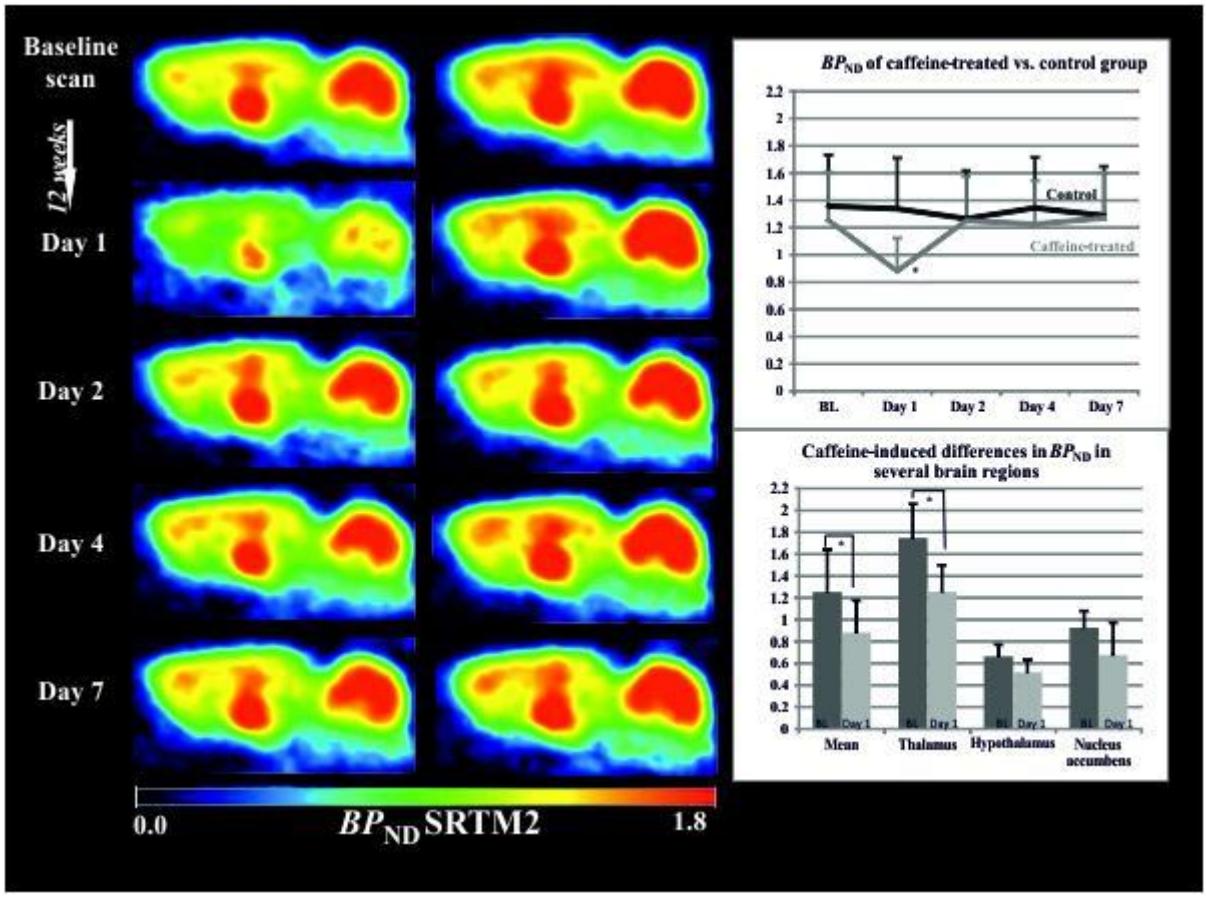
Objectives: Caffeine is the most popular psychostimulant worldwide and plays as a nonselective antagonist of the adenosine receptors an important role in physiological processes such as sleep and arousal. Due to this antagonism, the sleep latency is prolonged and the sleep duration is reduced. Simultaneously, in vitro studies investigating the effects of chronic caffeine consumption on brain adenosine A_1 receptors (A_1ARs) indicate a receptor upregulation. Receptor expression after caffeine withdrawal has not been elucidated yet. Thus, the present study examines in vivo effects of long-term caffeine consumption and subsequent withdrawal on the A_1AR in several brain regions. This is of special interest with regard to potential neuroprotective effects of caffeine consumption.
Methods: Sixteen adult, male rats underwent five positron emission tomography (PET) scans with [^{18}F]CPFPX in order to determine the A_1AR availability. After the 1st baseline (BL) PET scan, the water supply of half of the animals contained caffeine (0.41±0.04 g/L, corresponding to 4-5 cups of coffee per day in humans) for 12 weeks. Subsequently caffeine was withdrawn and repeated PET measurements were performed after day 1, day 2, day 4, and day 7 in all animals.
Results: At day 1 after ca. 5h (5 half-lives) of caffeine discontinuation a significant decrease (mean 34±2%, $p< 0.01$) of *the binding potential (BP_{ND}, representing receptor density)* was observed compared to the control group. This is most likely due to an A_1AR occupancy by caffeine (and its metabolites). Interestingly, unlike all other investigated regions in caffeine treated rats, the hypothalamus and nucleus accumbens showed no significant intraindividual differences between BL and 1st withdrawal scan. After a caffeine withdrawal time of approximately 27 hours the region- and group-specific effects were abolished and the BP_{ND} settled around BL values indicating no long-lasting upregulation of A_1ARs after chronic caffeine consumption.
Conclusions: The hypothalamus and nucleus accumbens were revealed as relatively caffeine-insensitive areas (n=8). Potentially in these regions, chronic caffeine administration leads to a lower occupation of the A_1ARs or to a faster unblocking of receptors after caffeine withdrawal. Moreover, in vivo no persistent A_1AR upregulation after chronic caffeine consumption could be observed. However, a long lasting caffeine-induced effect on sleep cannot be excluded and needs further investigations.



[BPND of caffeine-withdrawn & vehicle-treated rats]

171 - **Can sleeping birds preen? Dissociation between sleep-related EEG activity and behavior in pigeons**

Presented by: Dolores Martinez-Gonzalez

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[1]Avian Sleep Group, Max Planck Institute for Ornithology, Seewiesen, Germany, [2]Cognitive Neurobiology and Helmholtz Institute, Department of Psychology, Utrecht University, Utrecht, The Netherlands, [3]Institute of Neuroinformatics, University of Zürich / ETH Zürich, Zürich, Switzerland, [4]Department of Psychology, McGill University, Montreal, QC, Canada

Dissociations between sleep-related brain and behavioral states have been observed in mammals, including humans. Like mammals, birds exhibit rapid eye movement and slow wave sleep (SWS), the later associated with homeostatically-regulated EEG slow-wave activity (SWA). Although elevated SWA has also been observed during some episodes of feather preening in birds, movement artifacts have not been ruled out as an explanation for this activity. Consequently, preening has usually been taken as an indicator of waking in birds. We demonstrate that slow-waves during preening are not movement artifacts, and preening with slow-waves reflects a dissociated state between the forebrain and brain regions controlling preening.

EEG and head movements were recorded in domestic pigeons (*Columba livia*) with a 4-EEG-channel head-mounted data logger (Neurologger 2A) including a 3D accelerometer. Two epidural electrodes were placed on each hemisphere (mesopallium and hyperpallium) and referenced to an ipsilateral electrode on the cerebellum. All signals were sampled at 200 Hz. Behavior was video recorded. During preening, pigeons typically closed their eyes and exhibited rapid, repetitive movements of the head. Preening could occur with waking EEG activity or with high-amplitude, slow-waves (1-3 Hz) similar to those occurring during normal SWS. Individual slow-waves were not correlated with individual preening head movements. Moreover, changes in intra- and interhemispheric coherence between wakefulness and normal SWS followed a similar pattern during preening with slow-waves.

During wakefulness, interhemispheric coherence was higher than intrahemispheric coherence, whereas during normal SWS and preening with slow-waves, interhemispheric coherence decreased and intrahemispheric coherence increased relative to wakefulness.
Preening can occur together with SWS-like EEG activity recorded from the forebrain; the EEG activity is not a movement artifact. Preening is likely to involve central-pattern-generating circuitry in the midbrain, brainstem and/or spinal cord that does not require forebrain control, which is why it may be activated in a dissociated fashion during sleep. From an adaptive perspective, given that birds sacrifice visual vigilance during preening, presumably to protect the cornea, it might make sense for them to simultaneously discharge some sleep pressure in the forebrain.
Max Planck Society and Human Frontiers Grant RGP0004/2013.

93 - **Evolution of sleep patterns in amphibians and reptiles**
Presented by: Paul-Antoine Libourel

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Terrestrial mammals and birds, both homeotherms, show two sleep states, paradoxical sleep (REM sleep) and slow wave sleep, with distinct behavioural and electrophysiological features. However, whether these features have evolved independently in each clade or were inherited from a common ancestor remains unknown. In an attempt to infer common sleep features at the origin of tetrapods and amniotes, we performed ancestral state reconstructions of sleep features in amphibians and reptiles. Using data available in the literature, we reconstructed ancestral character states using maximum likelihood methods. We focused on behavioral parameters, such as the arousal threshold, the presence of twitches, eye movements during sleep, the existence of a recovery period of sleep after a deprivation, as well as electrophysiological parameters, EEG frequency, EEG amplitude, presence of sharp waves (ShW).
Most amphibians and reptiles display the behavioural criteria of sleep. Twitches and eye movements during sleep are likely present in reptiles. The decrease in EEG frequency in sleep-like states compared to the awake state is likely an ancestral feature in tetrapods. However, the amplitude of the EEG is more variable across amphibians and non-avian reptiles than in mammals during sleep. ShW, considered a marker of sleep in mammals, cannot be clearly related to sleep in either amphibians or reptiles.
We conclude that amphibians and reptiles display the behavioral characteristics of sleep. The electrophysiological patterns were more difficult to interpret, mainly due to the different methodology used to record brain activity and the different brain regions recorded. The presence of twitches and eye movements during sleep in amphibians and reptiles remains poorly understood, but raises the question of the existence of two sleep states in these species. The poikilothermic lifestyle of amphibians and reptiles is associated with important differences in physiology and behaviour when compared to mammals or birds, and the parameters typically used to describe sleep in mammals may not apply to animals with such a different physiology, neuroanatomy, and behaviour. Studying sleep in a comparative context remains essential, using as many behavioural, physiological, and electrophysiological variables as possible to gain better insights into the nature, function and evolution of sleep.

538 - **Activation in sleep and waking regulatory systems and in the brain of chick embryos and neonatal chicks**
Presented by: Dolores Martinez-Gonzalez

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Objectives: In mammals, wakefulness (W) is sustained by activity in an interconnected “arousal system”, including hypocretin/orexin (H/O), noradrenergic Locus Coeruleus (NA-LC), serotonergic Dorsal Raphe (5HT-DR) and cholinergic pontine (Ch-P) neurons. Sleep (S) is supported by activity in various GABAergic neuronal populations, and a lack of activity in the arousal system. Rapid eye movement (REM) S is supported by activation of Ch-P and MCH neurons. Bird S and W states are similar to mammals (Lesku and Rattenborg 2014); chickens develop S-like EEG patterns before hatching, and a stable W state by a few hours after hatching (Mellor and Diesch 2007; Martinez-

Gonzalez et al 2012). To better understand when activity in neuronal populations that regulate S and W becomes coordinated and able to support stable states, we investigated cFos expression (a commonly used marker of neuronal activation) in H/O, NA/LC, 5HT/DR, Ch-P and MCH systems of undisturbed chick embryos, and neonatal (P1) chicks that were spontaneously sleeping or kept awake by gentle handling.
Methods and materials: Fertilized eggs were incubated at 37.5°C, 55-60% relative humidity. Embryos (in ovo) and hatchlings were anesthetized and perfused with fixative. Cryostat-cut sections were processed by fluorescent double-labelling and standard cFos colorimetric techniques. Stereology was used to calculate the percentage of cFos-expressing cells in the 5 neuronal populations.
Results: General activation of arousal system neurons was low at embryonic day (E) 12, slowly increased at E16 and E20 and was the highest in the awake P1 chicks, when sensory areas of the thalamus and pallium also show increased cFos expression. Very low values were seen in sleeping P1 chicks. Activation of MCH neurons also progressively increased in embryos, reached its highest values at E20, but was low in both awake and sleeping P1 chicks. Significantly-correlated activity was seen only between NA-LC and 5HT-DR cFos expression in embryos, and among most arousal system areas at P1.
Conclusions: The arousal system becomes progressively recruited in embryos and becomes coordinated only after hatching. MCH neurons may be involved in the emergence of REM sleep-like in chick embryos. Absence of activation of the Ch-P and MCH systems in the sleeping P1 chicks may be due to the relatively short duration of the sleep episodes studied here.
Acknowledgements: This work was supported by HFSP Grant RGP0004/2013.

560 - **Nitric oxide modulation: a possible mechanistic approach to neuroprotective effect of *Centella asiatica* in sleep deprivation induced anxiety like behaviour and oxidative stress**
Presented by: Priyanka Chanana

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Introduction: Anxiety and oxidative stress are established classic effects of Sleep deprivation. Therefore, the present study was designed with the aim to evaluate the possible neuroprotective effect of *Centella asiatica* and an effort was made in deciphering the plausible mechanism of its effects in sleep deprivation induced anxiety.
Materials and methods: Male laca mice were sleep deprived for a period of 72 hours using grid suspended over water method. Two doses of C. asiatica viz 150, 300 mg/kg per oral were used. Also NO modulators like antagonist L-name and precursor like L-arginine were given, in combination with C. asiatica to elucidate the NO modulating potential of the drug. All the drugs were administered for a total of 8 days starting 5days prior to sleep deprivation exposure. The animals were tested behaviourally for evaluation of anxiety, change in motor activity and for their brain samples were biochemically tested for the evaluation of oxidative stress markers.
Results: 72-hour sleep deprivation caused significant anxiety-like behaviour, impaired locomotor activity and produced oxidative damage to the neurons as compared with naive (without sleep deprivation) animals. C.asiatica treatment brings about an improvement in sleep deprivation induced motor dysfunction, anxiety like behaviour and oxidative stress parameters. Also while the neuroprotective effect of C. asiatica was increased by NO antagonists, it was diminished by NO agonists.
Conclusion: Results of the present study suggests that NO modulation is involved in the protective action of C.asiatica against sleep deprivation-induced anxiety-like behaviour and associated oxidative damage.

208 - **Histamine deficiency elicits high-amplitude theta wave bursts during REM sleep**
Presented by: Alessandro Silvani

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Objectives: Orexin deficiency entails high-amplitude theta wave bursts (HAT) during rapid-eye movement (REM) sleep and cataplexy in narcoleptic mice and pediatric patients. The histamine

system may play a role in generating these events because it is directly stimulated by orexins. Aim of this study was to assess whether histamine deficiency is involved in HAT generation during REM sleep.
Methods and materials: 12 histidine-decarboxylase knock-out (HDC-KO) mice with congenital histamine deficiency, 7 double mutant (DM) mice with combined deficiency of orexin neurons and histamine, and 11 wild-type control (WT) mice were instrumented with electrodes for sleep recordings. In 3 additional WT mice, a cannula was also implanted for intracerebroventricular (icv) injection of a HDC inhibitor (alpha-fluoromethyl-histidine, α-FMH).
Results: HAT during REM sleep occurred significantly more often in DM than in HDC-KO mice. HAT were virtually absent in WT mice, but were elicited during REM sleep in each WT mouse after icv injection of α-FMH.
Conclusions: The occurrence of HAT during REM sleep both in WT mice after α-FMH treatment and in HDC-KO mice demonstrates a causal role of histamine deficiency. The more frequent occurrence of HAT during REM sleep in DM than in HDC-KO mice indicates that orexin deficiency elicits HAT during REM sleep through mechanisms that are at least partly independent of histamine deficiency.
Funding: University of Bologna.

213 - **Perinatal nicotine exposure changes sleep in adulthood**
Presented by: Alessandro Silvani

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Objectives: We investigated long-term effects on the sleep-wake cycle following perinatal exposure to nicotine - the main developmental toxin in tobacco - and to cotinine, which is its principal metabolite.
Methods and materials: C57Bl/6J mouse dams received nicotine or cotinine continuously via drinking water starting 3 weeks prior to breeding until pups were weaned. Control dams received only the vehicle. At the age of 17 ± 1 weeks, male mice born to nicotine (NIC, n = 10), cotinine (COT, n = 6) or vehicle (VEH, n = 8) treated dams were implanted with electrodes for sleep recordings. Sleep was then recorded for 48 hours in undisturbed conditions and for 6 hours during a cage-switch test, which consisted of exposure to bedding soiled by another male mouse.
Results: NIC and COT mice spent significantly less time in non-rapid-eye-movement (NREM) sleep than VEH mice in the 2 hours before and the 2 hours after the light-dark transition. During the cage-switch test, COT mice spent significantly less time awake than VEH mice.
Conclusions: The reduction of NREM sleep time around the light-dark transition indicates an insomnia-like phenotype, which may be linked to a specific circadian phase and to early life exposure to either nicotine or cotinine. The decrease in wake time during the cage-switch test in COT mice indicates a reduction in the behavioral arousal response to stress. Perinatal exposure to nicotine produces long-lasting reprogramming of wake-sleep behavior in adult mice, an effect that can be plausibly attributed to chronic exposure to its principal metabolite cotinine.
Funding: University of Bologna; M & G Phillipson Stiftelsen; Samariten Stiftelsen; Frimuraren Barnhuset Stiftelsen.

496 - **Erythropoietin (EPO) inhibits the increase of non rapid-eye-movements sleep (NREMS) that is present in rats with bleomycin (BLM) - induced pulmonary fibrosis (PF)**
Presented by: Drosos Tsavlis

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Objectives: PF is characterized by fibroblasts' proliferation, extracellular matrix remodelling and apoptosis. EPO has anti-oxidative and anti-apoptotic properties. Our aim was to investigate whether EPO along with the respiratory function improvement could also have any effect on the sick rats' sleep.
Methods: Fifty Wistar rats (300g) were devided into five groups:
Group 1 (n=10):control group.
Group 2 (n=10):intratracheal (it) and intraperitoneal (ip) injection of saline (0.5 ml/kg).
Group 3 (n=10):intratracheal BLM injection (7.5 mg/kg).
Group 4 (n=10):intratracheal BLM injection (7.5 mg/kg) followed by EPO intraperitoneal injection (2000

iu/kg).
Group 5 (n=10): intratracheal injection of saline (0.5ml/kg) and intraperitoneal injection of EPO (2000 iu/kg).
All rats were sacrificed in 14 days.Histological evaluation was performed on paraffin sections stained with hematoxyline-eosin and lung injury was estimated quantitatively in 15 randomly selected fields/slide by Image Pro Plus software version 4.1.
Rats were instrumented to obtain standard polygraphic recordings, such as EEG, gross body movement and cortical brain temperature (Tcort). Polygraphic signals were digitized and stored until visual scoring.
Results: In groups 1, 2 and 5 (control groups), the tissue damage was very small. There were fibrotic lessions only in the 10% of the lung surface. In group 3 (BLM group) the fibrotic lessions almost covered the lung surface (95%). On the other hand, in group 4 (BLM+EPO group) the fibrotic damage was as small as in the control groups, around 10% of the lung surface. The appearance of fibrotic lessions and tissue damage took place in group 3 and in group 4 ($p< 0.001$ and $p< 0.05$ respectively). The duration of NREMS was normal in groups 1,2 and 5 (control groups). The same happened with the Tcort and the activity of the EEG.In group 3 (BLM group) the duration of NREMS is extremely prolonged and its architecture was altered. The REM sleep was inhibited and the EEG hallmark was also affected i.e. theta activity.In group 4 (BLM+EPO group) the administration of EPO inhibited the increase of the duration of the NREMS and kept the REM sleep in normal limits.Moreover, the EEG was almost as normal as in the control groups 1,2 and 5, as well as the Tcort.
Conclusions: Treatment with EPO significantly ameliorated the extent and severity of the BLM-induced toxicity in lung tissue.NREMS was in normal limits in the control groups and the group of EPO-animals.

257 - **Repetitive intracerebroventricular microinjection of OrexinA regulates sleep homeostasis and fastens recovery from deep barbiturate anesthesia induced sleep**
Presented by: Olga Mchedlidze

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Introduction: Study evaluates hypothalamic Orexinergic system as the neuronal substrate for speed up regulation of sleep homeostasis and sleep-wakefulness cycle recovery from deep barbiturate anesthesia. Pre-clinical evidences concerning the effects of OrexinA intracerebroventricular (ICV) microinjection in animals under barbiturate anesthesia are very sparse and investigation of this question is highly topical.
Methods: In white rats surgery and implantation of stainless screws for EEG registration was made under chloralhidrate anesthesia. In control group (n=5) 7-10 days after surgery deep anesthesia was induced by sodium ethaminal (Nembutal 70 and/or 80 mg/kg). EEG registration of sleep-wakefulness was started immediately and lasted continuously for 48 hours.
In experimental animals (n=5) deep anesthesia was produced as in controls and immediately after disappearance of righting reflex *in vivo* microinjection of OrexinA in lateral ventricle (-0.92 from Bregma; L-1.6; H-3.6) at the doses 10-20 µg/5µl was made twice daily with 1 hour interval among them. EEG registration of sleep-wakefulness cycle started immediately after OrexinA microinjection and lasted continuously for 48 hours.
Recovery from barbiturate anesthesia induced sleep was evaluated by reappearance of righting reflex and by 8 distinct parameters indicating to the recovery of normal EEG and behavioral signs of sleep-wakefulness behavioral states. Statistical processing was made by Students' t-test.
Results: Repetitive *in vivo* ICV microinjection of OrexinA in lateral ventricle significantly shortens the time of righting reflex reappearance from anesthesia-induced sleep. Increase of OrexinA content in CSF significantly contributes to the acceleration of recovery from anesthetic sleep. The latency of the first normal episode of wakefulness was shortened twice. The first fragments of wakefulness were soon followed by slow wave sleep episodes significantly different from EEG picture of anesthetic sleep. Replacement of anesthetic sleep by slow wave sleep characteristic for intact animals took significantly shorter time in experimental animals then in controls.
Conclusions: Repetitive ICV Microinjection of OrexinA significantly shortens deep barbiturate anesthesia time and accelerates recovery of behavioral and EEG signs of wakefulness which is then followed by speed-up of normal slow wave sleep recovery.
Acknowledgements: Supported by Shota Rustaveli National Science Foundation, Grant #11/04

445 - **The direct non-circadian effects of light in a diurnal grass rat, *Arvicanthis ansorgei***
Presented by: Jeffrey Hubbard

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Objectives: Sleep and wake regulation involves two principle mechanisms: a circadian and a homeostatic process, in addition to a third, the non-circadian direct influence of light. To date the majority of laboratory rodent studies on sleep using EEG are performed in nocturnal rodents, such as mice and rats. However this raises a problem when examining the effects of light on sleep and wake, due to different, not yet fully known, neurobiological substrates between nocturnal and diurnal mammals. Recently we phenotyped a diurnal grass rat, Arvicanthis Ansorgei. In the present study we sought to examine the acute and sustained effects of light on sleep and wake.
Methods: 14 Male *Arvicanthis ansorgei* were implanted with EEG, EMG, EOG. Animals were placed under a baseline assessment of the circadian cycle, as well as 24-hours of continuous darkness. Non-circadian conditions were used to observe the direct effects of light: a 1-hour light pulse (LP) at ZT15 during the dark period, a 1-hour dark pulse (DP) at ZT3 during the light period, and an ultradian 1hLP:1hDP cycle over 24 hours. Finally, 6-hour sleep deprivations were performed under both light and dark conditions (starting at ZT0 or ZT12), to determine any changes in sleep homeostasis. Specific EEG rhythms and associated vigilance states were characterized (theta, gamma, and delta).
Results: Under baseline conditions Arvicanthis had an inverted sleep-wake cycle compared to mice. Single 1-hour light/dark pulses induced wake and NREM sleep, respectively. Under the 1hL:1hD cycle, light exerted a wake-promoting effect, as opposed to the dark-induced effect in mice. NREM Delta power during sleep deprivations was also altered depending on when it began, as well as its length.
Conclusion: These results suggests that the non-circadian direct effects of light are inverted as compared to nocturnal rodents, and are similar to certain data seen in human studies, suggesting that Arvicanthis is a valuable diurnal rodent model for sleep study. Our findings also suggest that the direct photic regulation represents a key sleep regulatory mechanism in addition to the homeostatic and circadian processes in diurnal rodent species.

51 - **Role of melanin-concentrating hormone neurons in the regulation of sleep**
Presented by: Akira Terao

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Objectives: Melanin-concentrating hormone (MCH) neurons are exclusively expressed in the lateral hypothalamic area. MCH neurons project widely throughout the brain, including several important areas implicated in sleep regulation. To determine the physiological role of MCH neurons, we assessed sleep in MCH-tetracycline-controlled transactivator (tTA); tetracycline operator (TetO)-diphtheria toxin A (DTA) transgenic mice, which enable temporal control of MCH neuron ablation by cell-specific expression of DTA.
Methods and materials: DTA expression was restricted to MCH neurons and DTA induced cell death by inhibiting protein synthesis. The timing of DTA expression was controlled by the presence or absence of doxycycline (Dox) in the chow. In the presence of DTA, tTA lost its ability to bind the TetO sequence, while in the absence of Dox, tTA induced DTA expression. The mice were fed with chow containing Dox (100 mg/kg) until 10 weeks of age. Dox(+) chow was then replaced with Dox(-) chow for 4 weeks. Control mice received Dox(+) chow throughout the experimental period. All mice were chronically implanted with EEG and EMG electrodes for polysomnographic recording of sleep-wake states. The vigilance states were automatically classified by SleepSign ver.3 software. The numbers of MCH(+) neurons were assessed immunohistochemically.
Results: When 90% of MCH neurons were ablated, the amount of NREM sleep was significantly reduced, accompanied by a reduction in the mean NREM episode duration. The reduced amount of NREM sleep was observed during both the light and dark phases. Conversely, no significant difference in the amount of REM sleep was observed. The EEG power spectra for both NREM and REM sleep in MCH neuron-ablated mice were indistinguishable from those before ablation, suggesting

that ablation of MCH neurons does not affect the nature of basal cortical activity. Next, we assessed the sleep profiles in response to fasting in MCH neuron-ablated mice. Their sleep responses as well as their amounts of food intake during and after fasting (re-feeding) were mostly identical to control mice.
Conclusions: Based on our results, the main role of MCH neurons in regulation of sleep appears to be maintenance of NREM sleep. Although many reports have suggested a role for MCH in the fasting condition, there were no significant differences in sleep responses in MCH neuron-ablated mice. Thus, MCH neurons have a minor role in regulating sleep in response to fasting.

243 - **Emotionally overreacting after sleep loss? - A functional magnetic resonance imaging study on the effects of experimental sleep restriction on cognitive reappraisal**
Presented by: Sandra Tamm

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Objectives: Sleep loss affects emotional processing and has been shown to be associated with changes in brain activation patterns, i.e. increased amygdala reactivity, in response to negative stimuli. Behaviourally, sleep deprivation also affects aspects of more complex emotional functions, such as emotional regulation, but how this is reflected in the brain is unknown. The study aims to investigate how emotional regulation, through cognitive reappraisal, is affected by sleep restriction in young and older adults. Behavioural outcomes, as well as underlying brain correlates are studied.
Methods and materials: 47 healthy young (age: 20-30, 24 females) and 32 healthy older participants (age: 65-75, 17 females) participated in an fMRI experiment on 2 occasions, once after a normal night's sleep and once after restricted sleep (3h). Participants were instructed to maintain, up-regulate or down-regulate their emotional response to 60 negative and neutral IAPS pictures and to rate their success in following the instruction after every stimulus. Participants rated their perceived unpleasantness in response to all stimuli outside the scanner.
Results: Sleep restriction did not significantly affect spontaneous unpleasantness in response to negative pictures, but older participants rated increased perceived unpleasantness compared to young. Sleep restriction caused a general decrease in self-rated success in regulating emotions, but older participants were less affected. In young participants, negative compared to neutral pictures yielded increased brain activity in bilateral amygdalae, and there was a non-significant trend towards increased activity in the sleep restriction condition. Down-regulation compared to maintain yielded a robust activation of dorsolateral prefrontal cortex and lateral orbitofrontal cortex. Sleep restriction caused less activity in these regions, but the effect was not significant. Imaging analyses of the older participants are ongoing.
Conclusions: Emotional regulation through cognitive reappraisal was inhibited by sleep restriction according to participants' ratings. The behavioural effects can partly be related to changes in brain activity, but the data has to be further analysed. The behavioural effect of sleep restriction was general, regardless of instruction type, suggesting general underlying changes in brain activity and connectivity, both in active regulating conditions as well as in the control (maintain) condition.

618 - **Sleep spindles: a local phenomenon in the human thalamus?**
Presented by: Helene Bastuji

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Sleep spindles of non-rapid eye movement (NREM) sleep are believed to subserve many sleep-related functions, from memory consolidation to cortical development. Spindles differ in location and frequency, being slower in frontal than in parietal areas. Recent data using intra cerebral recordings in human showed that they occur across multiple neocortical regions, and are spatially restricted to specific brain regions. The aim of the present study was to characterize the location and frequency of sleep spindles in the human posterior thalamus and their cortical projections, with the hypothesis that local cortical spindling activity should be related to local thalamic activity.
Using intracranial recordings for pre-surgical evaluation in 7 epileptic patients, we explored spindle

activity during stage N2 in 4 thalamic nuclei, ventro-postero-lateral (VPL), central lateral (CL), anterior pulvinar (PuA), and medial pulvinar (PuM). Analyses were performed using time-frequency and spectral power in the frequency range of spindling activity.
Spindles were of lower frequency and spectral power in CL and PuA (13 Hz, 30-80 μV^2) than in VPL and PuM (13.75 Hz, 250-340 μV^2). They were found to be present in one nucleus and not in the adjacent one in 25-75 % of the cases. These initial results strongly suggest that thalamic spindles are local phenomena, as is the case in the cortex, and that their frequency can differ as a function of the thalamic nucleus generating them.

373 - **Day-time sleep pressure is greater in elite athletes**
Presented by: Luke Gupta

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Objectives: Elite athletes exhibit higher levels of sleep disturbance when compared to non-athletes. We report the differences in day-time (afternoon) sleep pressure between elite athletes and non-athletes.
Methods and materials: Initially assessed using the PSQI, 15 non-athletes (9 female; mean age±SD: 22.1±3.1 y) and 13 elite-athletes (4 female; mean age: 22.8±4.4 y; 7 internationally and 6 nationally ranked; mean training volume: 16.0±6.7 h/ week) completed 7 days wrist-actigraphy (WA) prior to reporting to the sleep laboratory on two occasions for consecutive sleep latency tests (SLT) at 15:00. The SLT adopted the AASM MSLT montage. The first visit was discarded.
Results: Athlete PSQI scores (5.3±1.2) were significantly ($F_{(1,26)}$=4.8,P= 0.04) higher compared to non-athletes (4.1±1.8). WA derived total sleep time (TST) (6.5±0.7 vs. 7.0±0.9 h; $F_{(1,26)}$=2.2,P=0.15), sleep efficiency (77±6 vs. 82±7%; $F_{(1,26)}$=4.2,P=0.05) and sleep onset latency (SOL) (18.0±17.7 vs. 15.7±11.8 min; $F_{(1,26)}$=0.17,P=0.68) were similar; however rise times in elite athletes (07:27±01:06) were significantly earlier ($F_{(1,26)}$=6.3,P< 0.05) than non-athletes (08:29±01:02). WA also showed that TST on nights prior to SLT fell within 2 SDs of that individual's average. All athletes (but only 67% of non athletes) fell asleep during the SLT. Athletes demonstrated a significantly ($F_{(1,26)}$=5.4;P=0.02) shorter SOL (8.8±4.3 min) compared to non-athletes (13.3±5.8 min) during the SLT.
Conclusion: The results indicate degraded sleep quality, and amplified daytime sleep pressure among elite athletes. Given the sampling procedures employed, the results are consistent with the conclusion that the demands of training and competition may compromise sleep quality and induce states of mild sleep deprivation in elite athletic performers.

432 - **Lucid dream induction using L-alpha glycerylphosphorylcholine**
Presented by: Simon Kern

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Objectives: A lucid dream is a dream in which the dreamer is aware of the fact that he is dreaming. Various cognitive and behavioural techniques exist to induce and enhance lucid dreaming, some of them being subject to research already. Up until now few studies deal with the possibility of supplement aided lucid dream induction.
We conducted a double blind randomised placebo controlled study to test the possibility of lucid dream induction using L-Alpha glycerylphosphorylcholine (α-GPC), an acetyl choline precursor.
Methods: A mixed group of 28 subjects without or with little lucid dreaming experience as well as 12 subjects with advanced and frequent lucid dreaming experience where administered one night with a placebo and one night with 1200mg of α-GPC in randomised order. Dream reports were collected to analyse dream alterations and a lucidity scale was used to measure possible dream lucidity. One substance free buffer between the two conditions was mandated.
Results: There were 50 dream reports in total, 26 in placebo and 24 in α-GPC condition. There were four lucid dreams in total. Two experiences lucid dreamers reported a lucid dream in α-GPC condition. One advanced and one novice lucid dreamer reported a lucid dream in placebo condition.
Discussion: A-GPC seemed to have no effect on lucid dream probability. Experienced lucid dreamers posed the majority of reported lucid dreams which was expected by the authors. One lucid dream of a

novice lucid dreamer was in placebo condition which suggests that α-GPC did not facilitate lucid dreaming for subjects with few experience.
There are many substances that come into consideration for facilitating lucid dreaming. Further research should focus on investigating these substances in a controlled manner.

406 - **Sleep deprivation. decreases the amplitude of the late auditory evoked potentials during an attention network task**
Presented by: Asela S. Karunajeewa

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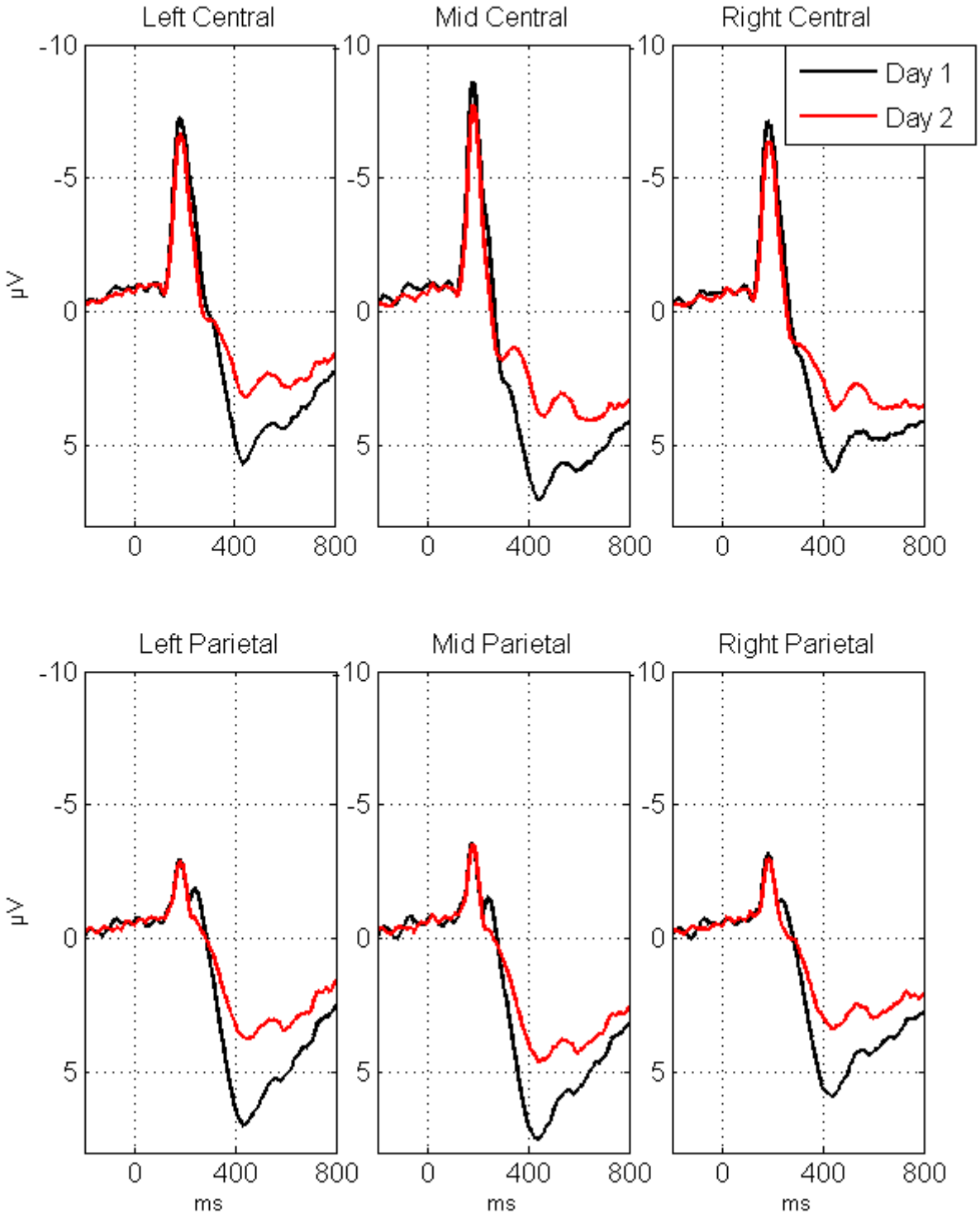
Objectives: To determine the impact of excessive daytime sleepiness on early and late stages of auditory information processing, by studying the changes in the auditory event-related potentials (AERPs) before and after sleep deprivation (SD).
Methods and materials: Thirteen normal volunteers (8 women and 5 men) performed an auditory cued attention tests, and a 20 minutes short version of a wakefulness maintenance test (MWT) over two consecutive days. Each day, five sessions of AERPs and MWT were recorded. The first session of the second day started 26 hours after sleep deprivation. From the first session of the first day until the last session of the second day the participants were not allowed to sleep. Sessions were separated by 2 hours interval.
Continuous EEG signals were recorded using a 64 active electrode cap with additional derivations for sleep assessment. EEG signals were recorded with an initial sampling rate of 600 Hz. Signals were offline down-sampled to 512 Hz and filtered with a 0.03-30Hz band-pass filter. EEG was segmented into epochs of 1000 milliseconds time-locked with the target. Only epochs with correct responses were averaged. Wavelet analysis of AERPs were also performed. Signals recorded at appropriate electrodes sites were averaged to obtain frontal, central and parietal regions of interest. T-Statistical analysis of AERPs amplitude were done in these regions.
Results: After SD, there was a significant strong decrement of the amplitude of a late positive potential (P3) in a time window of 300 to 800 milliseconds. This potential had maximal amplitude differences in parietal regions ($t=4.75$, $p< 0.001$). Wavelets analysis showed that theta oscillations were involved in the generation of this potential. SD did not significantly affect the cortical auditory evoked potential N1 peaking at frontal and central electrodes. Daytime somnolence was demonstrated by a significant decrease of the sleep latency at the MWT after the night of SD.



[AERPs before and after sleep deprivation]

Conclusions: Our data shows that SD has a strong impact on the treatment of information carried by the auditory system. However, sleepiness exerts the interference at a late stage of the treatment of the information. Sleepiness or decrease in arousal does not affect the modulation of the target processing at the cortical auditory level since auditory N1 component is not impaired by SD.

Study suported by SNF, project number 320030_149695

418 - **Comparing cortical responses to periodic 'strobe' visual stimulation across sleep and wakefulness using high-density EEG in humans**
Presented by: Omer Sharon

O. Sharon, Y. Nir
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Objectives: Sleep is defined as a reversible state of reduced responsiveness and immobility, and people woken up from sleep cannot reliably report events in their environment. The neuronal processes mediating sleep disconnection and how they influence sensory responses remain unclear. Here we examined cortical potentials evoked by periodic visual stimulation (´strobe´) through closed eyelids. Our goals were:
(1) to compare sensory responses across wakefulness and sleep, capitalizing on the extensive visual cortex that is readily accessible with EEG, and
(2) to establish the feasibility of this approach for probing brain activity in other unresponsive states such as disorders of consciousness and neurodegeneration.
Methods and materials: Healthy volunteers (n=7) with normal sleep and no history of neuropsychiatric disorders underwent full-night polysomnographic sleep studies with high-density (256 channel) EEG (EGI). Periodic visual stimulation was administered through closed eyelids using computer-controlled custom-made goggles tiled with LEDs. During stimulation trials (4 second duration), luminance was modulated sinusoidally at 5 different frequencies (3,5,8,10,12 Hz). Subjects underwent 5-8 blocks of stimulation during sleep (lasting 40 minutes each) and identical stimulation blocks during consolidated wakefulness before and after sleep, resulting in a total of 1750-2500 trials per subject. Sleep data were scored offline according to AASM guidelines and EEG analyzed separately for trials in wakefulness, N1, N2, N3, and REM sleep.
Results: Periodic visual stimulation did not significantly affect sleep architecture or cause awakenings, and participants did not report being tired or aware of stimulation during sleep. In wakefulness, we found robust periodic responses over the occipital cortex at the stimulation frequency and its harmonics. These responses persisted with comparable magnitudes across sleep. We are now exploring and quantifying potential differences between responses in sleep and wakefulness in terms of activity at higher harmonics, possible variations in temporal delays, and changes in spatial spread.
Conclusions: Our preliminary data suggest that steady-state visual evoked potentials (SSVEPs) at 3-12Hz are largely preserved across sleep, and constitute an effective approach for studying how the internal state of brain activity modulates sensory responses.
Acknowledgements: Funded by I-CORE Grant 51/11 to Y.N.

392 - **Sleep loss in the pre-training night promotes functional reorganization of the cortex during memory recognition**
Presented by: Mercedes Atienza

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Objectives: Sleep loss before memory acquisition decreases activation of the temporal lobe during encoding and promotes forgetting. But it remains unknown which neural systems are functionally affected during memory retrieval after one night of sleep recovery. To fulfill this goal, we have evaluated memory for pairs of famous faces with same or different profession (i.e., semantically congruent vs. incongruent faces) after one night of undisturbed sleep.
Methods and materials: We have analyzed EEG source activity during memory recognition in a group of young subjects who underwent 4 hours of acute sleep restriction (ASR, N=20) and in another group who slept 8 hours (controls, N=20) in the night before memory acquisition.
Results: Although the two groups showed similar performance in associative memory and benefited to the same extent from semantic congruence, patterns of EEG oscillations recorded during retrieval was quite different. Controls, relative to sleep-deprived subjects, showed decreased alpha power (i.e., higher activation) over a widespread frontotemporoparietal network typically activated during retrieval of episodic and semantic memory. Increasing delta power (i.e., higher activation) in the left parahipocampal and fusiform gyri were related to enhanced memory in subjects of the two groups, which is coherent with the lack of group differences in associative memory. However, in the ASR group, the improved associative memory was also associated with decreased alpha power in occipital

regions. Results further revealed that while the congruency benefit in controls was associated with increased activation of the left temporal pole and inferior parietal lobe through alpha oscillations, in the ASR group it was associated with higher activation of the inferior frontal gyrus through changes in delta power.
Conclusions: Overall, these findings suggest that a few hours of sleep loss in the pre-training night might reduce the ability to access the higher-level sensory representations during retrieval. In particular, successful memory retrieval under these conditions seems to rely more on cortical reinstatement of visual perceptual information and recruitment of executive prefrontal mechanisms, likely to compensate for the lack of episodic and semantic reinstatement induced by sleep loss in the pre-training night.

535 - **Sleep enhances prospective remembering by facilitating associative retrieval rather than strategic monitoring**
Presented by: Nicolas Legrand

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Introduction: Prospective memory (PM) refers to our ability to remember to do something in the future, either in response to an event (event-based PM) or after a certain amount of time has elapsed (time-based PM). Recall of the prospective component of an intention (i.e. remembering that something has to be done) is related to the level of attentional resources required to detect the prospective cues (monitoring effect). As well, recall of the retrospective component (i.e. what has to be done) also depends on the semantic coherence between the intention and the cue with preexisting knowledge (congruency effect). Previous studies showed a benefit of sleep on PM performance **[1-2]**, by improving associative recall. Using a virtual environment, we tested whether sleep modulates the monitoring and the congruency effect during retrieval of *event-* and *time-based* intentions.
Method and materials: Thirty young healthy subjects (15 males, mean age ± SD: 21.9 ± 2.9 y) participated in this study. They had to recall 12 intentions after a 12-hours interval filled either with daytime wakefulness or a night of sleep. Among the 12 intentions, 8 were event-based, implying high or low level of monitoring and presenting either a high or a low level of congruency; the 4 other intentions were time-based.
Results: Sleep improved the recall of event-based (wake: 60 % ± 19.1; night: 79.5 ± 8.7; $p < 0.001$), and time-based intentions (69.5 % ± 22.9 vs 85.4 % ± 15.4 for day and night conditions respectively; $p < 0.05$). Regarding event-based PM, sleep enhanced the recall of the prospective component only when a low level of monitoring was required (day: 61.25 % ± 27.5, night: 85 % ± 16.25; $p < 0.001$) but not when controlled processes were involved (i.e. high level of monitoring). Also, sleep improved equally the recall of congruent (day: 72.5 % ± 25, night: 91.2 % ± 15; $p < 0.01$) and incongruent intentions (day: 57.5 % ± 27.5, night: 78.7 % ± 13.7; $p < 0.01$).
Conclusion: Our results suggest that when assessed with an ecological paradigm, the benefit of sleep on PM is highly dependent on the nature of the processes underpinning the recall. Sleep has no effect on the congruency effect. Recall of the prospective component suggests that sleep may not allow subjects to perform better, compared to wakefulness, when higher attentional resources are required but rather preferentially enhances spontaneous associations between perceived cues and the corresponding prospective component.

384 - **No effect of sleep on the forgetting of unwanted memories**
Presented by: Per Davidson

P. Davidson[1], R. Hellerstedt[1], P. Jönsson[2], M. Johansson[1]
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Sleep has been shown to be beneficial for memory consolidation. Studies on the effect of sleep on memory supression have shown conflicting results. Some studies have found sleep to selectively strengthening items cued to be remembered while not affecting memory performance for items cued to be forgotten. Other studies have found sleep to “repair” items cued to be forgotten. In this study we examined if sleep, compared to wake, differently affected items cued to be remembered and items

cued to be forgotten using the Think / No Think (T/NT) paradigm. We also varied the emotional content of the images so that they were either negative or neutral, because sleep has previously been shown to have stronger effect on memory for emotional items than on neutral ones.
Participants were first asked to learn associations between word-image pairs. After reaching a learning criterion, they proceeded to the T/NT phase. In this phase, one third of the words were presented in green font colour and participants were told to think about the picture it had previously been associated with (Think items). One third of the words were shown in red to which the participants were asked to try to keep the associated image out of awareness (No Think items). One third of the words were not shown during this phase (Baseline). After a delay consisting of either a 2 hour nap or 2 hours of rest, participants were given a cued recall test for all the words, regardless of which color it had been shown in during the T/NT phase.
There was no significant effect of item type (Think, Baseline, No Think) on memory performance. There was no significant main effect of sleep on memory performance, nor were there any significant interaction effects of sleep and item type or sleep and emotion, or three way interaction of sleep, item type and emotion. See table 1 for complete statistics.

Table 1
Memory performance

		Think	Baseline	No Think
All items	All participants (N=25)	92.09 (9.91)	92.65 (6.83)	92.11 (8.71)
	Sleep (n=12)	92.01 (7.86)	92.11 (6.30)	90.32 (9.41)
	Wake (n=13)	92.16 (10.43)	93.15 (7.51)	93.75 (8.05)
Neutral items				
	All participants (N=25)	89.89 (13.13)	92.24 (8.97)	90.60 (10.10)
	Sleep (n=12)	89.15 (12.00)	89.83 (10.12)	89.06 (8.73)
	Wake (n=13)	90.58 (14.56)	94.47 (7.34)	92.03 (11.38)
Negative items				
	All participants (N=25)	95.49 (8.92)	92.97 (10.45)	93.66 (13.07)
	Sleep (n=12)	97.57 (5.75)	94.20 (9.42)	91.37 (16.65)
	Wake (n=13)	93.57 (10.98)	91.84 (11.59)	95.78 (8.82)

Values are presented as mean percentage of correctly recalled items at re-test.
Standard deviations within parenthesis.

[Memory Performance by Item type and Group]

This study failed to find impaired memory performance for No Think items compared to Baseline items after a delay period of two hours between the T/NT phase and the re-test. This lack of difference did not depend on whether the delay period had been spent asleep or awake. Contrary to previous studies, sleep did not result in superior memory retention and we did not find sleep to have a larger memory effect on emotional compared to neutral memories. One reason for this could be that we controlled for arousal so that the negative and neutral images only varied in valence.

455 - **Investigating sleep-facilitated unconscious cognitive processing using EEG and behavioural measures: a comparison between healthy younger and older people**
Presented by: Netasha Shaikh

N. Shaikh[1,2], E. Coulthard[1,2]
[1]University of Bristol, [2]NHS North Bristol Trust, Bristol, United Kingdom

The benefits of sleep upon cognition - particularly memory - are now well-acknowledged. Memory consolidation in non-rapid eye movement (nREM) sleep is attributed to hippocampo-cortical communication via thalamocortical networks, neural markers for which can be monitored using EEG. However, sleep also enhances brain processes over and above memory retention, such as gaining insight which improves performance -although, subjectively, one might not be aware of such

optimisation. Here, we will pilot the use of computerised cognitive tasks to investigate how hidden cues are processed as a result of sleep, and compare this in neurologically healthy younger and older participants.
Aims:
1) Identify and optimise a reliable task probing processing unconscious cues pre-and-post sleep;
2) To assess how this type of processing is reflected in sleep EEG
3) To assess age-differences in behavioural and EEG outcomes;
4) To establish a clinically-appropriate protocol based on this to take forward into dementia patients from our clinic.
Methods: We will recruit 15 healthy young (aged 18-49) and 15 healthy older participants (50 and over) to take part in the study. Our cognitive tasks will be performed before, and re-tested after a bout of sleep, and repeated with an equal period of wakefulness between the testing sessions.
Results: This study is currently ongoing; so far we have developed a promising task on the basis of current literature and pilot work. Current results confirm the task is indeed sleep-sensitive, with improvements in post-sleep performance attained only by participants with greater total sleep time (TST). Intriguingly, participants with less TST and poorer performance did not significantly differ in reaction times or report tiredness, which suggests differences in performance were not due to lethargy, but differences in offline sleep processing. This merits further investigation using EEG to explore neural markers in sleep with this task.
Conclusions: Sleep-facilitated qualitative information processing is relatively little-understood, particularly the EEG neural correlates of mechanisms underlying this processing, and changes with age. Comparing this across ages will allow investigation into age-related deficits that can be traced behaviourally and via EEG analysis. Relating to deficits in dementia is of future interest, particularly as there is little investigation on sleep-associated cognitive deficits in dementia patients beyond memory.

417 - **The role of sleep and circadian rhythm disturbance in the formation of psychotic-like experiences**
Presented by: Jan Cosgrave

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Sleep and Circadian Neuroscience Institute, University of Oxford, Oxford, United Kingdom

Objectives: There is recent evidence to suggest that sleep and circadian rhythm disturbance (SCRD) occurs before the onset of mental illness. This research aims to investigate whether screening on sleep quality can identify an individual's risk of experiencing psychotic like experiences (PLEs).
Methods and Materials: 46 University of Oxford students took part in a three-week in-depth sleep and circadian phenotyping study. Students were screened on the quality and perception of their sleep using the Pittsburgh Sleep Quality Index (PSQI) and the Insomnia Severity Index (ISI). Participants wore a CamNTech actigraphy device for three weeks to assess their rest-activity pattern. Sub-clinical PLEs were assessed using the Prodromal Questionnaire-16.
Results: From the sample of 46 subjects (23 good and 23 bad sleepers), a Mann-Whitney test indicated that PLEs were significantly greater for the poor sleeping group (Median = 3) compared to the good sleeping group (Median = 1), ($W = 64$, $p < 0.001$). However, no differences were found in sleep fragmentation, sleep onset, sleep offset and sleep onset latency between groups. A multivariate Poisson regression model was fit to the data to assess the relation between sleep and PLEs. The model of best fit included the main effects of PSQI score and total sleep time (sleep time after deducting wake after sleep onset) as well as the interaction between PSQI and total sleep time (Figure 1). The model suggests that both a perception of poor sleep quality combined with shorter sleep is what puts an individual at the highest risk of experiencing PLEs.
Conclusions: This is the first study to assess whether SCRD can increase an individual's risk for PLEs at a sub-clinical level. Our data suggests that perceived poor sleep quality combined with shorter sleep confers the highest risk for an individual to experience PLEs. These individuals have also completed two nights of polysomnography, 48 hours of melatonin sampling, two days of cortisol sampling, and three weeks of daily experience sampling for psychotic symptoms and mood, allowing for further in-depth analyses and profiling of their sleep and circadian rhythms.

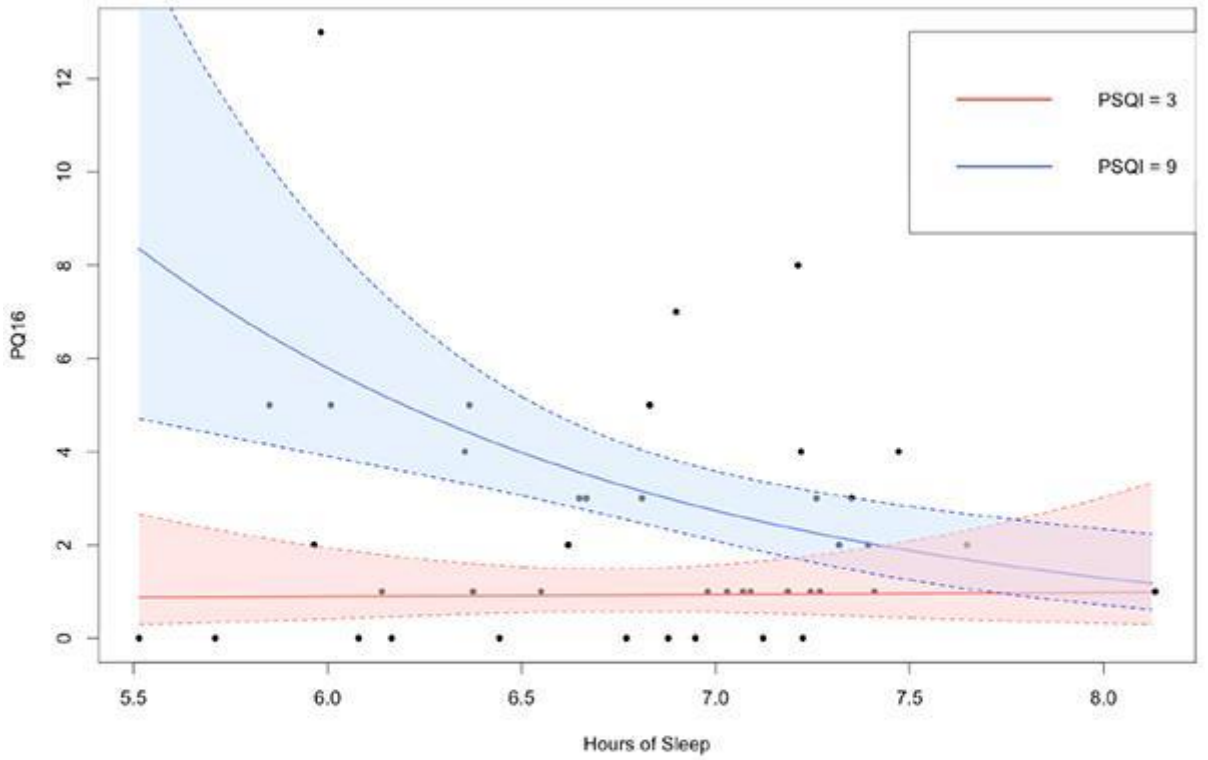

Figure 1: The interaction between hours of sleep, perceived sleep quality (PSQI) and psychotic like experiences (PQ16).
The dotted lines represent 95% confidence intervals. Block lines represent predictions of PQ16 score based on a PSQI score of 3 (red) and 9 (blue). The Pittsburgh Sleep Quality Index (PSQI) score is a measure of sleep quality, a higher score denotes poorer sleep quality. Individuals with a PSQI score of 3, show little effect of hours of sleep on the predicted PQ16 score. Individuals with a PSQI score of 9 are predicted to have a similar PQ16 score to those with a PSQI score of 3 when hours of sleep are within normal range, with the lines converging at around 8 hours. However, with a PSQI score of 9, decreasing sleep progressively increases the risk of PLEs. This suggests that a combination of both a perception of poor sleep quality and fewer hours of sleep are what puts an individual at the highest risk of experiencing PLEs.

[Figure 1]

549 - **Topological distribution of non-painful tactile evoked potentials**
Presented by: Adile Oniz

A. Oniz, G. Inanc, M. Ozgoren
Biophysics, Dokuz Eylül University, Izmir, Turkey

Aim and introduction: Over the last decades, number of sleep related studies has increased, but still sleep related processes needs to be clarified. One of the questions in the sleep research area is lateralization of sensory processing of stimulus. It is known that the handedness of an individual would affect the lateralization of sensory processing of stimulus. In this present study it is aimed to investigate the topological differentiation of tactile evoked potentials in right hand dominant individuals.
Methods: 21 healthy subjects (mean age: 22.90±2.17 years; 11 woman) have been recruited to the study. 40-channel Nuamps recording system (for electroencephalography, electrooculography, and chin electromyography), pneumatic stimulator, EMISU, and video recording system were used in the recordings. non-painful tactile stimuli of one type were presented via pneumatic stimulator to the subjects' second and third fingers of both hands. American Academy of Sleep Medicine (AASM) scoring system was used to determine the stages. Student t-test was used for the comparison of dependent groups.
Results: P50, N100, P200, N300, P450, N550, P900, and Nlate components were observed in response to the non-painful tactile stimulations throughout the night. In the analyses of topological distribution; while the amplitudes of P50 component in contralateral side electrodes were significantly higher than the ipsilateral side for both hand stimulations, amplitudes of N100 component in contralateral side electrodes were significantly higher than the ipsilateral side for only dominant (right) hand.
Conclusions: P50 and N100 components are related to sensory processing of stimulus. Results of

this present study showed the significant differences in amplitudes between hemispheres for P50 and N100 components. These findings could hint the dynamic differentiation or lateralization of sensory processing of stimuli during sleep.

443 - **A novel sleep spindle detection method to account for intra- and inter-individual differences in spindle characteristics**
Presented by: Laura B. Ray

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Objectives: Sleep spindles have garnered much interest in terms of their physiological and cerebral correlates, function for sleep maintenance, memory consolidation, relationship to cognitive abilities and clinical relevance. Until recently, this has been hindered by the difficult and labour-intensive task of visually identifying spindles. The interest in spindles has invigorated the proliferation of a variety of automated detection methods. However, the task of accurately detecting spindles has proven to be a significant methodological challenge. A novel detection method was developed to overcome methodological hurdles, including:
1) extracting the signal with high signal to noise ratio,
2) accounting for variations of spindle characteristics across the night, scalp and individuals, and
3) minimizing the number of user-defined parameters.
Methods and materials: Spindles were automatically detected in 15 young subjects. Complex demodulation was used to extract instantaneous power in the spindle band with high signal to noise ratio. To account for intra- and inter-individual differences, the signal was z-score transformed using a 60s sliding window. Spindle events were detected with a z-threshold=99.9th percentile. Amplitude, duration and oscillatory frequency were derived for each spindle. Each spindle was categorized as slow or fast by its peak frequency. An expert manually identified spindles from C3 during 20min of non-rapid eye movement stage 2 sleep from each recording and those spindles were compared to the automated detection. Spindles were also identified by a group of non-experts (mean N=18.4) and compared to the expert gold standard.
Results: True positive, true negative, false positive (FP) and false negatives were used to calculate: recall, precision, specificity, negative predictive value and FP rate, which were 72%, 72%, 90%, 88% and 10%, respectively. There was high overall agreement between the expert and automated scoring (F1 score=0.70,Φ=0.60) as well as, between the non-expert and expert scoring (F1 score=0.80,Φ=0.72).
Conclusions: This novel method of spindle detection effectively addresses many of the methodological challenges that currently plague the reliability and validity of automated spindle detection and meets or exceeds inter-rater reliability normally observed between expert scorers. We also present a method to efficiently obtain a benchmark from a large group of non-experts using internet-based crowd-sourcing techniques.

32 - **Beyond Rechtschaffen-Kales: real-time automated EEG tracking of arousal states using neural field theory**
Presented by: Romesh Abeysuriya

R.G. Abeysuriya[1,2,3], P.A. Robinson[1,2,3]
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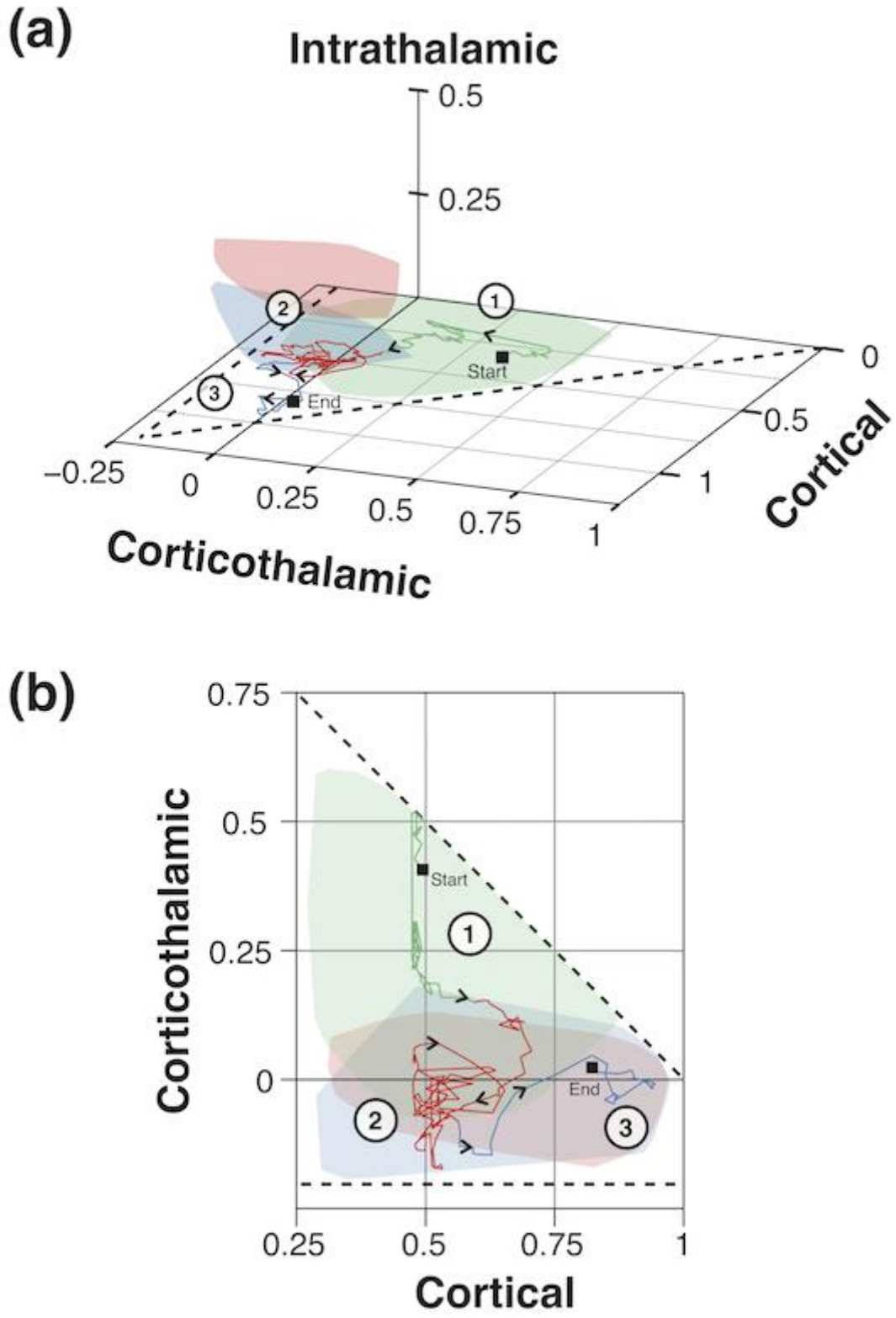
Objectives: Traditional sleep/wake staging (e.g., using Rechtschaffen-Kales stages) is fundamentally flawed because it forces classification of continuous dynamics into a few discrete categories that are neither physiologically informative nor individualized. There is also significant interobserver disagreement because subjective decisions contribute to determining sleep stage, which prevents consistent automated sleep scoring. The aim here is to replace traditional staging with a continuous, individualized, physiologically informative representation of arousal.
Methods and materials: A real-time fitting system is developed and used to fit the predictions of a neural field model to EEG, yielding a trajectory in a parameter space that measures intracortical, corticothalamic, and intrathalamic feedbacks.

Results: The fitting routine robustly tracks physiological arousal parameters over the course of a full night of sleep. Figure 1 shows a parameter trajectory for 4 mins of experimental data obtained by fitting the model to the EEG power spectrum:
(a) isometric view
(b) plan view.
The color of the trajectory indicates the corresponding traditional sleep stage: EC (green), S1 (red), S2 (blue). The numbers on the figure show the ordering, and arrows indicate the direction of the trajectory. The shaded regions correspond to population-averaged EEG features associated with traditional sleep stages.



[Figure 1 - Parameter trajectory]

The fitting routine is entirely automatic, does not require special configuration for different individuals, and runs in real-time on a PC. In contrast to the individual trajectory, the population-based regions associated with typical EEG features of traditional sleep stages (shaded areas) are very large, which demonstrates the physiologically uninformative nature of traditional sleep stages and reveals the underlying cause of inconsistencies in traditional scoring. Moreover, the parameter regions are only clearly distinguishable in the model´s 3D space, demonstrating that the dynamics of sleep cannot be

represented by a 1D classification system.
Conclusions: The system developed here tracks brain states in terms of physiology in real time during sleep and wake. It supersedes discrete staging systems by representing arousal states in terms of physiology. The system provides an objective measure of arousal state, solving the problem of interobserver disagreement. Discrete stages from traditional schemes can be expressed in terms of model parameters for backward compatibility.

350 - **An alternative actigraphy analysis to quantify nocturnal sleep: a pilot study**
Presented by: Jong Won Kim

J.W. Kim[1,2], A. Mullins[1,2], D. Bartlett[1,2], R.R. Grunstein[1,2,3]
[1]NHMRC Centre for Translational Sleep and Circadian Neurobiology, Woolcock Institute of Medical Research, Glebe, [2]Cooperative Research Centre for Alertness, Safety and Productivity, University of Sydney, [3]Department of Respiratory and Sleep Medicine, Royal Prince Alfred Hospital, Sydney, NSW, Australia

Objectives: Actigraphy has been widely used to monitor sleep in the ambulatory setting. However, the analysis of the data often requires a time-consuming, labour intensive process. In this pilot study, we utilised a new automatized quantitative analysis tool for actigraphy. Outcomes of the tool were compared with current analysis software, as well as polysomnography (PSG) measures.
Methods: Actigraphy (over 7 days) from sleep-disordered patients (N=12: 6 obstructive apneic, 5 insomniac and 1 narcoleptic patients) investigated at an academic-based clinical sleep centre were analysed by an algorithm based on logarithmic transformation and finite-impulse-response filter techniques. In particular, properties of nocturnal sleep (e.g., time-in-bed, total sleep time, sleep efficiency) were calculated and compared with those from conventional semi-manual actigraphy reports. These properties were also compared with PSG measures. Paired t-tests were performed to explore statistical differences between the analysis methods.
Results: Our tool assessed the patients' nocturnal sleep (i.e., time-in-bed) 521.3 ± 97.7 min, which is significantly shorter than the semi-manual method (549.7 ± 88.0 min, $p = 0.02$). However, these sleep bouts were longer than observed by PSG (450.9 ± 39.3, $p = 0.04$). Similar trends were found in the total sleep time and sleep efficiency.
Conclusions: Our automatized quantitative actigraphy analysis is time-efficient and provides a closer result to PSG compared with the conventional methods. This tool may show promise for automated analysis of clinical actigraphy if validated in a much larger sample for test evaluation metrics.

589 - **Development and validation of an automatic reference polysomnographic system for quantifying drowsiness**
Presented by: Clémentine François

V. Bosch, C. François, Q. Massoz, B. Fortemps de Loneux, J.G. Verly
University of Liège (ULG), Liège, Belgium

Objectives: Drowsiness is a major cause of various types of accidents. Therefore, preventing such accidents is a critical issue of safety and public health. Since polysomnography (PSG) is considered as the "gold standard" for sleep, we have developed and validated a new, automatic PSG-based system for quantifying drowsiness (which is closely related to sleep). This system is primarily intended to be used as a reference for the validation of non-PSG-based drowsiness monitoring systems. The objective of this study is to show that the level of drowsiness produced *automatically* by our system is in excellent accord with that produced *visually/manually* by experts.
Methods and materials: We conducted an experiment in which 24 healthy volunteers were asked to perform three visual Psychomotor Vigilance Tests (PVTs) - of 10 minutes duration each - in different sleep conditions (with up to 28 hours of sleep deprivation). For each test, we recorded PSG signals, and we processed successive, non-overlapping 20 sec epochs. Each epoch was processed in two distinct ways. *Automatically:* (1) we extracted from the EEG and EOG signals features that are indicative of drowsiness (alpha rhythm, theta activity, and slow eye movements) by using - in an innovative way - the Hilbert Vibration Decomposition technique and a tree-based classification method, and (2) we produced from them a level of drowsiness (LoD), inspired by the Karolinska Drowsiness Scale (KDS). *Visually/manually:* our experts extracted the same features and applied the KDS to produce their own LoD.
Results: Preliminary results (15 subjects) indicate that the level of drowsiness (LoD) produced

automatically by our PSG-based system increases with sleep deprivation, and also varies in accordance with the LoD determined *visually/manually* by our experts. In particular, when we compare the *automatic* extraction of the different features with the *visual/manual* one, we obtain a sensitivity of 0.85 and a specificity of 0.86 on average for all features.
Conclusions: This study shows that our automatic PSG-based system has the potential
(1) to become a promising reference for drowsiness quantification, and
(2) to help scoring experts save time. Moreover, this system could also be used as a diagnostic tool for people with excessive daytime sleepiness (EDS) which may be due to sleep disorders.

64 - **Effects of sleep deprivation on resting-state EEG and attention in healthy volunteers**
Presented by: Dong Wook Kim

D.W. Kim
Department of Neurology, Konkuk University Hospital, Seoul, Republic of Korea

Purpose: Although sleep deprivation can affect cognitive function significantly, only a few studies have quantitatively evaluated the effects of sleep deprivation in healthy subjects. Thus, this study utilized an EEG power spectral analysis to investigate whether alterations in EEG are associated with sleep deprivation.
Methods: This study included 24 healthy volunteers who underwent resting-state EEG and completed two attention exams after sleep deprivation. The same tests were repeated after the sound night sleep.
Results: After the sound night sleep, significant increases in low alpha (8-10 Hz) and theta (4-8 Hz) power were observed in the whole brain and were especially prominent in the frontal and parieto-occipital regions. The participants performed better on the attention tests after the sound sleep, but regional EEG changes were not correlated with this attentional enhancement.
Conclusions: The present study demonstrated that sound night sleep was associated with increased power in the theta and low alpha bands on a resting-state EEG and that this recovery was accompanied by improved attentional performance.

255 - **Emotion expression and emotion regulation in insomnia disorder**
Presented by: Chiara Baglioni

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Objectives: To investigate the relationship between emotion expression and emotion regulation and both objective and subjective sleep measures in patients with insomnia disorder (PID) and healthy good sleepers (HGS).
Methods and materials: A sample of 45 PID (19 men, 26 women; mean age 43.7 ± 13.2 y.) and 73 HGS (30 men, 43 women; mean age 42.0 ± 10.5 y.) was investigated using two nights of polysomnography, self-reported measures of sleep and two questionnaires on expression (Berkley Expressivity Questionnaire) and regulation (Emotion Regulation Questionnaire) of emotion. All patients and controls reported no clinically significant depression (Beck Depression Inventory score ≤ 13).
Results: Correlations between emotion and sleep variables were conducted for the two groups separately. In PID, analyses evidenced that insomnia severity (ISI) was positively associated with expression of positive emotions ($r=0.64$, $p< 0.01$) and intensity of emotion experience ($r=0.36$, $p=0.021$). In addition, in PID, the use of behavioral suppression as emotion regulation strategy was negatively correlated with insomnia severity ($r=-0.45$, $p=0.003$). With respect to polysomnography, in PID, duration of stage 1 sleep was positively associated with the expression of positive emotions ($r=0.30$, $p=0.048$) and the intensity of emotion experience ($r=0.36$, $p=0.019$). In contrast, in HGS, the expression of positive emotions was negatively correlated with insomnia severity ($r=-0.23$, $p=0.050$) and the use of behavioral suppression was positively correlated with insomnia severity ($r=0.24$, $p=0.046$).
Discussion: Results evidenced different correlations between emotion and sleep variables in the two investigated groups. In PID, severity of insomnia and time spent in light sleep were found to be associated with intense emotion experience and reduced use of behavioral suppression as emotion regulation strategy. These preliminary findings suggest that psychological treatment of insomnia may benefit from including interventions directed to improve the management of the emotional experience.

282 - **Learning as a model of neuroplasticity in primary insomnia**
Presented by: Elisabeth Hertenstein

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Objectives: Healthy sleep restores the brain's ability to adapt to novel input through memory formation and underlying neuroplasticity. The objective of this study was to further characterize indices of neuroplasticity in primary insomnia based on studies of learning in a hippocampus-dependent and an amygdala-dependent memory task.
Methods and materials: Twenty patients with primary insomnia according to DSM-IV criteria (17 females, 3 males, 43.5 ± 13.0 years) and 20 healthy controls (17 females, 3 males, 41.7 ± 12.8 years) completed a hippocampus-dependent virtual Morris water maze task (vWMT) and amygdala-dependent classical fear conditioning (FC). Repeated measures ANOVAs (rmANOVAs) were used to investigate potential group differences in the latency to find the platform (vWMT) and the eye-blink startle response to conditioned stimuli (FC).
Results: In the vWMT, the rmANOVA revealed a significant Group (insomnia vs. control) x Block (1 vs. 2) interaction ($F_{1,38}$ = 7.1, p = .011), with patients showing a slower learning progress after similar levels of encoding. In the FC task, the rmANOVA demonstrated a highly significant main effect for the factor CS type (CS+ vs. CS-) ($F_{1,38}$ = 20.0, p< .001), but no significant effects for the factor Group (insomnia vs. control) or the CS type x Group interaction (p > .1, for both analyses), indicative for similar levels of fear acquisition in both groups.
Conclusions: The finding of reduced learning in the vWMT in patients with insomnia is consistent with the hypothesis that insomnia is characterized by decreased plasticity in a hippocampo-neocortical (dorsal executive) network. Similar levels of fear acquisition in the two groups indicate unaltered plasticity in an emotional (ventral) network that includes the amygdala. Together, the findings are consistent with the notion that neuroplastic processes in higher order brain networks are preferentially affected by chronic disruptions of sleep, whereas neuroplastic processes in basic emotional networks might be more resilient and distinguish primary insomnia from major depression.

428 - **Emotional experience, presence and severity of insomnia and depressive symptoms: an ecological study of their effects on sleep quality**
Presented by: Silvia Cerolini

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Objectives: Recent reviews support the idea that negative emotions are associated with poor sleep quality (Kahn et al.,2013). Both negative and positive emotions are supposed to disrupt sleep (Espie et al., 2006), though there is still debate on this point (Baglioni et al., 2010). The present study evaluates the effects of pre-sleep positive and negative emotions (PE, NE) on the sleep continuity in the subsequent night, controlling for severity of insomnia and depression.
Method and materials: 255 participants (54.1% female, mean age 35.9 ± 12.27) kept sleep diaries for 7 consecutive nights and completed a Positive and Negative Affective Schedule (PANAS) each evening before going to bed. Upon recruitment participants also completed self-report questionnaires detecting the presence and severity of insomnia (Insomnia Severity Index, ISI; Questionnaire on Sleep Disorders, QDS) and of depression (Beck Depression Inventory, BDI).
Procedure: Based on the weekdays diaries, for each participant, the nights with the best (BN) and with the worst (WN) sleep efficiency index (SEI) were selected. Based on QDS data, three groups differing for sleep quality were defined: good sleep (N = 66), poor sleep (N = 138), and chronic insomnia (N = 51).
Results: The SEI differed significantly between nights (p < 0.001), and groups (p < .001). The interaction groups*nights was also significant (p < 0.001): before the WN all groups differ (insomnia M = 86.36 ±1.14, poor sleep M = 91.06 ± 0.69, good sleep M = 94.89 ± 1); before the BN only the insomnia group showed a SEI lower (M = 96.47 ± 0.41) than both the other groups (poor sleep M = 97.69 ± 0.25, good sleep M = 98.53 ± 0.36). Differences in the ISI and BDI scores were also significant (both p < .001); therefore partial correlations were computed among PE, NE and SEI in the WN and among PE, NE and SEI in the BN across groups controlling for ISI and BDI scores. Results

show no significant correlation in any group in the WN, and significant negative correlations between both NE and PE before the BN only in the poor sleep group.
Conclusions: Findings suggest that the perceived continuity of sleep among the good sleepers is not affect by emotions and among people with chronic insomnia it is associated only with depressive symptoms and the insomnia severity. Only in the BN of the poor sleepers the continuity of sleep is related to the intensity of pre-sleep emotions regardless of their valence, consistently with Espie's theory.

73 - **Cognitive factors predict sleep complaint across the insomnia phenotypes in young adults: the utility of data gathered using a smartphone App**
Presented by: Colin Espie

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Introduction: Many people with insomnia attribute their problem to mental phenomena (e.g. the racing mind). Thus cognitive behavioural therapy (CBT) seems appropriate. It is also an efficacious treatment. However, the specific association to insomnia of sleep-related cognitions (both content and timing), compared with generally anxious and depressive thoughts, remains largely unknown.
Methods: We took a large representative sample of data from a free iPhone App (Sleepio®) collected during the 2 months ending 16-Jan-2015. Analysis of records [n=131,796; 56%M; mean age 28.1(11.0)y] focused on relationships between demographic, sleep, clinical and psychological characteristics (all using recognised scales). Our particular interest was to see if this novel method of data acquisition could help address important questions about the cognitive management of insomnia.
Results: Participants meeting sensitive thresholds for difficulty initiating sleep [DIS: 54% of sample;26.9(10.4)y] were younger than those with difficulty maintaining sleep [DMS: 38%;31.3(12.6)y] or early morning awakening [EMA: 22%;30.9(12.9)y]. Women were more troubled by poor sleep than men (t=29.4,p< .0001). Having any possible insomnia subtype was associated with higher anxiety [Generalised Anxiety Disorder Questionnaire; range of t=20.7-53.7,p< .0001] and depressive [Patient Health Questionnaire; t=11.4-41.2,p< .0001] symptoms. Associations between sleep status [Sleep Condition Indicator (SCI)] and GAD (r=-.41) and PHQ (r=-.39) were moderate. On the Glasgow Content of Thoughts Inventory (GCTI) thinking that 'sleep is out of control' was the strongest cognitive predictor for DIS, DMA and EMA (R^2=16.7%), with sensory awareness at night also a factor in DMS. When PHQ, GAD and GCTI were entered in a stepwise regression model, GCTI variables explained the greatest amount of variance in SCI sleep status (β=-0.466;R^2=21.7%). Together, GAD and PHQ contributed a further 5.7% variance.
Conclusion: Mobile Apps may yield large quantities of useful, time-stamped, self-report data. This analysis supports the potential role of cognitive components of CBT in addressing the insomnia phenotypes.

484 - **What is a poor night's sleep? A quantitative approach to unravel the parameters of sleep quality**
Presented by: Fatanah Ramlee

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Objective: Poor sleep quality is a key determinant of sleep complaints but the factors contributing to poor sleep quality are ill-defined. Subjective ratings of sleep quality do not always correlate with sleep measures and it remains a mystery what constitutes a poor night's sleep. Previous studies have used qualitative methods to uncover the subjective meaning of sleep quality. Although these methods have high face and ecological validity, they are vulnerable to researcher biases and do not generate concrete information about sleep quality.This study aimed to identify the parameters of sleep quality using a quantitative choice-making approach.
Methods and materials: Participants were 50 good sleepers and 50 poor sleepers. They were asked to read and choose between two stories to answer questions “which night was a better night's sleep?” and “which night was a poor night's sleep?”A total of 17 possible parameters of sleep quality were pre-selected. Parameters selected covered the experience of the day before, during the pre-sleep period, during sleep, upon waking and the day after. All parameters were anchored with three options, except

for wake after sleep onset for which 5 options were provided. Participants chose between pairs of stories,and because the total number of possible stories exceeded 200 million, we used a sophisticated statistical algorithm (Markov Chain Monte Carlo with People) to sample the most relevant stories. Each participant completed 48 trials and Logistic Regression Models were fit to their choice data to identify relative importance of each parameter, and using this information we estimated the stories that represents the best night's sleep and the worst night's sleep.
Results: Of the 17 parameters, only those parameters that occurred during sleep, on waking and during the day after had a significant impact on the participants' choices. There was a significant interaction between “feeling refreshed”and“wake after sleep onset” ($p < 0.001$) suggesting that if participants sleep through the night,they were less concerned about whether or not they “felt refreshed” upon waking.There was no significant effect on the type of sleepers.
Conclusions: The overall judgment of sleep quality appeared to be determined by what happened during and after sleep, as well as performance during the day. Interestingly, this study did not find any differences between good and poor sleepers' choices on the parameters of sleep quality.

335 - **High frequency heart rate variability during worry predicts stress-related increases in sleep disturbances**
Presented by: Gouin Jean-Philippe

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Objective: Evaluate whether high frequency heart rate variability (HF-HRV) during waking restfulness and during worry predicts increases in sleep disturbances in response to a stressful life event.
Methods: Longitudinal study following 22 individuals from well-defined periods of lower and higher stress. HF-HRV during waking restfulness and in response to a worry induction were measured during a low stress period. Sleep disturbances were assessed using the Pittsburgh Sleep Quality Index (PSQI) and the Insomnia Severity Index (ISI) during low stress and high stress periods.
Results: During both the low and high stress periods, lower HF-HRV during worry was associated with greater PSQI scores. Importantly, lower HF-HRV during the worry induction prospectively predicted greater increases in the PSQI score from the low stress to the high stress periods.
Conclusion: HF-HRV during worry might represent an index of vulnerability to stress-induced sleep disturbances.

371 - **Rumination is associated with a reduced efficiency in cognitive control and perceived sleep quality**
Presented by: Charlotte Muscarella

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Ruminative thought is a characterizing feature of insomnia disorder. Despite its clinical relevance, research on the underlying cognitive mechanisms of rumination remains scarce. According to the processing efficiency hypothesis rumination interferes with normal cognition by taking up valuable working memory resources. Consequently, individuals with a tendency to ruminate will have to engage more effort to maintain effective task performance at the expense of cognitive efficiency. In the present study, we specifically investigated whether rumination was associated with a reduced cognitive control ability. In order to do this, we administered the continuous performance task (AX-CPT) to a group of undergraduates ($n = 84$). From this sample, low-ruminators ($n = 22$) and high-ruminators ($n = 23$) were selected. In the AX-CPT task, subjects have to provide a certain response to target trials (i.e., AX) and a different response to non-target trials (i.e., BX, AY and BY), while target trials are presented with a high frequency (70%) and therefore creating an expectancy bias. The main results showed that although both groups made a similar amount of errors on the task, high-ruminators were significantly slower than low-ruminators on non-target trials. Additionally, rumination was found to be significantly associated with poor subjective sleep quality and prolonged subjective sleep onset latency in the high-ruminators group only. The results lend further support that, given an equal performance in both

groups (similar error rates), rumination is associated with reduced efficiency in cognitive control (increased reaction time). Furthermore, these findings suggest that rumination is important for understanding sleep disturbances. In a follow-up study, we will examine whether this impairment in processing efficiency associated with a tendency to ruminate, also holds true in patients with insomnia disorder. Investigating the potential contribution of rumination to cognitive efficiency in patients with insomnia disorder may possibly elucidate reported difficulties in cognitive functioning in these patients.

272 - **Development of the pain-related beliefs and attitudes about sleep (PBAS) scale for the assessment and treatment of insomnia comorbid with chronic pain**
Presented by: Esther F. Afolalu

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Objectives: Sleep disturbance often contributes to the experience of chronic pain and vice versa. A valid instrument to assess the interaction between pain and sleep-related beliefs would therefore be a valuable clinical tool. The current study aimed to evaluate the psychometric and functional properties of a 10-item Pain-Related Beliefs and Attitudes about Sleep (PBAS) scale, designed to assess pain-related dysfunctional beliefs and attitudes about sleep among people with chronic pain.
Methods and materials: The PBAS scale was administered to four clinical samples. A sample of 137 chronic pain patients with comorbid insomnia completed the scale and a further 26 patients completed the scale on two occasions (a week apart). A third sample included pre and post-treatment data from 20 patients who received a 4 week hybrid cognitive behavioural therapy for sleep and pain management. To assess generalisability, 62 patients recruited from a different clinic with a different demographic profile also completed the scale. All participants also completed a selection of validated questionnaires to assess insomnia severity, sleep-related beliefs and pain interference.
Results: The PBAS scale was found to be reliable, as evidenced by adequate internal consistency and temporal stability. The two factors emerging from the factor structure analysis reflected pain interfering sleep quality and the reciprocal link between sleep and pain. The scale showed good concurrent and predictive validity as PBAS scores were significantly correlated with insomnia severity and other self-report measures of dysfunctional sleep beliefs. They were also a significant predictor of insomnia severity and pain interference. In addition, significant reduction and improvement in PBAS scores were observed in patients following a hybrid cognitive behavioural intervention for pain and insomnia.
Conclusions: These findings confirm that pain-related sleep beliefs are an integral part of chronic pain patients' insomnia experience. The data indicate that PBAS is a valid and reliable instrument for evaluating the role of these beliefs in chronic pain patients. Higher scores on the scale were associated with greater sleep disturbances and pain interference and the scale was sensitive to treatment response in chronic pain patients. Hence, cognitive behavioural interventions designed to address these pain-related sleep beliefs may help alleviate sleep disturbance and pain interference in this population.

476 - **Measurements of sleeping difficulties - a population-based comparison of three different insomnia scales**
Presented by: Jerker Hetta

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In health related population studies it is important to include questions about sleep, which has relations to physical and psychological health as well as life quality. Questionnaires in health surveys should be kept rather short in order to yield better response rates. In the present study we wanted to compare a short, 3 item scale (MISS) with the Pittsburgh Sleep Quality Index and the Insomnia Severity Index .
Method: A questionnaire was posted a random population sample 1 962 subjects (age 20 to 65 years) and we received answers from 1335 (68%). The questionnaire contained all questions from Pittsburgh Sleep Quality Index (PSQI) and the Insomnia Severity Index (ISI) and the MISS (Minimal Insomnia Symptom Scale.
Results: The Minimal Insomnia Symptom Scale (MISS) was highly correlated to Pittsburgh Sleep Quality Index (Pearson correlation .839) and to Insomnia Severity Index (ISI) (Pearson correlation

.847).
In an examination the relation between summed scores from the three insomnia scales to daytime symptoms of difficulties with concentration, irritability, sleepiness and fatigue, revealed similar and significant correlations for all scales as well as correlations to reported estimats of TST (total sleep time) and sleep latencies.
Conclusion: The three-item MISS scale give very similar information compared to Pittsburgh Sleep Quality Index (PSQI) and the Insomnia Severity Index (ISI). The MISS scale has reliable and valid key items about insomnia symptoms and can be used in health surveys and epidemiological studies.
References: The Minimal Insomnia Symptom Scale (MISS): a brief measure of sleeping difficulties.
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592 - **Cognitive complaints and neuropsychological evaluation in insomniac patients**
Presented by: Teresa Rebelo-Pinto

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Objectives: Our goal was to evaluate memory, attention and executive functioning after awakening in insomniacs and to compare the results with their subjective complaints and polysomnography (PSG) data from the preceding night.
Methods and materials: This study involved 71 insomniacs (46 males, 25 females; ages 18-74, mean=52.2, SD=14.05). After a type 1 PSG they were submitted to a neurocognitive evaluation including selective attention (D2), verbal memory (California Verbal Learning Test), visual memory (Rey Complex Figures), working memory (WAIS - III, digit memory subscale), sequencing (Trail Making Test), inhibitory control (Stroop test) and verbal fluency (Primary Mental Abilities, Factor F); to standard questionnaires: Insomnia Severity Index - ISI, Pittsburgh Sleep Quality Index - PSQI, Dysfunctional Beliefs and Attitudes About Sleep - DBAS 16, Glasgow Sleep Scale - GSS; and to standard clinical evaluation. Statistical tests used SSPS 17.
Results: Many patients had subjective complaints of attention (77.5%), memory (46.5%) and executive functioning (25.4%). We found alterations in all cognitive domains evaluated: working memory (60.6%); verbal fluency (45.1%); attention - processing speed (35.2%) and performing capacity (32.4%); visual memory (28.2%); sustained attention capacity (16.9%); verbal memory (16.9%), learning (15.5%) and retention capacity (14.1%); inhibitory control (14.1%); cognitive flexibility (16.9%) and sequencing ability (12.7%). Attention and visual memory complaints not always correlate with real impairment ($p \leq 0.05$). Participants with headaches ($p=0.011$) and anxiety complaints ($p=0.028$) had shorter sleep duration. Participants with attention deficits and poor cognitive flexibility had less %REM; those with memory alterations had less %N3 ($p \leq 0.05$). PSQI, ISI, GSS and DBAS scores were worse in patients with different complaints or cognitive alterations ($p \leq 0.05$).
Conclusions: Results show that PSG and subjective data relate differently with cognitive dysfunction in insomniacs. Furthermore, complaints about cognitive daytime functioning not always match real alterations in these domains. This suggests that both objective and subjective data should be used clinically.

153 - **"Diagnosis by behavioral observation" Home-videosomnography - a novel exploratory approach to intractable insomnia of children and the elderly**
Presented by: Osman Ipsiroglu

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Objectives: Exploring causes of intractable insomnia is a major challenge in sleep medicine. Aside from an in-depth history, gaining an understanding of sleep/wake behaviours as well as environmental

influences is essential. In this context, the value of formal sleep studies, which mainly gather neurophysiological data, is limited. Explorative screening tools are needed, e.g. modern video technologies.
Methods and materials: We investigated different combinations of hardware/software for home-videosomnography (HVS) and established a process for qualitative and quantitative analysis of HVS-recordings. A case vignette (HVS analysis for a 5.5-year-old girl with major insomnia and several co-morbidities) demonstrates how methodological considerations were addressed and how HVS added value to clinical assessment.
Results: We suggest an 'ideal set of hardware/software' that is reliable, affordable (~$500) and portable
(= 2.8kg) to conduct non-invasive HVS, which allows time-lapse analyses. The equipment consists of a net-book, a camera with infrared optics, and a video capture device.
(1) We present an HVS-analysis protocol consisting of 3 steps of analysis at varying replay speeds:
(a) basic overview and classification at 16x normal speed;
(b) second viewing and detailed descriptions at 4-8x normal speed, and
(c) viewing, listening, and in-depth descriptions at real-time speed.
(2) We also present a custom software program that facilitates video analysis and note-taking (Annotator©), and Optical Flow software that automatically quantifies movement for internal quality control of the HVS-recording.
The case vignette demonstrates how the HVS-recordings revealed the dimension of intractable insomnia caused by restless legs syndrome at a very young age, and illustrated the cascade of symptoms and challenging behaviours, which resulted in inappropriate diagnoses and medications.
Conclusions: The strategy of using HVS, although requiring validation and reliability testing, opens the floor for new 'observational sleep medicine', which has been useful in describing discomfort-related behavioural movement patterns in patients, e.g. with communication difficulties presenting with intractable insomnia and challenging/disruptive sleep/wake behaviours.

158 - **A retrospective study of the efficacy of ramelteon for insomnia: relevance to dose and timing of administration**
Presented by: Akiko Tsuchiya

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Objectives: To investigate the efficacy of ramelteon for insomnia, particularly with circadian disturbance, focusing on the relevance of dose and timing of administration.
Methods and materials: We reviewed the chart data of 145 continuations patients who administered ramelteon for insomnia for the first time at the sleep clinic of the Department of Psychiatry, Fujita Health University Hospital (Aichi, Japan), between October 2010 and May 2014. The efficacy was assessed using Clinical Global Impression of Improvement (CGI-I), and we analyzed its relationship with the dose and the timing of administration.
Results: A total of 28.8% patients were “very much” or “much” improved (CGI-I score of 1 or 2), and when “minimally” (CGI-I score of 3) was included, 56.6% patients were improved. In a subgroup of 114 patients of especially aiming phase advance, the ratio of improvement was 33.3% and 64.0% each. A low-dose
(1 or 2mg) group or a low-dose + early-administration (> 5hr before habitual bedtime) group had a tendency of higher improvement ratio compared with the remaining group; however, this difference did not reach statistical significance. The ratio of discontinuance due to adverse effects did not have significant difference by the dose. The cases with carry-over effects were significantly fewer in the low-dose group. Although the low-dose + early-administration group had a low ratio of discontinuance and carry-over effects compared with the remaining group, this difference did not reach statistical significance.
Conclusions: In our specialized sleep clinic, there were many refractory cases of insomnia; however, ramelteon was effective for about half of such patients. Particularly, it had a tendency of higher effectiveness for insomnia with circadian disturbance, although without statistical significance. The effectiveness of the low-dose administration or the combination of low-dose + early-administration was equal or a little better, and the acceptability was significantly higher, than those of the other fashion of administration, The prospective study having a control group will be necessary in the future.
Acknowledgments: This is not an industry-sponsored study. The authors have no conflict of interests to declare with regard to this study.

375 - **Novel dual orexin receptor antagonist lemborexant shows efficacy on sleep initiation and maintenance on sleep diary measures in phase 2 study**
Presented by: Jane Yardley

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Objectives: To determine a well-tolerated dose or doses of lemborexant that balance clinically significant efficacy for sleep onset and/or maintenance without morning residual sleepiness.
Methods and materials: The study was a multicenter (US), randomised, double-blind, placebo-controlled, parallel-group design, enroling subjects with insomnia disorder per Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). A Bayesian adaptive design tested 6 dose levels of lemborexant (1, 2.5, 5, 10, 15, 25mg) or placebo administered for 15 nights (30m before bedtime). Diaries were completed each morning. Safety was monitored via treatment-emergent adverse events (TEAEs), electrocardiograms, vital signs, chemistries and morning assessments of residual sleepiness (in-clinic only).
Subjective sleep efficiency (sSE), subjective Sleep Onset Latency (sSOL) and subjective Wake After Sleep Onset (sWASO) from sleep diaries were averaged for Baseline (BL), and during treatment (Days 1-7, 8-15).
Results: 616 screened, 291 randomised (63.5% F, mean age 48y). Mean (standard deviation; SD) BL Insomnia Severity Index was 20±3 (moderate-severe). Demographics were similar between treatment groups. Overall mean (SD) BL values were sSE: 65±11%; sSOL: 59±33m; sWASO: 110±48m. 94.5% of E2006 and 91.1% of placebo subjects completed.
Days 1-7: LS mean difference (lemborexant vs placebo) for change from BL in sSE was statistically significant for 5-25mg, increasing 6-9.4% more than placebo with overlapping confidence intervals among dose levels. Except with 1mg, sSOL decreased significantly, with median change from BL from -17min (2.5mg) to -26min (25mg); placebo -10min. sWASO decreased in all treatment groups (significantly for 10 mg: LS mean difference:-29min). Benefits seen for Days 1-7 were maintained for Days 8-15.
TEAEs were more common with lemborexant. Somnolence was dose-related. There were 2 SAEs (one placebo; one 25 mg [discontinued study]). All TEAEs except the SAE at 25 mg were mild or moderate.
Conclusions: Lemborexant has potential to treat insomnia disorder. Lemborexant was well-tolerated, with mild to moderate adverse events. Subject-reported efficacy was demonstrated for both sleep onset and sleep maintenance.

453 - **Associations between good sleep quality and neuroticism - do anxiolytics help? Results from an epidemiologic study**
Presented by: Randi Andenæs

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Background: Several studies show that there is a link between high level of neuroticism and poor sleep quality. However, little is known of the effect of anxiolytic medication on sleep when level of neuroticism is considered.
Objectives: The aim of the study was to investigate whether medication improve quality of sleep, when other lifestyle factors are adjusted for.
Methods and materials: A large population based study in Norway (HUNT3), with 50 805 participants was used. The mean age of participants was 53 years, ranging from 19 to 100. Using a unique id number, data from the HUNT3 and the Prescription Registry were linked. Good sleep quality was defined as answering never/rarely on all the following 4 questions;
(1) difficulty falling asleep,
(2) repeatedly awakening at night,
(3) too early awakening, and
(4) sleepiness during the day.
Neuroticism was measured with the Eysenck Personality Questionnaire, and Life Satisfaction using a single item. Logistic regression analysis was performed with anxiolytics/sedatives as dependent variable.

Results: The level of neuroticism was strongly associated with lower odds for good sleep. The higher level of life satisfaction, the higher odds for better sleep. When adjusted for age, physical activity, having a partner, smoking, life satisfaction and level of neuroticism, only the smallest dose of anxiolytics was associated with sleep quality. Low doses of anxiolytics were associated with 50 per cent lower chance of good sleep compared to those who did not use any medication. Only small differences were seen between men and women.
Conclusions: When adjusted for personality traits, moderate to high doses of anxiolytics did not improve sleep quality.

551 - **Clinical experience with a dual orexin receptor antagonist, Suvorexant (Belsomra) in Japan**
Presented by: Takashi Kanbayashi

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Introduction: Suvorexant (SUV, MK-4305, Merck), a dual orexin (OX1R and OX2R) receptor antagonist, is the first in a new class of drugs in development for the treatment of insomnia by inhibiting the wakefulness-promoting orexin neurons of the arousal system. Introduce some case reports which shows the effects of SUV on insomnia patients who have not been satisfied with current hypnotics.
Methods: Yuri Kumiai General Hospital in Akita prefecture (Approx. 500 beds. Department of psychiatry only have outpatients). Prescribed SUV to 28 outpatients who have sleep disorder. 20 patients out of 28 were examined. Types of insomnia are classified into 2 groups, which are difficulty in getting to sleep
(12 pts),and nocturnal awakening/ early morning awakening (11 pts) (concurrence was counted for both). The examination was performed every 2-4 wks. Primary diseases were mood disorder (11 pts), schizophrenia (3 pts), PTSD (1 pts), and primary insomnia (5 pts).
Result: 2 pts stopped administering SUV due to somnolence on the next day. SUV showed more effectiveness on WASO compared to sleep onset. Prescribed 20mg for patients below 65 and 15mg for over 65, however, they tended to complain about the somnolence on the next day. More than half of the patients took 7.5mg or 10mg at the end.
Conclusion: SUV works more on WASO than sleep onset. There were many patients who feel the somnolence on the next day, but it was diminished by using the half tablet. Some adverse events were observed, such as dizziness or headaches, but those were not serious and patients could keep taking SUV.

129 - **Effects of N^6-(4-hydroxybenzyl) adenine riboside and N^6-(2-sulfanyl-3-bromo) adenine riboside in stress-induced insomnia in mice**
Presented by: Pei-Lu Yi

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Objective: Stress is one of the common factors causing insomnia. Previous studies have shown that stress accelerates the oxidation of adenosine, an endogenous sleep regulator, and leads to insomnia. This study investigates whether N^6-(4-hydroxybenzyl) adenine riboside, an adenosine analogue extracted from *Gastrodia elata*, and its derivative, N^6-(2-sulfanyl-3-bromo) adenine riboside, produce somnogenic effects in normal and insomniac mice. We further determined the involvement of adenosine 2A receptors (A2AR) in the GABAergic neurons of the ventrolateral preoptic nucleus (VLPO).
Methods: C57BL/6 mice were surgically implanted with two EEG electrodes and a microinjection cannula directly into the VLPO. Mice were orally administered N^6-(4-hydroxybenzyl) adenine riboside and N^6-(2-sulfanyl-3-bromo) adenine riboside (1.0, 2.5, 5.0, 10, 20 mg/kg) at the beginning of the dark period. Cage exchange between mice, as an acute stressor, was performed at the beginning of the light period to induce acute insomnia. A selective A2AR antagonist (SCH58261; 2.0 mg/0.5µl) was

microinjected into the VLPO to clarify the mechanisms. Finally, determination of the c-fos expression in the transgenic mice of *GAD2-Cre::Ai14* after oral administration of these two compounds was used to clarify the activation of GABAergic neurons in the VLPO. The light:dark rhythm was controlled in a 12:12 h cycle.
Results: N^6-(4-hydroxybenzyl) adenine riboside and N^6-(2-sulfanyl-3-bromo) adenine riboside increased non-rapid eye movement (NREM) sleep during both the dark and the light periods in normal mice. Microinjection of SCH58261 into the VLPO blocked the sleep effects of N^6-(4-hydroxybenzyl) adenine riboside and N^6-(2-sulfanyl-3-bromo) adenine riboside. Both compounds reversed the acute stress-induced insomnia and this reversal effect was blocked by SCH58261. The expression of c-fos in the GABAergic neurons of the VLPO was increased after administration of N^6-(4-hydroxybenzyl) adenine riboside.
Conclusion: In mice oral administration of N^6-(4-hydroxybenzyl) adenine riboside or N^6-(2-sulfanyl-3-bromo) adenine riboside increases NREM sleep and effectively ameliorates acute insomnia. The somnogenic effect is mediated by activation of GABAergic neurons in the VLPO.

304 - **Change from olanzapine to asenapine…insomnia or stability?**
Presented by: Cristina Garcia Blanco

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Objectives: This study aims to determine the alterations in the sleep-wake cycle of the patients that have been changed from olanzapine 10 mg at bedtime to 10 mg asenapine.
Methods and materials: This is an observational study in which the duration and quality of sleep of a small sample of patients was assessed. It consisted of an initial interview, in which takes place the change of treatment; a second interview two weeks after, and a third interview at three months. Patients with bipolar area encompassed in the diagnosis were selected. Clinical interview and sleep self-reports were used.
Results: 70% of the patients reported mild insomnia conciliation the first four / five days. 60% showed no sleep disturbances in the second and third interview, after the first week of treatment. 15% required hypnotic treatment. 80% reported improvement in daytime sedation and appetite.
Conclusion: 80% of patients expressed overall improvement after the change in treatment; within this percentage, patients presenting sleep disorders preferred asenapine versus olanzapine because of better side effects profile.

625 - **Sleep disturbances in headache patients**
Presented by: Ivan Fokin

I. Fokin
64 Moscow Municipal Clinic, Moscow, Russian Federation

Objectives: Evaluation of clinical features of headache during sleep-wake cycles in patients with cluster headache (CH) and migraine and improvement of medical care for headache patients with sleep disorders.
Rationale: CH and migraine-related pain depends on patient's baseline condition during the sleep-wake cycle. CH and migraine significantly impair patient's physical performance and cause a considerable financial damage.
Materials and methods: 38 patients (20 CH and 18 migraine patients) and 22 healthy reference subjects were examined using clinical, psychological, neurophysiologic methods, and questionnaires.
Results: CH patients presented severe disorders of sleep architecture with absence of REM sleep before and after the pain attack and shift of the delta sleep stage with its prolongation in the morning after attacks. During the remission their sleep architecture was almost normal. In migraine, the following sleep disorders were found during the pain attack and in remission: absence of REM before and after pain episode; absence of the delta sleep stage; difficulty falling asleep; increased nocturnal wakefulness; frequent movements in sleep, and prevalence of superficial sleep. The time of the episode onset significantly affects the severity of pain attacks: CH and migraine episodes are more severe during sleep than during wakefulness.
Conclusion: The study demonstrated relations between HA and sleep disorders in migraine and CH patients. Regional centers should be established to study sleep disorders and their effect on HA and

to improve the quality of medical care. A complex approach to management of sleep disorders should be applied there with involvement of a multidisciplinary team.

9 - **Insomnia and daytime sleepiness in multiple sclerosis patients under treatment with Interferon Beta**
Presented by: Miguel Meira e Cruz

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[1]Portuguese Association of Chronobiology and Sleep Medicine, Lisbon, [2]Chronobiology and Sleep Unit Hospital Soerad, Torres Vedras, Portugal, [3]International Center for Neurological Restauration, Havana, Cuba

Introduction: Patients with multiple sclerosis (MS) commonly complaint of poor sleep which may be related to multiple factors, either with MS-related symptoms, imuno-therapeutic adverse effects and medication. On the other hand disturbed sleep may negatively impact the disease prognosis as may potentially affect immune response associated to MS patophysiology.
Objective: To study the prevalence of insomnia as a complaint and daytime sleepiness among patients with MS treated with Interferon Beta.
Methodology: 74 MS patients under treatment with Interferon Beta were selected from different regions of Cuba. The spanish versions of Insomnia Severity Index (ISI) and epworth sleepiness scale (ESS) were used to assess either insomnia and excessive daytime sleepiness among this sample.
Results: The sample had 39,4% males and 58,6% females with a mean age of 41,1+-12,28 years old. 31% of patients presented with subclinical or moderated clinical insomnia as indicated by ISI. Daytime sleepiness as measured by ESS was present in 2,7% of the sample.
Conclusion: As a significant amount of patients with MS treated with Interferon Beta have complaints of disturbed/non restorative sleep meaning insomnia this should be adequately characterized and addressed as this could contribute to worsen the prognosis. Furthermore, even though sleep is commonly disturbed in those patients, it doesn´t reflect on the self-perception of daytime impairment.

17 - **Nocturnal ictal apnea mimicking obstructive sleep apnea in a patient with left middle cingulate gyrus epilepsy**
Presented by: Floriana Boghez

F. Boghez[1], I. Mandruta[2]
[1]Neurology and Neurophysiology, Clinica Academica, [2]Neurology and Neurophysiology, Emergency University Hospital of Bucharest, Bucharest, Romania

Objectives: The role of the cingulate gyrus in respiratory function during sleep for a patient with cingulate gyrus epilepsy.
Methods and materials: Surface and intracranial electroencephalography (EEG, 10-10) in a 30 years old female patient with nocturnal ictal apnea during sleep.
Seizures started at the age of 12 with nocturnal attacks of three types, all coming from sleep: shiverring episodes, ictal apnea with fear of suffocation and sometimes secondary tonic-clonic seizures. At the begining of her sufferance, she was interpretated as an obstructive sleep apnea child. The surface EEG could not establish the precise corner of the epileptic focus but the intracranial EEG showed a left cingulate gyrus localization.
Results: Non-volitional spontaneus breathing is controlled by respiratory centers (medullary and pontine functional areas). Many areas of the brain when stimulated/lesioned affect respiratory function. The amygdala, the insula, the anterior cingulate gyrus and the orbitofrontal cortex (cortical areas from the limbic system) may, in this way, interfere with normal breathing.
The cingulate gyrus is an arched convolution that lies next to the corpus callosum on the medial aspect of the cerebral hemisphere. It is an **important part of the limbic system** and helps regulate emotions and pain. Cingulate gyrus epilepsy is rare. Radiofrequency thermal coagulation in the left middle cingulate gyrus of this patient caused the dissapearance of her nocturnal seizures.
Conclusions: An epileptogenic network that involves the anterior part of the cingulate gyrus can induce nocturnal ictal apnea, which may mimic the obstructive sleep apnea and which, of course, is a major risk factor for SUDEP (Sudden Unexpected Death in Epilepsy).

665 - **Epilepsy or parasomnia?**

Presented by: Floriana Boghez

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[1]Neurophysiology, Academica Clinic, [2]Emergency University Hospital of Bucharest, Bucharest, Romania

Objectives: An epileptic seizure is a transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain. Parasomnias are undesirable physical events or experiences that occur during entry into sleep, within sleep, or during arousal from sleep. There are some forms of epilepsy in which seizures occur mainly or exclusively during sleep and in these situations the differential diagnosis with parasomnia can be challenging. The most frequent form of such epilepsy is the nocturnal frontal lobe epilepsy, with more than 90% of seizures coming during the night sleep. These seizures can range from paroxysmal arousals to hypermotor seizures and epileptic nocturnal wandering and they can resemble with parasomnia episodes.
Method: Video-electroencephalography and polysomnography for a 29 years old female patient, with parasomnia-like nocturnal episodes which started 4 years ago, with variable frequency, no other personal antecedents, sleepwalking familial antecedents and normal cerebral MRI.
Results: The sleep video-EEG recorded a few nocturnal episodes with some stereotypy, no aura, some discreet interictal and ictal changes, short duration, all of them started in the light sleep with partial consciousness and recall. Frontal Lobe Epilepsy and Parasomnia (FLEP) scale was equivocal. Because we considered in the end that these events look more like a prefrontal/frontal epilepsy, we started the antiepileptic therapy two years ago and since then the frequency of seizures decreased significantly.
Conclusions: The different diagnosis of nocturnal epilepsy and parasomnia can be complicated and challenging and the history of the patient, the video-recordings of events, the electroencephalography and polysomnography are mandatory in these cases.

211 - **Assessment of sleep disorders in remitting-relapsing multiple sclerosis patients**
Presented by: Jaidaa F. Mekky

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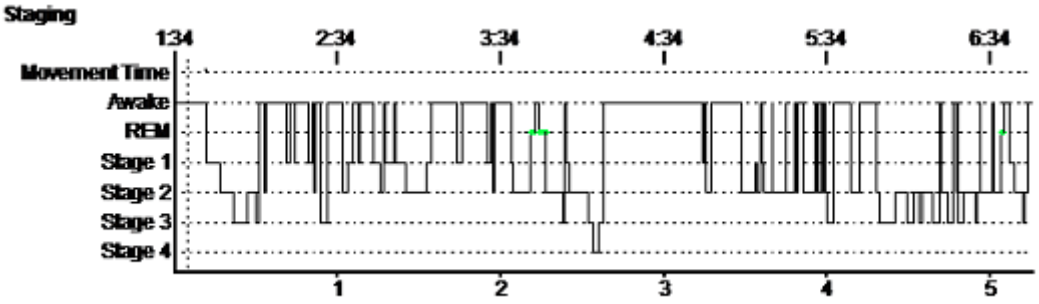
Multiple sclerosis is a chronic degenerative inflammatory disease of the central nervous system with a wide range of signs and symptoms, including neurological, menta and sleep disorders .
One puzzling aspect of MS for clinicians and researchers alike is the nature of the relation between sleep disorders and MS.
Objective: To study the sleep disorders in clinically definite RRMS patients during remission as regard the duration of illness , the EDSS score and the sites of MRI lesions.
Subjects: It was conducted upon 30 subjects who were divided into two groups:
· Group of multiple sclerosis patients: 15 patients
· Group of healthy individuals: 15 individual
Methods:
· Informed Consent was taken from every participate.
· History taking, general and neurological examination.
· Assessment of MS severity by expanded disability scoring scale (EDSS). .
· MRI brain and posterior fossa.
· Overnight polysomnography.
Results: Comparing the pateint and control group sleep studies there was a difference in the sleep efficiency , which was significantly lower among the MS patients ($p < 0.001$).
The sleep latency was longer , the arousal index and the total sleep change were higher also in the patient group .**MRI** findings in 13 patients who had longer sleep latency and , were plaques at centrum semioval, corona radiate, forceps major, periventricular parietal, cerebellum, pons, medulla and spinal cord.
There was an evident statistically significant difference between the two group regarding the sleep stages . The MS patients had longer stage one, two and REM sleep but significantly shorter deep sleep .REM latency was also significantly higher amaong pateints. **MRI** findings in 5 patients who had decreased REM sleep% and latency were plaques at centrum semioval, periventricular parietal and pons.



[hypnoram in MS]

The apnea hypopnea index, snoring index , denoting higher chance of sleep disordered breathing during the course of the illness. **MRI** findings in 3 patients who had Sleep-disordered breathing were plaques at centrum semioval, periventricular parietal, cerebellum and medulla.
The periodic limb movements index was also significantly higher in MS pateints.6 patients who had PLMD had plaques at centrum semioval, periventricular parietal, cerebellum, spinal cord and optic nerve.
Conclusion: Sleep disorders are common in MS and should be screened for carefully in all MS patients, taking into consideration sites of the lesion, duration of illness or EDSS score.

222 - **Sleep quality among patients suffering from multiple sclerosis**
Presented by: Zohreh Yazdi

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Objective: Multiple sclerosis (MS) is a common cause of neurologic impairment that usually starts in early life stage. Sleep disturbances is an issue that considered in patients suffering from MS and have a serious role in their quality of life and health. Different type of sleep disturbances have been seen in these patients such as insomnia, restless leg syndrome, sleep-related breathing disorders, and periodic limb movement. The aim of this study was to assess frequency of poor quality of sleep among MS patients in Qazvin, Iran.
Methods: In this cross-sectional study, 60 MS patients and 60 healthy control people were included. All MS patients referred to neurology clinic of a teaching hospital between September 2014 and November 2015 was interviewed. We used the validated Persian version of Pittsburg Sleep Quality Index (PSQI) to measure sleep quality in patients. Also, demographic data including sex, age, duration of the disease, education level and marital status were collected.
Results: Mean age of patients was 33.1±5.1, with a range of 18-57 years. Of the total patients, 43 patients were female (71.6%) and 17 patients were male (28.4%). Mean duration of disease was 4.6±1.2 years. There were not significant differences between patients and control people in case of their age and gender. Mean PSQI score were 6.9±3.4 and 4.2±2.5 in MS patients and control group, respectively. Differences between two groups was significantly meaningful ($P< 0.05$). MS patients with longer duration of disease had worse quality of sleep ($r=0.42$, $P< 0.05$).
Conclusion: According to our results, poor quality of sleep appears to be common in patients with MS. More studies are needed to identify baseline mechanism of poor sleep quality in MS patients.

291 - **Evaluation of sleep disorders in patients with severe traumatic brain injury during rehabilitation**
Presented by: Maria Gardani

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Objectives: To explore the presence and types of sleep disorders in chronic patients with severe

traumatic brain injury (TBI) undergoing inpatient rehabilitation using formal diagnostic criteria based on the International Classification of Sleep Disorders (2nd edition).
Methods and materials: In a cross sectional design, thirty (n=30) chronic inpatients with severe TBI responded to a semi-structured clinical interview about their sleep-wake patterns. The patients wore an actiwatch for seven days and completed self-report measures on sleep, mood, fatigue, pain and daytime sleepiness.
Results: Twenty participants (67%) had sleep-wake cycle disturbances (SWCD), of which fifteen (50%) met diagnostic criteria for a sleep disorder. Diagnosed sleep disorders in the sample were insomnia (26.7%), post-traumatic hypersomnia (6.7%), delayed sleep phase syndrome (10%), irregular sleep-wake pattern disorder (3.3%) and periodic limb movement disorder (3.3%). Sleep quality was estimated by senior clinical staff as interfering with rehabilitation in 36.6% of the sample. Poor sleep quality was associated with greater anxiety, fatigue, and daytime sleepiness.
Conclusions: Consistent with previous studies, the present investigation showed high levels of disturbed sleep-wake cycle disturbances in rehabilitation patients with severe TBI and this was associated with anxiety, fatigue, and daytime sleepiness. These findings highlight the importance of assessing and treating sleep problems in TBI patients undergoing rehabilitation.

512 - **Sleep/wake habits in epileptic patients - a self-reported sleep study**
Presented by: Nicholas-Tiberio Economou

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Objectives: Sleep and sleep habits have not been adequately investigated in patients with epilepsy. Our objective was to investigate sleep/wake patterns in adults with epilepsy using self-reported instruments.
Materials and methods: Results of structured sleep questionnaires and 1-week sleep logs were compared between 70 patients with epilepsy (age 39.5±12.9 years) and 167 controls (38.02±13.03 yr) referred to the sleep laboratory matched on age, gender, body mass index and apnea-hypopnea index. Variables of interest included Total Sleep Duration (TSD; habitual total sleep time in hours [TST] plus naps/24 hr), number of awakenings, and mean nap number/week and mean duration. Comparisons were made within epilepsy subjects by epilepsy type (focal-63%-vs. generalized; temporal [TLE] 68% vs. extratemporal [XTLE 32%]), antiepileptic drug (AEDs) mono- vs. polytherapy, number, and AED standardized (STD) dose. Comparisons between and within groups were performed using Student's t-test, ANOVA and ANCOVA; Mann-Whitney Test was used for non-normally distributed variables and logistic regression, Pearson's and Spearman's coefficients where appropriate.
Results: There was no difference between epilepsy and controls in TSD 8.35 vs. 7.9 hr; p=.226), number of awakenings (4.04 vs. 4.52; p=.543), or nap number (2.04 vs. 1.42; p=.07) or duration (101.7 vs. 113.2 min; p=.32). Among all epilepsy subjects, TSD was correlated with AED STD dose (r=+.440, p< .001) and associated with partial (p=.041) and total seizures/month (p=.044). Among focal epilepsy, a positive correlation was found between TST and AED STD dose (r=+.579, p=.048) and partial (p=.032) and total seizures/month (p=.033).
Discussion: Self-reported sleep duration and time spent napping are not different between epilepsy patients and matched subjects referred for sleep testing. However, longer sleep duration is associated with higher AED burden and more frequent seizures.

287 - **Simultaneous return of consciousness and sleep-wake cycle consolidation in acute traumatic brain injury**
Presented by: Catherine Duclos

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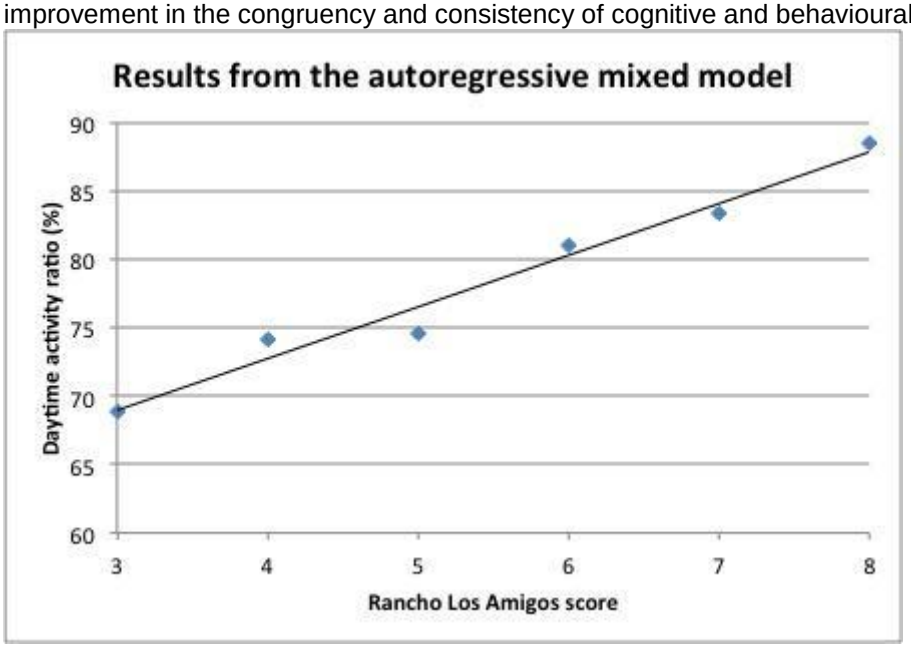
[1]Center for Advanced Research in Sleep Medicine, Hôpital du Sacré-Coeur de Montréal, [2]Department of Psychiatry, [3]Department of Psychology, Université de Montréal, [4]Traumatology Program, Hôpital du Sacré-Coeur de Montréal, Montréal, QC, Canada, [5]Division of anaesthesia, University of Cambridge, Cambridge, United Kingdom, [6]Critical Care Department, Hôpital du Sacré-Coeur de Montréal,

[7]Department of Medicine, Université de Montréal, Montréal, QC, Canada

Objectives: Recent evidence suggests that the presence of a circadian sleep-wake rhythm could help discriminate between vegetative and minimally conscious states in chronic traumatic brain injury (TBI). This study aimed to verify whether the sleep-wake cycle could also be used to detect signs of improving consciousness in acute TBI recovering from coma. We hypothesized that sleep-wake cycle consolidation would improve with increasing consciousness.
Methods and materials: Twenty-eight medically stable moderate-severe TBI adults (29.0±13.9 years; admission Glasgow coma score: 7.7±3.6) were recruited from a level-1 trauma centre in Montreal, Canada. Patients wore a wrist actigraph for 11.4±4.1 days, starting 19.7±12.8 post-injury, when they had recovered spontaneous eye-opening/closing and motor capacity, and continuous sedation and long-lasting sedatives had ceased for >24h. Sleep-wake cycle consolidation was estimated with the daytime activity ratio (DAR): [daytime (7:00-21:59) activity/24-h activity]*100. A DAR ≥80% designated a consolidated sleep-wake cycle. While the actigraph was worn, the Rancho Los Amigos (RLA) scale of cognitive functioning was assessed daily by occupational therapists. The RLA evaluates key features of consciousness, such as level of response to stimuli, ability to follow command, confusion, attention, and the appropriateness of verbalisation and motor actions. The DAR and RLA were integrated into a linear mixed model analysis using both autoregressive and compound symmetry covariance structures.
Results: Overall, there were 216 days of actigraphy recording and RLA assessment. Mean DAR was 77.9±12.3% and 119 days (55.1%) were consolidated. The Akaike's Information Criterion was smallest for the autoregressive mixed model, suggesting a stronger fit. A significant effect of RLA on DAR ($p < 0.01$) was found, showing a strong linear relationship ($p < 0.001$) between increasing DAR and improvement in the congruency and consistency of cognitive and behavioural response (Fig.1).



[Figure 1]

Conclusions: This study shows that the consolidation of the circadian sleep-wake cycle goes hand in hand with the recovery of consciousness in acute TBI. Though further studies are needed to understand the neural correlations of consciousness and the sleep-wake cycle, these results could have implications for the development of interventions targeting the circadian clock and aimed at optimising functional recovery in both acute and chronic disorders of consciousness.

205 - **Sleep related rhythmic movement disorder during REM sleep associated with obstructive sleep apnea syndrome**
Presented by: Gulcin Benbir Senel

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Objective: Sleep related rhythmic movement disorder (RMD) is characterized by repetitive and

rhythmic motor behaviors during sleep. Although RMD occurs most often in association with NREM stages, it rarely occurs solely during REM sleep. Here is presented a patient with RMD during REM sleep associated with obstructive sleep apnea syndrome (OSAS).
Case report: A 50-year-old male was admitted to our sleep disorders unit complaining of loud snoring and excessive daytime sleepiness for 10 years. His wife has witnessed frequent cessation of breathing. He awakens for urination three times per night. He complaints of sweating prominent on his chest and neck area during the night. He has dry mouth on awakening. He feels sleepy all through the day and falls asleep when he is not involved with an active work. He has hypertension and hypercholesterolemia under control with treatment. A whole-night polisomnography showed that the respiratory disturbance index was 43 per hour. Oxygen saturation was decreased to 85% related with abnormal respiratory events, especially during REM sleep. Interestingly, rhythmic rolling movements of the head, and sometimes trunk, were observed in REM sleep during bioelectrical arousals following obstructive hypopneas and apneas. Similar movements were also observed in light sleep as the patient enters sleep, but in lesser in severity and shorter in duration.
Conclusion: This case demonstrates an example for the presence of rhythmic movement disorder during REM sleep, and draw attention to comorbid conditions as OSAS that should be investigated as a precipitating factor in adult patients with RMD.

154 - **Suggested clinical immobilization test with a smartphone-based electromyography system for screening Willis Ekbom disease**
Presented by: Osman Ipsiroglu

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[1]Capstone Design Project, Department of Electrical and Computer Engineering, University of British Columbia, [2]Sleep/Wake Behaviour Clinic and Research Lab, Department of Paediatrics, BC Children's Hospital, University of British Columbia, [3]Treatable Intellectual Disability Endeavour - British Columbia (TIDE-BC), Vancouver, BC, Canada

Objectives: Willis Ekbom disease (WED) might often be missed/misdiagnosed due to diagnostic criteria, which are based on the patients' ability to vocalize the experienced sensorimotor discomfort. Our goal has been to develop a smartphone-based electromyography (sb-EMG) system that can provide objective information during the Suggested Clinical Immobilization Test (SCIT).
Methods and materials: A student-team of the Capstone Design Project, an interdisciplinary program offered by the UBC Department of Electrical and Computer Engineering [http://www.ece.ubc.ca/courses/capstones], was assigned to develop the sb-EMG. The goal was that the completed sb-EMG system should be small, non-invasive, user-friendly, fast, accurate, low-cost (under $500), and applicable in clinical practice.
Results: The combination of Android-based software and a Bitalino-based hardware was chosen as the most suitable solution: (a) Android [https://source.android.com/] was chosen to be the software platform of choice due to the wide range of open-source resources. (b) Bitalino [http://www.bitalino.com/] is a hardware platform designed for acquiring physiological signals and was selected based on an evaluation of overall system design, application development support, feasibility, sustainability, and value for its cost with respect to other hardware options. A functional prototype was implemented, which can acquire EMG data, transfer it via wireless Bluetooth interface to a smartphone, and graph the EMG signal on the mobile phone's screen. The prototype consists of a 25g (without battery), 4x2x1.5cm, single-channel hardware component and a software application usable on any mobile phone running Android 4.0 or higher. With the addition of more sensors, the system is scalable to acquire data from up to five different channels. The system also features a 3.7V, 700mAh rechargeable battery that can be interchanged with higher capacity alternatives.
Conclusions: The sb-EMG prototype showed excellent potential to enable the acquisition and analysis of objective EMG signals during SCIT. Currently, we are validating the prototype with a standard EMG-system.

515 - **Lenticulostriate stroke-related restless legs syndrome involve the body of the caudate nucleus and an increased dopaminergic tone**
Presented by: Elisabeth Ruppert

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Objectives: The role of dopamine in the pathophysiology of restless legs syndrome (RLS) remains poorly understood. Dopaminergic agonists represent an efficient treatment of RLS, but they might also cause augmentation syndrome. Secondary RLS related to stroke has been previously reported in the case of infarction of basal ganglia and adjacent corona radiata, paramedian pons and thalamus with contiguous internal capsule. We explored dopaminergic metabolism in patients presenting with lenticulostriate stroke-related restless legs syndrome (RLS) using MRI and isotopic explorations of both glucose and dopamine.
Methods and materials: All patients referred to our sleep disorder center and presenting with stroke-related RLS following infarction of the basal ganglia were prospectively included over a period of one year. Structural imaging was performed using cerebral MRI, whereas the neural metabolism was analysed using PET with ^{18}F-FDG and brain dopamine was explored using both PET with ^{18}F-F-DOPA and SPECT with ^{123}I-FP-CIT.
Results: Four patients were included, and based on MRI study, the body of the caudate nucleus was the only structure that was affected in all patients. Metabolic findings showed in all four patients a hypometabolism in the infarction area, in the ipsilateral thalamus and in the contralateral cerebellum. Three patients displayed decreased dopamine transporter binding in the ipsilateral striatum, whereas higher levels of dopamine precursor were observed in the ipsilateral putamen of all four patients.
Conclusions: A systematic study of small lesions associated with RLS may contribute to understanding the pathophysiological mechanisms underlying this condition. In this regard, the body of the caudate nucleus might be a structure of interest. The isotopic findings reinforce the hypothesis of an increased dopaminergic tone in the striatum as part of RLS pathophysiology. Therefore, the efficacy of low doses of dopaminergic agonists in RLS might be explained by stimulation of inhibitory D2-like autoreceptors.

436 - **Self-reported sleep problems and restless legs syndrome in Georgian young adults: a pilot study**
Presented by: Lia Maisuradze

L. Maisuradze[1,2], S. Kasradze[2]
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Objectives: Restless legs syndrome (RLS), commonly seen in middle and advanced age, often appear before twenty years of age and implicate with sleep. However, compared to the western countries, population-based studies on this association in Georgian young adults are limited. The aim of this study was to determine self-reported sleep problems in students with RLS.
Methods and materials: The participants (n=117), 86 females and 31 males (age: 18-20 years) were interviewed regarding the main sleep-wake characteristics, sleep-wake schedule and habits and sleep complaints. The students completed following standard questionnaires: RLS, Sleep Impairment Index, Epworth Sleepiness Scale. Students were asked to evaluate sleep quality and to fill 15 items questionnaire that was generated based upon the relevant literature. General information about sleep behavior was collected.
Results: 15 Subjects (12,82%) out of 117 respondents had four positive response on the RLS criteria: 11 females (12,8% out of 86) and 4 males (12,9% out of 31). 60% (six females and three males) of the 15 subjects with RLS had a positive family history; none had history of known iron deficiency. 13 (86.6%) had sleep disturbance: unpleasant feelings in the legs affect nocturnal sleep of nine females and four males. Two females had excessive daytime sleepiness. Insomnia Symptoms were determined in six students (five females and one male).
Conclusion: Our findings indicate that reports of poorer and insufficient sleep are linked to RLS in young adults. Trouble falling asleep is most common sleep complaints among the subjects, particularly in the students having RLS. RLS is a risk factor for developing behavioral problems and sleep disturbances in Georgian young adults.

366 - **Periodic limb movements during sleep - signatures in 3D-videosomnography and electromyography**

Presented by: Heinrich Garn

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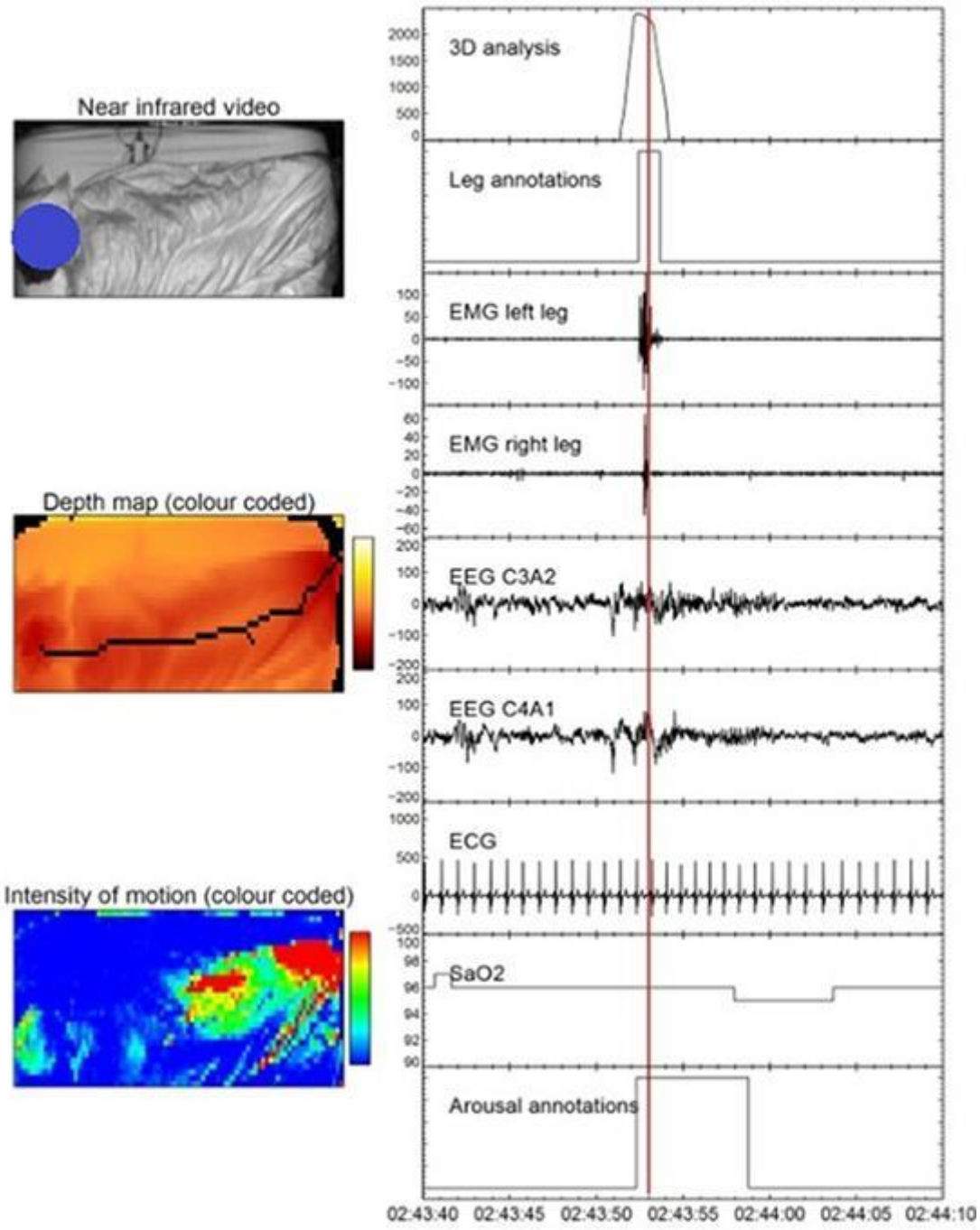
Objectives: Periodic limb movement disorder (PLMD) causes fragmented and non-restorative sleep and excessive daytime sleepiness. Frequent sequelae of PLMD are neuropsychological deficits, depression and an increased frequency of sickness absences.
The purpose of our study was to investigate and compare two methods of detection and classification of periodic limb movement in sleep (PLM):
(a) 3D-videosomnography, and
(b) electromyography (EMG) as used in conventional polysomnography (PSG).
We wanted to know how well detections of leg movements seen in 3D video correlate to EMG signals derived at tibialis anterior muscles.
Methods and materials: Our video analysis system uses a novel 3D near-infrared sensor. The height profile of the body is measured in high spatial and temporal resolution. Changes in this profile indicate motor events. These events are assigned to the limbs using a dynamic human model. A number of selected features in the spatial, temporal and frequency domain are continuously computed. Based on these features, the automatic detection and classification of motor events is performed.
Time-synchronised PSG and 3D-videosomnographic sleep data were recorded from 25 sleep lab patients in a multi-centric clinical study in Austria. EMG detections annotated as PLM by standard PSG apparatus were compared to leg movements automatically detected in 3D.
The figure compares data from 3D videosomnography (left) and standard PSG (right).



[Comparison of 3D videosomnography and standard PSG]

Results: Numerous deflections seen in EMG and fulfilling the AASM criteria for leg movements (LM) were not associated with actual motion. On the other hand, we found LM in 3D, where no motion was detected by the EMG. These effects also caused different PLM counting in the two methods.
In EMG, a substantial portion of recordings was disrupted by bad electrode contacts, pretending numerous LM and PLM events where there was no relevant motion.
Conclusions: EMG signals qualifying for PLM can indicate either tonic stress or actual motor events. Therefore, judgements on the PLM index (PLM per hour of sleep) based on EMG may overestimate clinical PLM.
On the other hand, leg movements caused by other muscles than the tibialis anterior are missed in standard PSG recordings.
In both cases, 3D videosomnography provides more precise and specific diagnostic data.

Another important advantage of the 3D technology is the no-touch approach: It avoids bad electrode contacts and facilitates ambulatory applications.

50 - **Apelin level in restless legs syndrome**
Presented by: Selda Korkmaz

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Objective: RLS is a common sleep-related movement disorder. Recent studies have focused on its vascular complications and these study results have indicated that RLS patients have increased the risk for cardiac and cerebral vascular complications compared to general population. The reason for increased vascular complications in RLS patients is not known. In a previous study, RLS patients have increased oxidative and decreased antioxidant capacity. In this present study, we pretend to determine apelin level and its association with disease severity in RLS patients. Apelin is an antioxidant member of adipokine family and its cell protective effect has been shown in different studies. We hypothesize that RLS patients have decreased apelin level. To the best of our knowledge, plasma apelin level has not been previously studied in patients with RLS.
Method: Fourteen recently diagnosed RLS patients having moderate to severe symptoms and age, gender and BMI-matched 14 healthy volunteers were included in the study. IRLSS and PLMI, sleep efficiency, WASO in PSG recordings were used to determine the severity of disease. Apelin was measured in the morning following PSG recording.
Result: Apelin level was significantly lower in patient group compared to healthy control group (p=0.004). There wasn´t any correlation between apelin level and IRLSS, PLMI, WASO, sleep efficiency in the patients group.
Conclusion: Since apelin level found significantly lower in RLS patients, reduced apelin could be responsible of vascular complications in RLS and can be a new indicator to determine it.

410 - **Sleep quality in restless legs syndrome among healthcare workers: shift workers and non-shift workers**
Presented by: Zahra Banafsheh Alemohammad

Z.B. Alemohammad, S.M.E. Taghavi, K. Sadeghniiat-Haghighi
Occupational Sleep Research Center, Baharloo Hospital, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran

Objectives: Restless Legs Syndrome (RLS) is a sleep disorder with an association to sleep quality. We investigated the sleep quality in RLS patients among healthcare workers with or without shift work.
Methods: All female healthcare workers (n=540) in four educational hospitals enrolled in this cross sectional study. International RLS Study Group (IRLSSG) questionnaire, IRLSSG Rating Scale, Pittsburgh Sleep Quality Index (PSQI) and a data collection sheet consist of demographic data and disorders related to secondary RLS were distributed between the participants.
Results: The prevalence of primary RLS was higher in shift workers (15.5%) in comparison to non-shift workers (12%), but the difference was not significant. In RLS negative shift workers and non-shift workers the PSQI scores were 7.30 and 6.10 respectively (P value=0.001). In RLS positive shift workers and non-shift workers the PSQI scores were 9.02 and 7.76 respectively (P value=0.092).
Conclusion: healthcare workers have poor sleep quality aggravated with both RLS and shift work. Despite the significant effect of shift work on sleep quality in RLS negative participants, it has no significant effect in RLS patients.

487 - **Increased prevelance of restless legs syndrome in sarcoidosis - preliminary results**
Presented by: Senay Aydin

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Aim: Prevalence of RLS estimates are 1.9-4.6% in general adult populations. In Turkey, RLS prevalence was reported as 3.2% in 3,234 adults in the general population. Cardiovascular disease, coronary artery disease, obesity, arthritis, neuropathy, uremia, folate deficiency, vascular insufficiency, chronic obstructive pulmonary disease are all conditions that found to be associated with RLS in many studies. Many sarcoidosis patients suffer from fatigue and sleep disturbances. In this study we evaluate the prevelance of RLS in sarcoidosis patients and its relation with fatigue and mood changes.
Material and method: All the patients diagnosed sarcoidosis with radiological and pathological criteria was included and questinaires was done to all the patients. IRLSSG diagnostic criteria was used for all the patients in the diagnosis of RLS. All the retrospective data of the patients about full blood count analyses, biochemical results, respiratory function tests, radiological findings, stage of the disease, comorbid diseases and medicine they used were recorded. Patients were divided into two groups according to the presence of RLS. The fatigue severity, cognitive status, sleep quality, insomnia, anxiety and depression were evaluated by using “Fatigue Severity Scale (FSS), Mini Mental Status Examination (MMSE), Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI), Insomnia Severity Index (ISI), Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS) in all patients in both groups, respectively.
Results: Restless legs (RLS) were reported by 34 (35,1%)of the primary lung sarcoidosis patients. In 63 patients (64,9%) no RLS was present. 72.2% of patients were female and the average age was 45,12 ±11,02. There was no difference between the groups in terms of age, gender, anthropometric measurements and cognitive status. Also, in patients with a diagnosis of RLS was observed statistically significant increase in fatigue, depression and anxiety scores (respectively p:0,03,p:0,00, p:0,00), although there was not discrepancy between the two groups in sarcoidosis stages and Medical Research Dyspnea Score (MRDS)(p:0.135).
Conclusions: RLS were demonstrated in more than half of the studied sarcoidosis patients which is a high prevalence compared to normal population. Further studies are needed to establish whether RLS might contribute to fatigue and if these complaints improve after treatment.

14 - **Non-pharmacological treatments of insomnia for long-term painful conditions. A systematic review and meta-analysis of the patient- reported outcomes in randomized controlled trial**
Presented by: Nicole K.Y. Tang

N.K.Y. Tang[1], T. Lereya[1], H. Boulton[1], M.A. Miller[2], D. Wolke[1,2], F.P. Cappuccio[2]
[1]University of Warwick, [2]Warwick Medical School, University of Warwick, Coventry, United Kingdom

Study objectives: Insomnia is a debilitating comorbidity of chronic pain. This study evaluated the effect of non-pharmacological sleep treatments on patient-reported sleep quality, pain and wellbeing in people with long-term cancer and non-cancer (e.g., back pain, arthritis, fibromyalgia) pain conditions.
Design: We systematically searched Cochrane CENTRAL, MEDLINE, Embase, and PsychINFO for relevant studies. Search period was set to inception of these databases to March 2014. Studies were included if they were: original randomized controlled trials (RCTs); testing a non-pharmacological intervention; that targets sleep; in adults; with painful health conditions; that has a control group; includes a measure of sleep quality; and at least one other health and wellbeing outcome.
Measurement and findings: Means and standard deviations of sleep quality, pain, fatigue, depression, anxiety, physical and psychological functioning were extracted for the sleep treatment and control groups at baseline, post-treatment and final follow-up. Methodological details concerning the treatment, participants, and study design were abstracted to guide heterogeneity and subgroup analyses. Eleven RCTs involving 1066 participants (mean age=45-61 yr) met the criteria for the meta-analysis. There was no systematic evidence of publication bias. Non- pharmacological sleep treatments in chronic pain patients were associated with a large improvement in sleep quality [Standardized Mean Difference=0.78, 95% Confidence Interval (0.42, 1.13); p< 0.001], small reduction in pain [0.18 (0, 0.36); p< 0.05], and moderate improvement in fatigue [0.38 (0.08, 0.69); p< 0.01] at post- treatment. The effects on sleep quality and fatigue were maintained at follow-up (up to 1 yr) when a moderate reduction in depression [0.31, (0.09, 0.53); p< 0.01] was also observed. Both cancer and non-cancer pain patients benefited from non- pharmacological sleep treatments. Face-to-face treatments achieved better outcomes than those delivered over the phone/internet.
Conclusions: Although the body of evidence was small, non-pharmacological sleep interventions may represent a fruitful avenue for optimizing treatment outcomes in patients with chronic pain.

362 - **Associatons between self-rated sleep time and psychological distress is different in men**

and women
Presented by: Martin Ulander

M. Ulander[1,2], A. Broström[2,3], U. Alehagen[4,5], Å. Wahlin[6], P. Johansson[4,5]
[1]Dept of Neuroscience and Inflammation, Linköping University, Faculty of Health Sciences, [2]Dept of Clinical Neurophysiology, Linköping University Hospital, Linköping, [3]School of Health Sciences, Dept of Nursing, Jönköping University, Jönköping, [4]Linköping University, Faculty of Health Sciences, [5]Dept of Cardiology, Linköping University Hospital, Linköping, [6]School of Health Sciences, Dept of Gerontology, Jönköping University, Jönköping, Sweden

Objectives: To examine associatons between sleep time and depressive and anxiety related symptoms in home-dwelling elderly people as to whether such associations differed between men and women.
Methods: 675 home-dwelling elderly subjects (52% women, mean age±SD 77.7±3.8 years) completed questionnaires regarding subjective sleep time and sleep-related complaints (Uppsala Sleep Inventory, USI), depressive and anxiety symptoms (Hospital Anxiety and Depression Scale, HADS) and vitality (Short Form 36, SF36). Subjects were divided into short sleepers (i.e., ≤6 hours, 36.7% of the sample) average sleepers (i.e., 7-8 hours, 53.7%) and long sleepers (≥9 hours, 9.7%). Statistical analyses were performed with ANCOVA, Kruskall-Wallis test and chi-square test. First, sleep time and gender were included as main effects, and then an interaction term (i.e., Sleep time x Sex) was added. If this was significant, LSD post-hoc analyses were performed. Diastolic blood pressure, cardiovascular disease, prescription of diuretics, prescription of sleep medication, prescription of antidepressants, difficulties initiating sleep and difficulties maintaining sleep were included as covariates based on correlation analyses.
Results: Short sleep duration was associated with depressive symptoms in men, but not in women. Fatigue was associated with both short and long sleep duration in men, but not in women. Regarding anxiety, no gender differences were found.
Conclusion: Elderly men and women may experience different symptoms in association with short and long sleep time. This needs to be taken into consideration when examining outcomes of variations in sleep duration.

121 - **How is the quality of sleep in Indian university students?**
Presented by: Zubia Veqar

Z. Veqar, M.E. Hussain
Centre for Physiotherapy and Rehabilitation Sciences, Jamia Millia Islamia, New Delhi, India

Introduction: Factors contributing to poor health in university population are multitude with poor sleep quality being one of the very important ones.University students are known for depriving themselves of sleep while juggling their studies and social demands leading to irregular sleep schedules and poor sleep quality. A few studies have reported the rate of prevalence of poor sleep quality in this population but none has been published from India to the best of my knowledge.
Objective: To assess the sleep quality and its related parameters among Indian university students.
Methods*:* It is a questionnaire based observational study which is a part of a larger study being conducted at Jamia Millia Islamia. The institutional ethical was taken prior to the commencement. The students aged between 18-40 years were recruited from all over the campus by flyers, poster, website and word of mouth. A verbal consent was taken from the recruited subjects and the purpose of the study was explained o the students who were willing to volunteer. Their confidentiality was adequately maintained. Students were asked to complete a self-administered Pittsburgh Sleep Quality Index(PSQI) in English to assess their sleep and its characteristics. The results first underwent the descriptive analysis and Kolmogrov-Smornov statistical analysis test was done to assess the normality of the distribution and to further assist in the confirmation of significant deviations from the norm.
Results*:* A total of two hundred and eight Indian subjects were finally recruited for the study. There were sixty eight males (30.4%) and one hundred and forty females (62.5%). 29.33% subjects were reported to be having a poor sleep quality (Fig1). Subjective sleep quality was reported as being very bad was reported by 0.5%, fairly bad by 6.7% fairly good by 55.8% whereas 37.0% reported a very good sleep quality.40.4% reported a very poor sleep latency. 8.1% slept for < 6 hours, 49.5% for 6.1-7.0 hours and 42.3% slept for more than seven hours. 92.3% reporting an efficiency of > 85%. 99% were not on any sleep medication.48% respondents reported daytime sleepiness less than once a week.
Conclusion*:* Poor sleep quality is a fairly common problem in the Indian University students. General

lectures should be organised about the importance of maintaining regular and healthy sleeping habits so that problems can be handled before the convert themselves into full blown disorders.

31.10.2015 - 17:45-18:45
Symposium: Earlier Career Scientists

652 - **Sleep disturbances in rats after forced activity in resting phase. An animal model of night work**
Presented by: Jelena Mrdalj

T. Pedersen[1], J. Mrdalj[1], P. Meerlo[2], S. Pallesen[1], S. Skrede[1], A. Rørvik Marti[1], J. Wisor[3], R. Murison[1], T. Henriksen[1], J. Grønli[1]
[1]University of Bergen, Bergen, Norway, [2]University of Groningen, Groningen, The Netherlands, [3]Washington State University, Spokane, WA, United States

Objectives: Work during the night and being forced to shift sleep to other times of day is known to shorten and disturb sleep in humans. However, objective EEG-findings are sparse. Here we aimed to model night work in rats and examine the degree of sleep disturbances during work and recovery.
Methods: Male rats were implanted with transmitter (s.c.) for EEG and EMG monitoring throughout the experiment. Mimicking human night and day work, rats were exposed to forced activity in rotating wheels for 8h on 4 successive days, either in their resting or active phase. Normal 12hL/12hD cycle was kept throughout the experiment. One subgroup of animals in each group was kept in constant darkness during recovery.
Results: Work (independent of time of day), increased wakefulness and reduced sleep (SWS and REM sleep) during a 4-day work shift period. Number of awakenings did not differ. Resting phase workers slept less in the acute period after work compared to active phase workers. During recovery, active phase workers showed a SWS rebound on recovery day 1 and 2 in the active phase, but returned to baseline values on day 3. In resting phase workers the sleep was inverted in 5 recovery days; more sleep in the active phase and less sleep in the resting phase. If kept in constant darkness during recovery, active phase workers again showed SWS rebound the first recovery days. In resting phase workers the sleep was inverted on day 1, and they continued to have less sleep and more wakefulness in the resting phase throughout the whole recovery period.
Conclusions: Resting phase work induces sleep disturbances lasting several days after work termination. Sleep - wake disturbances after a shift work period may be of endogenous nature. The animal model can be used to further investigate sleep disturbances after shift work.

441 - **Increased sleep latency and reduced sleep efficiency are associated with non-dipping pattern in resistant hypertensive patients**
Presented by: Rosa Maria Bruno

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[1]Institute of Clinical Physiology - CNR, [2]University of Pisa, [3]IRCCS Stella Maris Foundation, Pisa, Italy

Background: non-dipping pattern and elevated nocturnal blood pressure (BP) are associated with increased risk of cardiovascular events and are very common in patients with resistant hypertension (RH). Aim of the study was to investigate whether non-dipping is associated with diagnosis of sleep disorders such as obstructive sleep apnea syndrome (OSAS) and restless legs syndrome (RLS), or with other sleep features in RH.
Methods: 45 consecutive patients with RH (defined as the failure to achieve BP target despite 3 antihypertensive drugs, including a diuretic) were enrolled (mean age 60±10 years, men 73%, 4.3±1.0 BP-lowering drugs). Cardiovascular profile was characterized by medical history, physical examination and routine blood samples. All patients underwent: neurological examination, home polysomnography (PSG), 1-week actigraphy, and measurement of office and 24-h BP. Non-dipping pattern was defined as a nocturnal fall in systolic BP< 10% of daytime values.
Results: Non-dipping pattern was present in 31 RH (69%). Non-dippers were similar to dippers as far as office and 24h-BP, number of BP-lowering drugs and cardiovascular risk factors are concerned. OSAS (AHI>5) was present in 83% of the population, moderate-severe OSAS (AHI>15) in 56%, RLS in 32%: none of these conditions was associated with non-dipping pattern. Non-dippers also showed similar values of AHI (22±19 vs 24±17, p=0.68) and PLMS index (6±12 vs 5±13, p=0.80) compared to

dippers, as well as similar PSG (6.1±1.3 vs 6.9±1.0 h, p=0.12) and actigraphic (6.7±1.0 vs 7.0±0.4 h, p=0.40) sleep duration. Conversely, PSG sleep latency (25.3±26.0 vs 9.0±6.4min, p=0.01) and actigraphic wake after sleep onset (p=0.03) were increased in non-dippers, while actigraphic sleep efficiency was reduced
(84.3 vs 85.2% p=0.02). Difference in PSG sleep latency and actigraphic sleep efficiency were both significant even after adjustment for age, sex, nocturnal systolic BP and total sleep time (p=0.04 and p=0.05 respectively).
Conclusions: In resistant hypertension, a condition characterized by high cardiovascular risk and high prevalence of sleep disorders, non-dipping pattern is associated with increased sleep latency and reduced sleep efficiency, regardless of objective sleep duration, diagnosis of OSAS or RLS. This finding suggests that a dysregulation in both initiation and maintenance of sleep may hamper nocturnal BP fall and represent a new target for reducing cardiovascular risk in RH.

506 - **Daytime light irradiance positively influences the sleep homeostatic process through melanopsin-based phototransduction in mice**
Presented by: Jeffrey Hubbard

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CNRS UPR 3212 and Sleep Disorders Center, Université de Strasbourg, Strasbourg, France

Objectives: Light influences sleep and waking through circadian and direct effects, yet its putative influence on sleep homeostasis remains unclear. We previously reported that sleep homeostasis was affected in mice lacking melanopsin (Opn4), a photopigment crucial for light irradiance detection. Here we sought to determine whether changes in irradiance level will influence the homeostatic response in wild type and melanopsin KO mice.
Methods: Backcross male *Opn4*$^{-/-}$ mice and their littermate controls were exposed using a controlled LED cabinet to one of three light intensities (< 10, 150, or 600 lux) for 7 days (exposure duration determined from a previous preliminary study) using a standard 12h:12h light/dark cycle in order to respect the circadian phase. Sleep was recorded under baseline conditions, during the exposure to the specific lighting conditions, including a 6-h sleep deprivation performed by gentle handling on the final day. EEG quantification and power spectrum was performed, with a special focus on EEG delta power (0.75-4 Hz), a reliable marker of sleep need.
Results: Under baseline conditions, wild-type mice showed significant ($P < 0.05$) increases in delta power as a function of light intensity, with the highest under 600 lux (195%, determined over the course of baseline), vs. 150 lux (160%) and < 10 lux (140%). The peak of delta power reached following a 6-hour sleep deprivation (started at light onset) significantly increased with the level of irradiance (240%, 190%, and 150%, respectively). Furthermore, theta activity during waking (a marker of alertness) also increased as a function of light intensity in these mice. Mice lacking melanopsin displayed overall lower delta power amounts and their responses to the sleep deprivation were not significantly altered by the increase in light intensity. Interestingly, the genotype difference was more evident as light intensity increased.
Conclusion: These preliminary results indicate a positive relationship between light intensity and the increase in sleep-need with time-spent-awake, an effect which is mediated primarily through melanopsin-based phototransduction.

630 - **Mechanisms of respiratory-related cortical arousal during sleep: role of breath timing and respiratory load compensation**
Presented by: Jason Amatoury

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Objectives: A threshold level of negative intrathoracic pressure generated during respiratory loading is believed to be the key trigger for cortical arousal during sleep (respiratory arousal threshold). If so, cortical arousals during airway narrowing should coincide with inspiration, when negative intrathoracic pressure swings are greatest. Accordingly, this study aimed to determine when in the respiratory cycle

respiratory-related arousals typically occur. In addition, this study characterised the changes in breathing (respiratory load compensation) and upper airway muscle activity that occurred prior to respiratory-induced arousal.

Methods and materials: Data were acquired in 62 subjects [16 controls, 46 OSA; age: 45 ± 12 (mean ± SD) yrs, BMI: 32.4 ± 6.8 kg/m^2; AHI: 0-112 events/h] who undertook a standard sleep study and a detailed upper airway physiology study involving transient CPAP reductions (ΔCPAP) from a holding pressure to induce cortical arousals during NREM sleep. The proportion of arousals occurring during inspiration was determined. Inspiratory and expiratory time (Ti, Te), respiratory rate (RR), minute ventilation (Vi) and peak genioglossus electromyogram (EMGggPeak, %max) were measured for breaths 1 to 3 postΔCPAP (B1-B3) and during the immediate pre-arousal breath (PreArB).

Results: 6 (4-10) [median(IQR)] CPAP drops were analysed per subject and ΔCPAP for controls vs. OSA were similar (6.0 ± 1.8 vs. 7.0 ± 2.2 cmH_2O; P>0.05). For the group, only 61 ± 25% of arousals occurred during inspiration, with similar proportions between controls and OSA (P > 0.2). Table 1 summarises respiratory and EMG parameters for the group (P > 0.9 for control vs. OSA for each outcome). Following CPAP drop, there was an immediate increase in RR and Te and a decrease in Vi. Te decreased further by PreArB. Ti and EMGggPeak increased progressively from B2 to B3 to PreArB.

	B1	**B2**	**B3**	**PreArB**
Ti, s	0.0 ± 0.3 ^	0.1 ± 0.3 ^	0.2 ± 0.3 *^	0.4 ± 0.3 *
Te, s	-0.6 ± 0.4 *^	-0.6 ± 0.4 *^	-0.7 ± 0.4 *^	-0.9 ± 0.5 *
RR, breaths/min	2.4 ± 2.3 *	2.4 ± 2.7 *	2.1 ± 2.3 *	2.2 ± 2.2 *
Vi, L/min	-2.4 ± 2.2 *	-2.7 ± 2.3 *	-2.9 ± 2.1 *	-2.6 ± 2.2 *
EMGggPeak,%max	0.9 ± 2.3 ^	0.9 ± 1.7 *^	1.4 ± 2.8 *^	7.1 ± 8.5 *
Data (mean±SD) presented as a change from the CPAP holding pressure (60s average).				
* P < 0.05 vs. PreΔCPAP. ^ P < 0.05 vs. PreArB.				

[Table 1]

Conclusions: While arousals commonly occurred during inspiration, a substantial proportion also occurred during expiration, suggesting that there are additional mechanisms other than intrathoracic pressure that contribute to respiratory load-induced arousals. The changes in respiratory load compensation during airway narrowing may result in a mismatch between respiratory pattern generator output and respiratory afferent feedback that could also contribute, at least in part, to respiratory load-induced arousal.

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