



INTERNATIONAL
SOCIETY FOR
CHRONOBIOLOGY



Faculty of Psychology
University of Warsaw

30th Program and Abstracts
July 2 – 5, 2019, Warsaw, Poland

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Conference Organizer

Faculty of Psychology, University of Warsaw

Faculty of Psychology at University of Warsaw has over 100 years' tradition. Since 1915, it has been a leading psychology research center in Poland. Currently, the faculty is ranked in Poland as the top research institution in psychology (the highest grade awarded by the Ministry of Science and Higher Education) as well as the top psychology program with broad international cooperation. It offers students both Polish and English psychology programs.

Dear Colleagues and Friends,

We are pleased to invite you to attend the 30th Conference of the International Society for Chronobiology, which will be held in Warsaw, Poland from 2 to 5 July 2019. International Society for Chronobiology (ISC) is an international organization that aims to promote research on chronobiology and biological rhythms in all organisms and using a variety of approaches. ISC connects clinicians and researchers across different fields including biology, medicine, biotechnology and health sciences, psychology, pharmacology, educational and social sciences, as well as agricultural sciences. The 30th ISC Conference is organized at the University of Warsaw, which is the largest university in Poland with over 48 000 students and more than 7000 employees. University of Warsaw is also the top university in Poland and belongs to the top 3% of universities in the world. It is situated next to the UNESCO protected Warsaw Old Town, among historical buildings, in a walking distance from the Royal Palace and Vistula river. Warsaw, the capital of Poland and a rapidly-developing city at the center of Europe, has a vibrant cultural scene and with more than 70 museums and numerous performances and concerts every day it has all a big city can offer. Conference participants will have the opportunity for scientific exchange during symposia and poster sessions covering all areas of chronobiology including: human, animal, insect, and plant timekeeping; circadian, seasonal, and lunar rhythms; sleep and wakefulness in norm and pathology; chronotypes and individual differences in rhythms; genetic and molecular mechanisms of rhythms and cellular clocks; shift work and jet lag; circadian rhythm disorders and chronodisruption; chronotherapy of somatic and psychiatric disorders; melatonin and pineal gland; light and entrainment; role of rhythms in health and psychiatric/somatic diseases; rhythms in behaviour and performance. We hope that you enjoy the conference and we are looking forward to welcoming you to Warsaw!

Ramón C. Hermida
ISC President

Konrad S. Jankowski
Conference Chair

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Organizing Committee

Konrad S. Jankowski, University of Warsaw, Faculty of Psychology – Chair

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Yvan Touitou (Fondation Adolphe de Rothschild, France)

Han Wang (Soochow University, China)

Adam Wichniak (Institute of Psychiatry and Neurology, Poland)

Keynote Speakers

Prof. Christian Cajochen

Basel, Switzerland

New developments of non-image forming effects of light in humans

Prof. Derk-Jan Dijk

Guildford, United Kingdom

Circadian regulation of the human sleep-wake cycle: new insights

Prof. Andries Kalsbeek

Amsterdam, Netherlands

Daily rhythms in energy metabolism: how to time best light, food and activity

Prof. Timo Partonen

Helsinki, Finland

Chronobiology of mood and chronotype-driven impacts on health at population level

Prof. Francesco Portaluppi

Ferrara, Italy

Pathophysiologic control of melatonin on cardiovascular function and blood pressure regulation

Program

2 July 2019 Tuesday

From 16:00	Registration
Opening ceremony	
17:30-18:00	Welcome from the Organizing Committee
18:00-19:00	Keynote Lecture – Prof. Timo Partonen <i>Chronobiology of mood and chronotype-driven impacts on health at population level</i>
19:00-21:00	Reception

	3 July 2019 Wednesday	
9:00-10:00	Keynote Lecture – Francesco Portaluppi <i>Pathophysiologic control of melatonin on cardiovascular function and blood pressure regulation</i>	
10:00-10:15	Coffee break	
10:15-12:30	Symposium: Shift Work Chair: Arti Parganiha (India)	
	Yvan Touitou (Rothschild Foundation)	Atypical work hours and the circadian system: what can be done to prevent health deleterious effects
	Irena Iskra-Golec (SWPS University of Social Sciences and Humanities)	Shift work management
	Giovanni Costa (University of Milano)	Shift workers: builders and victims of the 24/7 Society
	Beata Peplowska (Nofer Institute of Occupational Medicine)	Association of the rotating night shift work with obesity, and lifestyle
	Arti Parganiha (Pt. Ravishankar Shukla University)	Costs and benefits of human shift optimization
12:30-13:30	Lunch	
13:30-14:30	Keynote Lecture – Christian Cajochen <i>New developments of non-image forming effects of light in humans</i>	
14:30-14:45	Coffee break	
14:45-16:30	Symposium: Clocks in Animal Models Chair: Han Wang (China)	
	Han Wang (Soochow University)	The circadian clock promotes spermatogonial differentiation and fertilization through retinoic acid signaling
	Vinod Kumar (University of Delhi)	Disrupted night environment affects behavior, nocturnal sleep and cognitive performance in animals: Evidence from diurnal songbirds
	Jaromir Myslivecek (Charles University)	M4 muscarinic receptor regulation of locomotor activity biorhythm is caused by core clock changes and striatum, thalamus, motor cortex and intergeniculate leaflet are involved
	Telma Quintela (University of Beira Interior)	Amyloid- β -Induced Alterations in Choroid Plexus Circadian Clock
	Marta Iwanaszko (Northwestern University)	Distinct patterns of circadian regulation in aging brain

14:45-16:30	Symposium: Circadian Rhythms in Disease Chair: Letizia Galasso (Italy)	
	Letizia Galasso (University of Milan)	Breast cancer survivors: analysis of rest-activity circadian rhythm
	Anna Korompeli (National and Kapodistrian University of Athens)	Melatonin Secretion levels in Intensive Care Unit (ICU) patients: An observational descriptive study
	Adrian Chrobak (Jagiellonian University Medical College)	Associations between biological rhythms disturbances and bipolar disorder in clinical and non-clinical samples
	Denis Gubin (Tyumen State Medical University)	Distinct Daily Patterns of Intraocular Pressure in Healthy Controls and Patients with Stable or Advanced Glaucoma
	Adam Wichniak (Institute of Psychiatry and Neurology Poland)	Sleep-wake rhythm in patients with severe mental disorders - evidence from actigraphic studies
16:30-16:45	Coffee break	
16:45-18:10	Symposium: Non-visual Effects of Light Chair: Angel Correa (Spain)	
	Angel Correa (Universidad de Granada)	Does economic decision-making depend on circadian synchrony and spectral lighting?
	Giuseppe Barbato (University of Campania)	Effects of low intensity (40 lux) monochromatic blue (470 nm) and red (630 nm) lights on alertness and attention
	Irena Iskra-Golec (SWPS University of Social Sciences and Humanities)	Monochromatic blue light and timing of exposure effect on EEG, mood, and light perception
	Patrycja Siemiginowska (Jagiellonian University)	Monochromatic blue light effect on cognitive performance
16:45-18:10	Symposium: Circadian aspects of treating sleep disorders at a sleep medicine center – joint symposium with the Polish Sleep Research Society Chair: Adam Wichniak (Poland) & Wojciech Jernajczyk (Poland)	
	Magdalena Flaga-Łuczkiwicz (DIALOG Therapy Center)	Poor sleep quality in safety-sensitive work – an opportunity for sleep rhythm improving interventions
	Ewa Poradowska (Institute of Psychiatry and Neurology Poland)	Chronotype in patients with insomnia referred to sleep disorders center
	Michał Jarkiewicz (Institute of Psychiatry and Neurology Poland)	Night eating syndrome - treatment challenges
	Joanna Szmyd (Institute of Psychiatry and Neurology Poland)	Circadian and CBT-I interventions for psychosis
18:10-19:30	Poster Session (wine, beer & snacks)	

4 July 2019 Thursday		
9:00-10:00	Keynote Lecture – Derk-Jan Dijk <i>Circadian regulation of the human sleep-wake cycle: new insights</i>	
10:00-10:15	Coffee break	
10:15-12:30	Symposium: Genetic and Molecular Mechanisms of Rhythms and Clocks Chair: Urs Albrecht (Switzerland)	
	Gregor Eichele (Max-Planck-Institute)	Acetylation of BMAL1 by TIP60 links positive and negative arms of the molecular circadian clock
	Urs Albrecht (University of Fribourg)	Cyclin Dependent Kinase 5 (CDK5) Regulates the Circadian Clock
	Nicholas Foulkes (Karlsruhe Institute of Technology)	Evolution without the Sun: Circadian Clocks and DNA repair in Blind Cavefish
	Valter Tucci (Istituto Italiano di Tecnologia)	DNA Methylation and the circadian clock
	Teresa Kowalska (University of Silesia)	Spontaneous peptidization of biogenic amino acids and circadian rhythm of certain peptidization processes
	He Qianying (Affiliated Hospital of Guizhou Medical University)	The C Gene BMAL1 Impact on the Survival and the Biological Mechanism of Nasopharyngeal Carcinoma After Radiotherapy
12:30-13:30	Lunch	
13:30-14:30	Panel Discussion: Trends and Future of Chronobiology Research Chair: Luiz Menna-Barreto (Brazil)	
14:30-14:45	Coffee break	
14:45-16:30	Symposium: Psychology of Chronotypes Chair: Christoph Randler (Germany)	
	Christoph Randler (Eberhard Karls University Tuebingen)	Sexual aspects of morningness-eveningness
	Oliwia Maciantowicz (University of Warsaw)	What keeps Narcissus awake late at night? Role of neuroticism in explaining chronotype in grandiose and vulnerable narcissism
	Kinga Szymaniak (University of Warsaw)	How do night owls get angry? - disentangling the relationship between trait anger and sleep time preferences
	Jan Jędrzejczyk (University of Warsaw)	Do you have enough willpower to rise early? Self-control and chronotype
	Kamila Zapałowicz (University of Warsaw)	Chronotype differences in psychosocial adjustment among children and adolescents

14:45-16:30	Symposium: Circadian Disruption and Health Chair: Natalia Bobko (Ukraine)	
	Oksana Mykytyuk (Bukovinian State Medical University)	Peculiarities of the Clinical Course of the Osteoarthritis in Shift-Workers: Analysis of Clinical Data and Questionnaires
	Sławomir Kujawski (Nicolaus Copernicus University in Toruń)	Hemodynamic and autonomic parameters dynamics during Total Sleep Deprivation in relation to clinical spectrum of hypertension
	Łukasz Mokros (Medical University of Łódź)	Social jet lag may predict suicidal behaviours among students of medical faculty and psychology
	Anna Antoniuk (Kundiiev Institute of Occupational Health)	Age and Experience Related Changes in ECG of Truck Drivers
	Natalia Bobko (Kundiiev Institute of Occupational Health)	Workability and Wellbeing in International Truck Drivers: Effects of Night Work
16:30-16:45	Coffee break	
16:45-18:10	Symposium: Chronobiotic Interventions for Health Chair: Hsin-Jen Chen (Taiwan)	
	Hsin-Jen Chen (National Yang-Ming University)	Body composition and blood pressure change by reminding young adults to eat breakfast and to avoid night snack
	Maciej Stolarski (University of Warsaw)	Effects of chronotype and time of day on mood responses to CrossFit training
	Denis Gubin (Tyumen State Medical University)	Personalized Response of Glaucoma Patients to Melatonin Administered to Ameliorate Disrupted Circadian Rhythms
	Pavol Svorc Jr (Ostrava University)	Dynamics of Changes in Heart Rate Variability After Prolonged Exposure to Dark
16:45-18:10	Symposium: Chronotype and Well-being Chair: Subhabrata Moitra (Spain)	
	Dominika Pruszcak (University of Warsaw)	Morningness-Eveningness and well-being association: the role of Time Perspectives
	Łukasz Mokros (Medical University of Łódź)	Can chronotype and social jet lag predict burnout among physical therapists?
	Subhabrata Moitra (ISGlobal)	Are the evening owls more prone to develop asthma/allergic symptoms than the morning larks?
	Marcin Zajenkowski (University of Warsaw)	Why do evening people think they are smart?
19:30-23:30	Banquet	

5 July 2019 Friday		
9:00-10:00	Keynote Lecture – Andries Kalsbeek <i>Daily rhythms in energy metabolism: how to time best light, food and activity</i>	
10:00-10:15	Coffee break	
10:15-12:30	Symposium: Circadian Rhythms and Seasonality Chair: Dietmar Weinert (Germany) & Arcady Putilov (Russia)	
	Dietmar Weinert (Martin Luther University Halle-Wittenberg)	Photoperiodism in dwarf hamsters (Genus <i>Phodopus</i>) – effects of circadian rhythm disturbances and geographic origin
	Sergey Kolomeichuk (Kola Science Center of the Russian Academy of Sciences)	Seasonal Changes in Sleep Habits in Children of Northern Russia
	Dominika Kanikowska (Poznan University of Medical Sciences)	Seasonal Effects upon Healthy and Obese Adults with Particular Reference to Selected Hormones and Lifestyle
	Maki Sato (Aichi Medical University)	Seasonal Differences of Melatonin Concentration and Clock Gene Expressions in Obese Men
	Arcady Putilov (Siberian Branch of the Russian Academy of Sciences)	Circadian Rhythms and Seasonality in Our Own Species and Animal Models
12:30-13:30	Lunch	
13:30-14:55	Symposium: Disruption of Sleep-Wake Rhythm Chair: Tae-Won Jang (Republic of Korea)	
	Wojciech Waleriańczyk (University of Warsaw)	Exploring the role of midpoint sleep in the context of work psychology
	Arti Parganiha (Pt. Ravishankar Shukla University)	Effect of low-frequency electromagnetic radiation emanating from base transceiver station (BTS) might affect sleep quality and rest-activity rhythm in humans
	Tae-Won Jang (Hanyang University)	Sleep assessment during shift work in Korean firefighters: a prospective observational study
	Arcady Putilov (Siberian Branch of the Russian Academy of Sciences)	Model-based simulations of weekday-weekend shift in sleep times debunk the myth of weekend catch-up sleep
14:55-15:10	Coffee Break	

15:10-16:35	Symposium: Assessment of Circadian Rhythms Chair: Konrad S. Jankowski (Poland)	
	Dietmar Weinert (Martin Luther University Halle-Wittenberg)	Methods and analytical tools for chronobiologic investigations
	Oksana Senyk (Ivan Franko National University of Lviv)	Composite Scale of Morningness: results of adaptation into Ukrainian
	Krzysztof Fronczyk (University of Warsaw)	Do Composite Scale of Morningness items exhibit DIF depending on gender and average sleep duration of subjects?
	Konrad S. Jankowski (University of Warsaw)	Assessment of Social Jet Lag
16:35-16:45	Farewell	

Poster Presentations

1	Pavol Svorc	Sex differences in pH and blood respiratory gases in zoletil-anaesthetized rats in the dependence on LD cycle
2	Yu Kume	Association between rest-activity patterns and frailty in Japanese elderly persons
3	Maria Bolla	Altered circadian rhythm in the Snord116- deleted mouse, an experimental model of PraderWilli syndrome
4	Lucia Castelli	Academic achievement in Motor Science School in Milan: effect of chronotype
5	Monika Lesicka	Analysis of selected circadian gene polymorphisms in breast cancer - searching for their functional significance
6	Małgorzata Sobol-Kwapińska	How disruption of circadian rhythm by newborn affects parents' time perspective and quality of life. Systematic review
7	Marta Iwanaszko	Low-temperature reprogramming induces changes in circadian transcriptome
8	Khyati	Altered light regimes affect physiology, adult life span and reproductive output in a serious Lepidopteran pest, <i>Spodoptera litura</i> (Fabr.)
9	Tetiana Martynovska	Effects of night work on chronic fatigue development and its relation to biological wellbeing in telephonists
10	Svitlana Dovgopola	Chronopsychological Changes in Personal Qualities of Surgeons Working 24-Hour Duties
11	Martyna Marciniak	Lifestyle and chronotype among medical students at Poznan University
12	Luiz Menna-Barreto	Test timing of memory and reading comprehension in adolescents: relations with chronotype
13	Luiz Menna-Barreto	School schedules and biological rhythms in teachers
14	Antonino Mule	Chronotype influences physical performance in adolescent soccer players
15	Zofia Orzechowska	The impact of the chronotype on the effect of the dietary restriction among obese patients - preliminary report
16	Dorra Dridi-Jeddi	Murine Chronotoxicity to Pharmaceutical Wastewater
17	Kamila Litwic-Kaminska	Sleep quality of student-athletes – the role of chronotype, stress and life satisfaction

18	Dana Baran	Biological Rhythm Disruption and Mental Conditioning
19	Aleksandra Domagalik	Thalamus activity during working memory task correlates with circadian phase
20	Halszka Oginska	Season-dependent differences in actigraphy recordings and daytime sleepiness
21	Ana Allen Gomes	An epidemiological study of sleep-wake timings in school children from 4 to 11 years old: insights on the sleep phase shift across development, and implications for the school starting times' debate
22	Ana Allen Gomes	Presenting the Research Project "True Times - Morningness-eveningness and time-of-day effects on cognitive performances and emotional states: new lessons from children and adolescents
23	Mylene Malek Beyret	Experimental study of chronotoxicity of the anticancer agent « Ifosfomide »
24	Sunghyun Hong	Circadian control of ORE1 by PRR9 positively regulates leaf senescence in Arabidopsis
25	Joanna Pawlak	Sleeping and activity patterns correlations with symptoms and course of affective disorders
26	Agnieszka Fulczyk	Which analytical techniques allow discovery and documentation of circadian rhythm of spontaneous oscillatory peptidization with biogenic amino acids?
27	Yuan Zhang	Knock down Bmal1 triggered different colon carcinoma cells fates by altering the delicate equilibrium between AKT/mTOR and P21/P53 pathways
28	Mona Boaz	Dietary intake by BMI category in nurses working rotating shift
29	Agnieszka Bukowska-Damska	Study of the Association between Work at Night and Women's Bone Mineral Density – Background, Aims and Methods
30	Zuzanna Laszczkowska	Dispositional mindfulness amongst chronotypes

Abstracts of Oral Presentations

Atypical work hours and the circadian system: what can be done to prevent health deleterious effects

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In industrialized countries about 75% of the active population work atypical hours. Artificial light at night, shift and night work decrease the sleep duration and disrupt the temporal system, the melatonin secretion, sleep cycle, social life, and meal times. This results in a chronodisruption of the biological clock corresponding to the misalignment between the biological clock and social time. All of these factors experienced by shift and night workers result in detrimental effects on health with an increased incidence of cancers, cardiovascular risks, diabetes, obesity, mood disorders, and possibly age-related macular degeneration, as assessed in a large number of epidemiological studies. To counter these effects a number of behaviors should be avoided like exposure to light up to 30 min prior to going to sleep; opting for a morning shift that starts before 07 h; undertaking more than three successive night shifts; and, in light of the potential risks with pregnancy, performing shift work or night work when pregnant cause adverse effects. In addition some agents are used to resynchronize the clock, such as bright light, and chronobiotics like melatonin, and specific psychotropic medications with the aim of improving sleep, or conversely to enhance alertness, depending on the work requirements.

Shift work management

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The lecture provides an overview of sources and mechanisms of shift work effects on health and social well-being of the individuals involved as well as shift work stress preventive measures the organizations and individuals may adopt. Shiftwork is defined as a system of working hours falling outside the standard work period including night hours. Thus, working shift requires periodical alternation of sleep and wakefulness timing (sleep during the day and activity at night) what disturbs circadian rhythms of life processes governed by the circadian pacemaker. Theoretical models of shift work stress based on research results were developed to describe the mechanisms of shift work impact on the working individual. The mechanisms of that negative impact are not fully understood but so far circadian misalignment, sleep restriction and social misalignment were identified. The relationship between shift work and cardiovascular diseases, gastrointestinal and metabolic disorders has already been proved. The less strongly documented is the linkage between shift work and cancer, mental health problems and reproduction-related problems. The evidence from mainly cross-sectional research showed that working on the most attractive socially times (evenings and weekends) resulted in impoverishment of shift workers' social and family life. Interventions (prevention measures) aimed at reduction of negative shift work effects include designing shift systems according to ergonomic criteria (primary prevention). Activities of secondary health prevention include shift workers health surveillance, approaches to promote sleep, wakefulness, adjustment of the circadian clock to the shift arrangement as well as education and counselling. Compensative measures are applied in case of unavoidable negative shift work effects. They include counter-weights aimed at compensation of inconveniences caused by shift work (i.e. monetary compensation) and counter-values aimed at reduction of negative effects (i.e. reduction of working hours).

Shift workers: builders and victims of the 24/7 Society

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In the modern 24/7 Society working time has become a key issue of work organization in relation to growing economic competition and globalization of labour markets, development of new technologies and production strategies, and provision of essential services to the general population. Shift and night work enable round-the-clock activities not only in relation to technological constraints and basic public services, but also to support productive and commercial business and a wider use of leisure time. In general about 20% of the working population is involved. Shift and night work can have a negative impact on workers' health and well-being due to: disruption of physiological circadian rhythms of biological functions; reduced performance efficiency resulting in errors and accidents; interference on family and social life; chronic health disorders at metabolic, digestive, cardiovascular, neuropsychic level, and probably cancer. Women may suffer from more specific adverse effects due to their peculiar hormonal and reproductive function and family roles. Shift workers may show different levels of (mal)adaptation and (in)tolerance, which manifest themselves in different times and degrees, since the effects of this stressful condition can vary widely depending on many intervening factors concerning individual characteristics, working conditions, family and socioeconomic status. All that implies significant economic and social costs not only for individuals, but also for companies and the whole society: it is therefore necessary to adopt a systemic approach to take appropriate preventive and protective actions. Design of shift schedules according to ergonomic criteria, adoption of flexible working hours, greater work autonomy and control, better information and training, careful medical surveillance, and a balanced integration among work, environment and society are the main tools to enable people to keep working without health impairment and to support a correct evolution of homo sapiens in 24/7 society.

Association of the rotating night shift work with obesity, and lifestyle

Beata Peplowska

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Night shift work has been linked to some chronic diseases like cardiovascular and metabolic diseases and cancer. Modifiable factors such as smoking, physical activity, alcohol consumption and obesity contribute to the etiology of these diseases. Unhealthy lifestyle changes have been suggested to play a role in the development of potential health effects of shift work, and the evidence for the association between night shift work and lifestyle factors has been mounting. Physical activity, smoking, alcohol drinking and BMI were analyzed in two populations (each included current rotating night shift workers and day workers): 725 nurses and midwives (women), aged 40-60; and 605 blue collar workers (both women and men), aged 35-60. Information was collected through a questionnaire. The distribution of the lifestyle factors and body mass index (BMI) was compared between rotating night shift and day workers. Among nurses and midwives, current night shift work status was associated with higher total and work-related physical activity (PA), but lower recreational PA, with increased OR for recreational "inactivity" (OR=1.57, 95%CI:1.11-2.20). Current smoking was more common among night shift nurses and midwives than women working during the days only (34.7% vs. 26.2%, respectively), with higher prevalence of heavy smokers, i.e. persons smoking ≥ 15 cigarettes per day (16.1% vs. 9.2%). Current night shift work and its duration were consistently associated with obesity (BMI ≥ 30 kg/m²). In the study of industry workers, the prevalence of current smoking among women was higher compared to former or never night shift workers (40.6% vs. 33.3% and 17.9%, respectively). The OR for alcohol drinking was reduced by approximately 50% (OR = 0.45, 95%CI:0.21–0.97) among the current female night shift workers compared to the day workers. Current night shift work was associated with recreational inactivity (OR = 2.43, 95% CI: 1.13–5.22) among males. In addition, in this group we observed a statistically significant positive relationship between night shift work duration and BMI ($p = 0.029$). Both studies confirm the previous evidence highlighting poor lifestyle among night shift workers, with increased smoking, lower exercising and increased body weight. These findings provide important public health implications for the prevention of chronic diseases among night shift workers.

Costs and Benefits of Human Shift Optimization

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Today we live in a 24-h society that demands round the clock attention from various service providing agencies, such as security, health, media, telecommunication, transport, and industries, to name a few. These agencies have introduced and adopted *shift work* (24/7) system in order to optimize the utilization of human resources and productivity. In a nutshell shift work has become an indispensable part of modern life, although it produces a number of detrimental effects on human health. The most obvious consequences are (1) sleep disorders, (2) impairment of physical and mental health, (3) preponderance of gastrointestinal and cardiovascular diseases, and (4) longevity reduction. Shift workers also suffer from work-related fatigue and impaired alertness. These problems have been imputed to external (ED) and/or internal desynchronization (ID) of the circadian rhythm(s). Nearly all bodily functions, from cellular to organismal levels are rhythmic in nature. In humans, most of the physiological and behavioral variables, such as core body temperature, neuroendocrine secretions, sleep-wake cycle, hormonal secretions, subjective alertness, cognitive performance, exhibit circadian rhythm with a period equal to 24 h. All these rhythms remain in synchrony with the light-dark cycle and other oscillatory components of the environment. The internal bodily rhythms also keep synchrony among each other. It has been indisputably accepted that shift work disrupts the human circadian timing system (CTS). Both external and internal synchronizations of rhythms go haywire in shift workers. Therefore, researchers in this domain have been looking for remedial and preventive strategies that could minimize the detrimental effects of shift work. We have reviewed a number of suggested countermeasures aimed at improving the coping ability of shift workers. In summary, shift optimization would certainly increase the productivity of the organizations that have shift working as an unavoidable component.

The circadian clock promotes spermatogonial differentiation and fertilization through retinoic acid signaling

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The circadian clock generates and maintains 24-hour oscillations in almost all organs. However, the testis remains mysterious without a clear understanding of its circadian function. Here we revisited the long thought exception in the circadian system. Transcriptome analysis reveals more than 1,000 rhythmically expressed genes in the zebrafish testis. Key circadian clock genes are expressed in both the Sertoli cells and spermatogonia and regulate genes involved in retinoic acid (RA) signaling. Loss of *Clock1a* generally or Sertoli-cell-specifically results in arrested spermatogonial differentiation and reduced fertilization, which can be rescued by time-of-day-specific RA treatment. Conditional overexpression of *clock1a* shows that chronical perturbation of circadian regulation leads to similar reproductive defects. The circadian clock acts through RA signaling to synchronize spermatogonial differentiation and to promote fertilization via *izumo1*. Hence, we demonstrate that the testis clock ticks in a cell-specific manner and contributes to reproduction through RA signaling, highlighting circadian roles in male fertility.

Disrupted night environment affects behavior, nocturnal sleep and cognitive performance in animals: Evidence from diurnal songbirds

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Cyclic day-night environment synchronizes internal rhythms and shapes the temporal pattern in the behaviour and physiology within each day in both diurnal and nocturnal animals including birds. Disruption of periodicity in the environment can cause negative effects at multiple levels, including daily activity behaviour, nocturnal sleep, metabolism, reproduction and advanced brain functions, such as the learning, memory and decision-making. In general, there is decay in the 24-h periodicity of behaviour and physiology, and in the decline of exploratory and cognitive performance in diurnal birds when subjected to the disrupted night in an equinox 24-h light environment. Recent studies in my laboratory have shown the effects of dim light at night (dLAN) and LL (loss of night, LON) on activity behaviour, nocturnal sleep, exploration, learning and cognition, and personality in zebra finches (*Taeniopygia guttata*) and Indian house crows (*Corvus splendens*) that were initially entrained to an equinox photoperiod, i.e. 12h light: 12 h darkness. We also found the effects on cellular and molecular correlates of cognitive performance in the hippocampus (HP), pallium and midbrain of Indian house crows, as revealed by ZENK (a neuronal activation marker) and tyrosine hydroxylase (a motivation marker) expressions. These results on diurnal birds give insights into the possible LON impact on brain health and functions in an emerging ecosystem in which diurnal species including humans may be inadvertently exposed to an illuminated night such as in an overly-lighted metropolitan urban habitat.

M4 muscarinic receptor regulation of locomotor activity biorhythm is caused by core clock changes and striatum, thalamus, motor cortex and intergeniculate leaflet are involved

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We have shown previously that deletion of M₄ muscarinic receptors (MR) increases locomotor activity and changes biorhythm parameters in females, not males. Further, muscarinic drug effects differed on the morning and on the evening. Here, we searched for the mechanisms that are responsible for locomotor activity biorhythm changes. We performed biorhythm analysis in two experiments: in the experiment 1, the mice (C57Bl/6NTac and M₄ MR ^{-/-} mice (KO) on the same background) were first exposed to standard LD regime (12/12 light/dark cycle, light on at 7:00 AM) for 8 days and then they were exposed to constant darkness (for 24 hours/day, DD regime) for other 16 days. In the experiment 2 were the mice (after standard LD regime) exposed to DD regime and to one light pulse (300 lx, 1h, administered at zeitgeber time 14, onset of subjective night) on day 9. In the experiment 1, the biorhythm activity curves differed, period (τ , duration of diurnal cycle) was shorter in DD regime. Moreover, day mean, night mean and their difference were higher in KO animals. Also, mesor (midline value) was higher in KO. The time, in which the maximal slope occurred was lowered in WT and KO and was lower in KO than in WT. In the experiment 2, there were no differences in biorhythm parameters between WT and KO. In vitro autoradiography showed that M₄MR proportion represents 24% in the motor cortex, 50% in the striatum, 69% in the thalamus, and 48% in the intergeniculate leaflet. The M₄MR densities were negligible in other brain areas, like suprachiasmatic nuclei, involved in biorhythm regulation. These results suggest that core clock output is changed and that the structures involved in biorhythm regulation in WT and KO are the most probably the same.

Amyloid- β -Induced Alterations in Choroid Plexus Circadian Clock

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The choroid plexus (CP) are complex intraventricular structures involved in a variety of processes that monitor and maintain the biochemical and cellular homeostasis of the central nervous system, constituting the interface between blood and cerebrospinal fluid. During aging, CP exhibits morphological changes and a functional decline, which is accepted to be greatly enhanced in Alzheimer's Disease (AD). The recent discovery that CP is also a peripheral circadian clock and the fact that aging of the circadian system may also increase susceptibility to AD, led us to hypothesize whether amyloid-beta (Abeta) will contribute to changes in CP molecular clock. For this purpose, we evaluate clock genes expression at different time points, in female and male APP/PS1 mouse model of AD. Our results showed a dysregulation of Bmal1 circadian expression in female and male APP/PS1 transgenic mice with 12 month old. We also assessed Bmal1 circadian expression, in rat CP epithelial cell line (Z310), in the presence of Abeta. In accordance, Bmal1 circadian expression was abolished in the presence of the principal component of the amyloid plaques. These results demonstrate that Abeta disrupts normal CP circadian clock, giving a step ahead to understand the mechanistic pathways involved in AD-related circadian alterations.

Distinct patterns of circadian regulation in aging brain

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Aging process induces numerous changes in gene expression patterns and is correlated with changes in the circadian clock, which when disrupted enhances aging. Cycling core clock components, which promote rhythmic expression of diverse number of genes and processes in the body, directly and indirectly impact multiple biological processes and through them behavior. As the clock in the brain is the main regulator of circadian rhythmicity we conducted an RNA sequencing study which compared circadian transcriptome of young and old *Drosophila melanogaster*. We used computational approaches to detect differentially expressed and rhythmic genes, including identification of differentially cycling genes. Overall, the rhythmic behavior of the core clock genes remains robust in old flies, while subtle changes in circadian phase and gene expression levels of *Clk*, *cwo* and *vri* appear in aging brains. Results of the analysis of temporal expression show unobserved before two distinct peaks of gene expression levels in young vs. old brains, which lead to identification of diverse brain cells activity, focused on regulation of transcription and repair in old flies, and various metabolic processes in young. We observed a substantial number of *de-novo* cycling genes unique to the old brain transcriptome, and rhythmic genes with a significant shift of phase in old flies, which included transcription factors regulating RNA transcription and immune response, like *Deaf1*, *Rel*, *slp2* and *TfIIA-s*. Altogether our results show a dynamic landscape of changes emerging in aging fly brains. This work is supported by a grant from the Simons Foundation/SFARI (597491-RWC) and the National Science Foundation (1764421).

Breast cancer survivors: analysis of rest-activity circadian rhythm

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Rest-activity rhythm (RAR) indicates the activity levels during the 24 hours. In detail, RAR disruption has been found in breast cancer (BC) at different stages of clinical pathway (Berger et al., 2012). To date, there are no studies that analyze RAR in BC survivors several years after the diagnosis. Aim of the current study is to analyze RAR, by actigraphy, in a population of BC survivors 5 years after the primary diagnosis, and to compare their RAR characteristics with healthy controls. A total of 28 women were recruited for the study: 15 were BC survivors at 5 years from the primary diagnosis (BC-group) and 13 were controls (Ctrl-group), matched for age, sex and BMI. All participants were requested to undergo clinical visit to obtain: height and weight to calculate BMI, systolic and diastolic blood pressure, heart rate, glycemia, total cholesterol, high density lipoproteins, low density lipoproteins and triglycerides. In addition, all participants were monitored for a continuous 7-day actigraphic monitoring to evaluate RAR. Anthropometric, cardiovascular and blood chemistry characteristics were homogeneous in BC-group and Ctrl-group: no significant differences were observed between the two groups for all the parameters. The single cosinor method revealed statistically significant RAR ($p < 0.001$) in all the participants. The population mean cosinor showed a significant RAR in both groups ($p < 0.001$). A significant difference in RAR between BC-group and Ctrl-group was demonstrated by the Hotelling T^2 test. Specifically, MESOR (192.0 vs 276.4 a.c. in BC-group and Ctrl-group, respectively; $p < .001$) and Amplitude (167.0 vs 222.6 a.c. in BC-group and Ctrl-group, respectively; $p < .001$) resulted significantly lower in BC-group compared to Ctrl-group. Breast cancer survivors, at 5 years after diagnosis, showed lower activity levels compared to healthy controls. Berger et al., (2012). Circadian rhythms, symptoms, physical functioning and body mass index in breast cancer survivors. *J Cancer Surviv*, 6:305-314.

Melatonin Secretion levels in Intensive Care Unit (ICU) patients: An observational descriptive study

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Introduction: Disturbances of circadian rhythmicity in the Intensive Care Unit (ICU) patients have been the objective of many studies during recent years. Among other variables, alteration of melatonin secretion, a sleep biomarker, has been studied in critically ill patients, though with contradictory results. Many studies have reported that the circadian rhythm of melatonin can be altered by the influence of light. **Aim:** The aim of the study was to estimate melatonin secretion in conscious ICU patients and to describe the impact of light exposure on melatonin serum levels, depending on bed positioning relative to natural light (Dark vs Light Side). **Methods:** In total, 10 patients were analyzed. Blood was drawn at two time-points (8.00 and 20.00) for 24-96 hours. In order to estimate the melatonin secretion pattern, serum melatonin levels were measured by ELISA and the mean level was calculated for each time-point for each patient. **Results:** Melatonin levels in the ICU patients were slightly lower at 20:00 than at 8:00 ($p=0.104$). Analysis by gender revealed that female had marginally higher melatonin levels in comparison to male patients at 8.00 ($p=0.104$) as well as 20:00 ($p=0.078$). Regarding males only, we found a significant decrease in melatonin levels at 20:00 in comparison to 8:00 ($p=0.02$). Comparison of melatonin levels between Light Side and Dark Side ICU patients revealed no difference. Although Light Side patients demonstrated marginally decreased melatonin levels at 20:00 in comparison to 8:00 ($p=0.067$), such decrease was not observed in Dark Side patients. **Conclusions:** Lack of difference between melatonin levels at 8:00 and 20:00 may indicate that more appropriate time-points should be chosen for future studies. Consistent with the literature, melatonin levels were higher in female compared to male ICU patients. Bed positioning of ICU patients seems to affect melatonin levels over the day.

Associations between biological rhythms disturbances and bipolar disorder in clinical and non-clinical samples.

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A large number of studies have demonstrated that biological rhythms disturbances play an etiological role in bipolar disorder (BD). Those alterations may be detected not only during acute episode of the illness such as mania or depression but also in the state of remission. Moreover, studies point out that the associations between bipolar spectrum symptoms and biological rhythms alterations can also be detected in general population. The growing interest in assessing those links led to the development of the Biological Rhythms Interview of Assessment in Neuropsychiatry (BRIAN), a novel tool allowing complex assessment of biological rhythms. The aim of our presentation is to summarize: 1) results of our non-clinical studies evaluating associations between affective and personality traits with circadian preferences in general population; 2) present validation of the Polish BRIAN scale in remitted bipolar disorder patients, indicating its associations with affective and personality traits. In non-clinical population, we have shown that eveningness is associated with higher rates of bipolar spectrum symptoms and unfavourable affective temperaments traits. In BD sample we have shown that the Polish version of the BRIAN scale presented high feasibility and consistency, indicating that the patients had greater biological rhythm disturbances than the healthy volunteers. We have revealed that cyclothymic and depressive temperaments are linked with biological rhythm disturbances in BD, while hyperthymic temperament can be protective. Our results also point out associations between circadian preferences and lithium treatment.

Distinct Daily Patterns of Intraocular Pressure in Healthy Controls and Patients with Stable or Advanced Glaucoma

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Objectives. Intraocular pressure (IOP) variability and 24-hour, 12-hour rhythms were assessed in patients with stable (S) or advanced (A) primary open-angle glaucoma (POAG) and in sex- and age-matched control subjects (Cs). **Methods.** IOP (both eyes) was measured for a 72-hour span at 3, 8, 11, 14, 17, 20, 23-h in a home setting by iCare ONE rebound tonometer in the three groups: S-POAG, (n=65, mean age 67.6 ± 7.6); A-POAG (n=50, 69.9 ± 8.2); and Cs (n=89, 68.1 ± 10.6). To exclude bias, stemming from different inter-individual / inter-group mean values, data were expressed as percentages of the individual averages (IOP%). **Results.** IOP% of Cs had bimodal pattern, resembling blood pressure. The amplitudes and phases of the 24-h and 12-h rhythms were similar between the 2 eyes ($r > 0.9$). In POAG, the 12-h component was not evident visually. IOP% variability (SD) of both POAG groups was about twice as high and the 24-h amplitude (24h-A) about 1.5 as high as in Cs. However, higher 24h-A was merely related to elevated SD, since 24h-A/SD and 12h-A/SD ratios, and percentage rhythms of 24h&12h in both POAG groups were significantly lower than in Cs ($p < .0001$). IOP% variability in S-POAG vs. A-POAG was not different in terms of SD, 24h-A&12h-A or their ratios to SD. Notably, the mean phase of the 24-h rhythm of A-POAG was inversed to nocturnal position vs. diurnal position of S-POAG group ($p < .0001$). **Conclusions.** IOP% patterns in POAG differ from that of Cs in terms of higher overall variability and transformed spectra with dampened 24-h and 12-h percentage rhythm. Furthermore, A-POAG patients have inverted IOP circadian pattern with nocturnal phase that is persistent for both eyes, regardless of gender.

Sleep-wake rhythm in patients with severe mental disorders - evidence from actigraphic studies

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Objective: Disturbances of sleep and abnormal sleep-wake rhythm are common features of severe psychiatric disorders. In present study we evaluated rest and activity pattern in patients with psychotic disorders. **Method:** 97 patients (43 F/54 M, mean age 27.3±6.9) diagnosed with psychotic disorders treated with sedative (risperidone, olanzapine) and non-sedative (aripiprazole, sertindole) antipsychotics drugs were examined during the last week before the discharge from the open psychiatric rehabilitation ward. The patients filled out sleep diaries, Athens Insomnia Scale, Epworth sleepiness scale (ESS). Mental status was evaluated with the use of the PANSS scale. An actigraphic recording (Actiwatch AW4, Cambridge Neurotechnology) was performed for seven days. The patients were compared with a group of 40 sex and age matched healthy controls (HC). **Results:** Mean wake activity differed between patients and HC, and between males and females, with greater wake activity in HC than patients ($p<0.05$) and in females than males ($p<0.01$). Bedtime was later in HC than in patients ($p<0.001$), whereas getup time was earlier in HC only in comparison to patients treated with olanzapine ($p<0.01$), and consequently time in bed was shorter in HC than in patients ($p<0.001$). **Conclusions:** Patients with psychotic disorders have low daytime activity and increased time in bed regardless of the kind of pharmacological treatment. Chronobiological and behavioral interventions have been considered as an important methods for treatment of sleep and wake rhythm disorders in these patients.

Does economic decision-making depend on circadian synchrony and spectral lighting?

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The current study tested whether people make better economic decisions at optimal times of day according to their chronotype, and whether lights of different spectral quality can influence such decisions. The influence of chronotype (MEQ, MCTQ, wrist temperature measures) and time of day (8 am vs. 10 pm) on decision-making was measured by the Ultimatum Game. Participants had to accept/reject different offers proposed by another participant ("1/9": 1€ for participant / 9€ for proposer). Acceptance involved distribution of gains as proposed, whereas rejection involved no gain for anyone. Subjective affect (PANAS) and event-related potentials linked to fair/unfair offers were also measured. Follow-up experiments used an auditory version of the Ultimatum Game, manipulated lighting (blue-enriched white light 440nm peak vs. orange light 595nm peak; 200lx both) in different day sessions, and measured altruistic behaviour in tasks requesting donation of time/money. Circadian rhythms of wrist temperature confirmed that morning chronotypes had earlier circadian phases than evening-types (midsleep time 4:00 vs. 6:30 am). Most relevant, Morning-types accepted more unfair offers than Evening-types. Frontal brain potentials were smaller for unfair vs. fair offers, only in Morning-types. Our lighting effects depended on the chronotype: Intermediate-types exposed to orange (vs. blue-enriched) light, reported increased positive affect, made more egalitarian offers and rejected more unfair offers (Ultimatum Game), and were more prone to donate personal resources (time and money). Conclusions: Decision-making behaviour in economic tasks can depend on individual differences in circadian rhythmicity, probably mediated by differential fluctuations of affective state and by personality traits. Morningness was related to more rational decision-making (accepting unfair offers was -annoying, but- more beneficial), which might rely on the inhibitory control of negative emotions raised by the perception of unfairness. Finally, the use of long-wavelength (orange) lighting at medium intensity might enhance altruistic behaviour.

Effects of low intensity (40 lux) monochromatic blue (470 nm) and red (630 nm) lights on alertness and attention

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Light has been shown to improve cognitive performance and to increase alertness. It has been suggested that alerting effects are mediated by ability to suppress melatonin, which is mostly sensitive to the short (blue) wavelength (Chellappa et al., 2011). However, Figueiro et al. (2009) reported that both blue and red light can induce alertness at night, and Sahin et al. (2013) reported that exposure to low intensity red light and not to blue light increases alertness during the afternoon. Our study addressed this question by comparing exposure to low intensity (40 lux) monochromatic blue (470 nm) and red (630 nm) lights during the afternoon. Subjective and objective measures of alertness (EEG) and attention were studied. Twenty subjects (13 females, 7 males, mean age: 23 years) took part of a consecutive 8 hour protocol, 9:00 AM - 17:00 PM, subjects were randomly assigned to the two different light condition. Light exposure (30 minutes) occurred between 15:30 and 16:00. Alertness was assessed by VAS scales and O1-O2 EEG, attention was evaluated using the attention network test which provides measures of alerting, orienting and executive control. All measures were assessed at 10:00 AM (baseline), 14:00 PM (previous light exposure), and 16:00 PM (post light exposure). VAS measures of alertness and EEG theta activity decreased throughout the protocol, with decreased vigilance ($F(2,44)=5,3$ $p= 0.009$) and activation ($F(2,44)= 3,5$ $p=0.05$), and increased theta value ($F(2,44)=5,3$ $p= 0.009$) at 16:00. Mean RT was also higher at 16:00 ($F(2,44)= 6,53$, $p=0.003$). No significant effect was found for both blue and red light exposure on alertness and ANT measures, with only accuracy worsening with red light exposure ($F(2,44)= 3,31$, $p=0.05$) Results do not support the hypothesis that either monochromatic low intensity blue or red light can increase alertness and performance during the afternoon hours.

Monochromatic blue light and timing of exposure effect on EEG, mood, and light perception

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Increasing evidence indicates monochromatic blue light (MBL) effect on alertness and mood especially after night time exposures. There is shortage of research however, on timing of exposure effect and on how the individuals perceive the light under the study. The experiment was aimed at examining the effect of MBL on electroencephalographic (EEG) activity, mood, and light perception at three different times of day. A within subjects counterbalanced design with repeated measures was applied. Thirty young, male volunteers aged between (M=20.5 years, SD=3.34 years) were exposed to two dim light conditions comparable in luminance on room surfaces at eye level while sitting (6.96- 7.53 Cd/m²): MBL (460 nm) and polychromatic white light (PWL). Measurements were taken after 30 minutes of exposure to both light conditions at times of increased sleepiness in the morning, early afternoon, and evening. Mood was assessed by UMACL (Matthews et al., 1990) and Thayer list (Thayer, 1970) and light perception by The light perception sheet (Knez, 1995). Two factorial analyses of variance with repeated measures were applied to the data. The factors were: light conditions (LC), and exposure timing (ET). The amplitude of theta EEG band decreased in MBL when compared to PWL. Decrease in hedonic tone and increase in tense arousal were found in MBL comparing to PWL. These changes may indicate increase of alertness and tension. There were found significant differences in subjective assessment of light conditions. MBL was perceived as less soft, warm, comfortable, and natural but more cold and glaring than PWL. No interactional effects of light conditions and exposure timing effect were found on EEG, mood and light perception.

Monochromatic blue light effect on cognitive performance

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There is growing research on blue light effect on performance. However there are no reports on monochromatic blue light (MBL) effects on the daily course of performance. A within subject counterbalanced repeated-measures experiment was designed to examine cognitive performance in two light conditions (MBL of 460 nm and polychromatic white light - PWL of 6.5 lx) comparable in luminance (.677 – .762 cd/m²). Healthy male volunteers (N=30) took part in six sessions (2 light conditions x 3 times of day: morning, afternoon and evening), individually coming to the laboratory for one session per day. The performance was assessed using computer task after 4 hours of exposure to light. Words or pictures were presented to left or right visual field. ANOVA was applied on the reaction times and number of errors (factors: two light conditions and three times of day: morning, afternoon, evening). In words processing there was significant effect of light in right cortex with regard to reaction time (faster reactions in MBL regardless of the time of day). With regard to accuracy, few phenomena were observed. In words processing in left cortex significant results were obtained (higher accuracy in the morning than in the evening regardless of the light conditions). Analysis of the processing of pictures yielded significant interactions of light conditions and times of day in left and right cortex. In the right cortex in MBL the accuracy was higher in the morning than in the afternoon whereas in PWL it was higher in the morning than in the evening. Presented results indicate that blue light might affect cognitive processing (in right and left cortex) and that its effects should be examined with regard to the time of day.

Poor sleep quality in safety-sensitive work – an opportunity for sleep rhythm improving interventions

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Adequate sleep is important in jobs in which proper performance of duties influences health and safety of other people. Night work and long work hours are common in safety-sensitive work such as medical professionals, police, fire fighters, and they influence the occurrence of sleep disorders. Which strategies should be used to improve sleep in situations when working at hours disrupting their circadian rhythm cannot be avoided? Research on physicians, as those we would expect to be best educated on ways to strengthen circadian rhythm, shows that they try to cope with sleep disturbances related to night work in maladaptive ways. The aim of this presentation is to discuss the discrepancy between knowing and applying the knowledge, consequences of working in safety-sensitive professions on circadian rhythm and sleep disturbances as well as present recommendations regarding dealing with shift work sleep disorder.

Chronotype and psychiatric comorbidity in patients with insomnia referred to sleep disorders center

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Adequate sleep is important in jobs in which proper performance of duties influences health and safety of other people. Night work and long work hours are common in safety-sensitive work such as medical professionals, police, fire fighters, and they influence the occurrence of sleep disorders. Which strategies should be used to improve sleep in situations when working at hours disrupting their circadian rhythm cannot be avoided? Research on physicians, as those we would expect to be best educated on ways to strengthen circadian rhythm, shows that they try to cope with sleep disturbances related to night work in maladaptive ways. The aim of this presentation is to discuss the discrepancy between knowing and applying the knowledge, consequences of working in safety-sensitive professions on circadian rhythm and sleep disturbances as well as present recommendations regarding dealing with shift work sleep disorder.

Night eating syndrome - treatment challenges

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Nocturnal eating, morning anorexia, circadian rhythm dysregulation, insomnia and depressive are associated with night eating syndrome (NES). This variety of symptoms requires interdisciplinary treatment. Nevertheless, most commonly used is pharmacotherapy, particularly monotherapy with Selective Serotonin Reuptake Inhibitors (SSRIs). This treatment approach addresses only some of the therapeutic needs of the patients with NES. Especially, abnormality of the circadian rhythm, including late meal timing, which is considered the core feature of NES requires more targeted treatment. In reported case of 42-year old male with NES chronotherapy and behavioral interventions were effective treatment. The review of the literature and the case report suggest that patient with NES could benefit from individualized treatment. Chronotherapy and behavioral interventions should be considered together with SSRIs as initial treatment of NES.

Circadian and CBT-I interventions for psychosis

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Objectives: Individuals suffering from psychosis experience numerous health difficulties, that significantly reduce their quality of life, among which sleep disturbances can be found. Insomnia, hypersomnia, circadian sleep-wake rhythm disorder and other sleep disturbances might hinder recovery and worsen occurring symptoms. Different types of sleep disturbances are reported in almost half of all patients experiencing the psychotic disorder. **Methods:** This presentation provides an overview of published studies and an analysis of programs involving CBT-I (Cognitive Behavioral Therapy for Insomnia) nonpharmacological methods aimed at prevention and treatment of sleep disturbances in patients experiencing psychosis. **Results:** Findings from analyzed studies show that CBT-I and chronobiological interventions for psychotic patients provide a moderate or large improvement in sleep architecture (sleep latency, total sleep time and night time wakings) in psychotic patients. Some studies demonstrated also the beneficial impact of CBT-I interventions for reducing anxiety, depression, and delusions, as well as improvement in the daytime functioning. **Conclusions:** Growing body of research supports the statement that patients with psychotic disorders with co-occurring sleep disturbances can benefit from non-pharmacological interventions as CBT-I. Taking into account that there is a close relationship between sleep disturbance and psychiatric symptoms CBTI and chronobiological interventions look promising in its effectiveness for treating sleep disturbances in people with psychotic disorders.

Acetylation of BMAL1 by TIP60 links positive and negative arms of the molecular circadian clock

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Many physiological processes exhibit circadian rhythms driven by cellular clocks composed of interlinked activating and repressing elements. To investigate this molecular oscillator, we combined genetic approaches and analyses of interactions of key circadian proteins with each other and with clock gene promoters. We show that transcriptional activators and repressors control BRD4-PTEFb recruitment to E-box-containing circadian promoters. During the activating stage of the circadian cycle, the lysine acetyltransferase TIP60 acetylates the activator BMAL1 leading to recruitment of BRD4 and the pause release factor P-TEFb, followed by productive elongation of circadian transcripts. CRY repressor proteins accrue during the repression phase of the circadian cycle, prevent TIP60 from acetylation of BMAL1 and thus repress BRD4-P-TEFb recruitment and productive elongation of circadian transcripts. We propose that the control of BRD4-P-TEFb recruitment is a novel temporal checkpoint in the circadian cycle.

Cyclin Dependent Kinase 5 (CDK5) Regulates the Circadian Clock

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Circadian oscillations emerge from transcriptional and post-translational feedback loops. An important step in generating rhythmicity is the translocation of clock components into the nucleus, which is regulated in many cases by kinases. In mammals, the kinase promoting the nuclear import of the key clock component Period 2 (PER2) is unknown. Here we show that the cyclin-dependent kinase 5 (CDK5) regulates the mammalian circadian clock via phosphorylation of PER2. Knock-down of *Cdk5* in the suprachiasmatic nuclei (SCN), the main coordinator site of the mammalian circadian system, shortened the free-running period in mice. CDK5 phosphorylated PER2 at serine residue 394 (S394) in a diurnal fashion. This phosphorylation facilitated interaction with Cryptochrome 1 (CRY1) and nuclear entry of the PER2-CRY1 complex. Taken together, we found that CDK5 is the kinase that drives nuclear entry of PER2, which is critical for establishing an adequate circadian period of the molecular circadian cycle. Therefore, CDK5 is critically involved in the regulation of the circadian clock and may represent a link to various diseases affected by the circadian clock.

Evolution without the Sun: Circadian Clocks and DNA repair in Blind Cavefish

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It is of course well accepted that the environment has a fundamental impact upon the evolution of organisms. At the molecular genetic level, the contribution of individual gene function to evolutionary change has been extensively studied. However, precisely how much more complex regulatory gene networks are shaped by evolution in response to different environmental conditions remains poorly understood. We have addressed this issue by studying a species that has evolved for millions of years in an extreme, constantly dark subterranean aquatic environment, namely the Somalian blind cavefish *Phreatichthys andruzzii*. By comparison with a normal, surface dwelling fish species, the zebrafish *Danio rerio*, we have explored two biological systems that are based on complex interacting gene regulatory networks: the Circadian Clock and DNA repair mechanisms. Our findings have revealed that evolution acts at multiple levels in both regulatory networks, resulting in a very specific loss of function of genes encoding light responsive regulatory elements. By this comparative study, we have also gained considerable new insight into the mechanisms whereby light is normally perceived by these two key physiological systems.

DNA Methylation and the circadian clock

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The circadian clock is regulated by many epigenetic processes. DNA methylation has been proposed as a new regulator of cellular circadian mechanisms. Here we have investigated how DNA methylation modulates light-entrainment, and the transcriptional and translational feedback loops (TTFLs) of the circadian clock. We studied the after-hours (*Afh*) circadian mice, which are characterized by a point mutation in the *Fbxl3* gene and lengthened circadian period and we observed specific changes in cell-cell coupling, which is accompanied by changes in light-dependent electrophysiological activity in the retina and abnormal *Opn4* expression. Furthermore, we observed an abnormal activity of the DNA methyltransferases (DNMTs) enzymes, along the retinal-hypothalamic tract and changes in genome-wide DNA methylation of the suprachiasmatic nucleus (SCN) of the hypothalamus. In an effort to investigate possible epigenetic control mechanisms behind these alterations, we identified a novel link between the transcription factor Rev-Erba, a core component of cellular clock loops, and *Fbxl3* that accounts for these epigenetic alterations. The results of this study help to understand the epigenetic landscape of the regulation of circadian rhythms.

Spontaneous peptidization of biogenic amino acids and circadian rhythm of certain peptidization processes

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In our studies on biogenic amino acids undertaken over ten years ago, we were the first ones who discovered their ability to undergo spontaneous oscillatory peptidization, when dissolved in aqueous or organic-aqueous solvents [1, 2]. Basic analytical technique used in our investigations was high-performance liquid chromatography (HPLC) hyphenated with different detection systems (DAD, ELSD, MS). With some of the investigated amino acids, a circadian rhythm of the oscillations was additionally discovered (*L*-proline, *L*-methionine, *L*-serine), which was not the case though with a number of other investigated amino acids. However, it is impossible to claim that at least some of the other investigated amino acids do not follow the circadian rhythm of oscillatory peptidization, because even the most advanced analytical tools available so far (with HPLC in the first instance) are far from being perfect and can easily overlook this phenomenon. Complementary investigations were carried out on the effect of heavy water (D₂O) on the oscillatory (and circadian) rhythm of peptidization with the selected amino acids, by replacing with it water (H₂O) in the employed mixed solvents. Similar to the recognized hampering the biological life processes by heavy water, spontaneous oscillatory peptidization of the targeted amino acids was also drastically hampered by D₂O. In these studies, we used mass spectrometry, scanning electron microscopy and turbidimetry as analytical tools, along with HPLC as the leading measuring technique [3-5]. References: [1] M. Sajewicz et al., *J. Phys. Org. Chem.*, 23 (2010) 1066-1073 [2] M. Sajewicz et al., *RSC Advances*, 4 (2014) 7330-7339 [3] A. Godziek et al., *Reac. Kinet. Mech. Cat.*, 123 (2018) 141-153 [4] A. Fulczyk et al., *Reac. Kinet. Mech. Cat.*, 125 (2018) 555-565 [5] A. Fulczyk et al., *Reac. Kinet. Mech. Cat.*, <https://doi.org/10.1007/s11144-019-01538-4>

The C Gene BMAL1 impact on the Survival and the Biological Mechanism of Nasopharyngeal Carcinoma after Radiotherapy

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Objective: To investigate the effects of clock gene BMAL1 on DNA damage, apoptosis and clinical prognosis of nasopharyngeal carcinoma (NPC) after radiotherapy. **Methods:** CCK8 assay, apoptosis and cell cycle were detected by flow cytometry. Clone formation assay was used to detect the effect of BMAL1 gene on the radiosensitivity of CNE2. WB was used to detect the expression level of downstream ATM gene protein in the cells of overexpression group. **Results:** The OS, PFS, RFS, DMFS in the high expression group of BMAL1 was significantly higher than that in the low expression group ($P < 0.05$). The results of cell cycle analysis showed that the proportion of S phase in BMAL1 overexpression group was lower than that in negative control group 24 hours after 8Gy irradiation ($P < 0.001$), BMA) and the G2 / M phase ratio was higher. The clone formation rate and survival score in the overexpression group of BMAL1 were lower than those in the negative control group ($P=0.042$), and the survival score was lower than that in the negative control group ($P=0.037$). **Conclusion:** The high surface of BMAL1 protein increases apoptosis and radiosensitivity by decreasing S phase ratio and increasing G2 / M phase block. At the same time, the interaction between BMAL1 gene expression and ATM pathway indirectly regulated the expression of downstream gene, suggesting that BMAL1 gene affects ATM pathway and its downstream gene expression.

Sexual aspects of morningness-eveningness

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Following previous studies, chronotype was related to sexual attitudes and behavior. Evening people tend to be more promiscuous, follow short-term mating strategies and extra-pair matings, which should lead to a higher reproductive success. In this study, one aim was to assess reproductive success directly by asking for children, and, second, to obtain a higher sample size for the analysis of sexual behavior and chronotype than in previous studies. $N=1843$ heterosexual persons (551 men, 1288 women, 4 without data) responded to our online survey on long-term relationship orientation. This study confirmed previous results about chronotype and sexual behaviour and provided evidence for reproductive success. Results were presented and related to previous work.

What keeps Narcissus awake late at night? Role of neuroticism in explaining chronotype in grandiose and vulnerable narcissism.

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Dark Triad's tendency toward eveningness is not a broad scientific field, some got even Ig Nobel Prize for this interest. Despite this humorous story chronotype indeed is an important predictor in human psychological health and wellbeing. Narcissism connections with morningness-eveningness were most inconclusive in previous studies, therefore our research aims to further investigate narcissism relationship with chronotype. There is an increasing consensus on the importance of distinguishing between grandiose and vulnerable narcissism. Little is known about their differentiation in chronotype. Recent findings suggest that vulnerable narcissism rather than grandiose narcissism is connected with more psychological problems. Most suspect that vulnerable narcissism strong connection with negative emotionality is responsible for those effects. Our study (N=234) showed that both narcissistic traits, together with neuroticism correlate with evening chronotype. Further regression analyses revealed that grandiose and vulnerable narcissism connection with chronotype is differently regulated by neuroticism. The inclusion of neuroticism explained the variance of vulnerable narcissism in the model, whereas for grandiose narcissism neuroticism behaved as a suppressor. Results of this study contribute to a deeper understanding of narcissistic traits and their consequences in daily life. For more, it adds rationale for the hypothesis that chronotype effects with more complex personality traits' are mediated through higher order traits such as neuroticism.

How do night owls get angry? - disentangling the relationship between trait anger and sleep time preferences

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An increasing amount of evidence indicates that evening chronotype is linked to many negative psychological outcomes such as heightened perceived stress, affective lability, behavioral dyscontrol and altered neural response to reward. In line with recent findings, these associations may have their foundation in so-called “social jetlag” defined as discrepancies between social and biological time - in sleep timing between work and free days. Such discrepancies are also found in the evening chronotype. The social jetlag was also shown to be a significant predictor of aggressive behaviours. However, although sleep time preference was reported to be associated with aggression, the relationship between chronotype and trait anger has been scarcely investigated. Trait anger is a strong positive correlate of negative emotionality and other characteristics that were found to be a domain of evening-type individuals, e.g. reward responsiveness and impulsiveness. Taking it all into account, the present research explored how trait anger is associated with individual chronotype. A total of 263 volunteer participants (50.2% females, age range = 18–49 years, mean = 23.3 ± 4.97 years) took part in the study. Subjects were asked to complete a set of self-report measures including subscale from a State Trait Anger Expression Inventory-2 (STAXI), Morningness-Eveningness Questionnaire (MEQ), Present Hedonism subscale from Zimbardo Time Perspective Inventory (ZTPI) and Positive and Negative Affect Schedule (PANAS). Consistently to our hypotheses, trait anger was positively related to evening chronotype. Importantly, this relation became insignificant when controlling for hedonistic orientation and Positive Affect subscale from PANAS, both of which were found to be associated with approach motivation - a key aspect of anger. Therefore, our findings enrich current state of knowledge on anger-chronotype relation shedding a new light on the role of anger’s motivational underpinnings in chronotype preferences.

Do you have enough willpower to rise early? Self-control and chronotype

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Research on chronotype has found that it is related to many life outcomes, e.g. emotional functioning, health, educational achievement. Similar outcomes are correlated with one of the Big Five traits – conscientiousness and also self-control – ability to inhibit prepotent reactions. Previous research has documented relationship between these constructs: morningness was positively correlated to both conscientiousness and trait self-control. In recent years, the most prominent model of self-control - strength model – was heavily criticized. Therefore, other explanations of self-control has been sought. One of them is a concept of lay willpower theories, i.e. believing that willpower is limited (as in the strength model) or unlimited. Present research aim to replicate findings on associations between chronotype, conscientiousness, trait self-control and explore associations between chronotype and willpower theories. Study involved 174 participants. Results confirmed that being morning-type is related to being more conscientious and having more self-control. Morningness was also positively associated with mental exertion aspect of willpower theories, but not with resistance to temptations aspect. Possible explanations of these relationships and probable direction of causation are discussed.

Chronotype differences in psychosocial adjustment among children and adolescents

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While a lot is known about the distribution and variability of chronotype in adolescents and adults, less studies focused on differences in chronotype in prepubertal children. Hence, the aim of the present study was to examine individual differences in circadian phase preference (“chronotype”) in relation to the psychological and psychosocial functioning in the group of Polish children and adolescents (N=1582, three levels of age: I - 6-8 years, II - 14-15 years, III - 18-19 years). Subjects were assessed with Polish version of Morningness–Eveningness questionnaire of Hörne & Ostberg. Three separate studies were conducted. The first study aimed to replicate previously observed associations between morningness–eveningness and sleep quality, depression, and anxiety. The group of 548 students (147, 201, 200 from I, II and III level of age, respectively) took part in the study. The Rhythm of Life Questionnaire, Athens Insomnia Scale, Pittsburgh Sleep Quality Index, Kraków Depression Inventory, Questionnaire of Mood, State-Trait Anxiety Inventory and State-Trait Anxiety Inventory for Children were used. Morningness was related to greater sleep quality displayed as well as sleep time but also in the others aspects of sleep like sleep continuity, sleep latency, morning mood, sleep effectiveness or sleep regularity. On the other hand, eveningness was linked with general higher anxiety (state and trait) and different aspects of depression tendency like sadness, attention difficulties or indecisiveness, apathy, suicidal thoughts and physiological symptoms. In the second study, the relationship between child circadian preference and mother’s chronotype as well as parental attitude was explored in the group of 347 students (113, 98, 136 from I, II and III level of age, respectively). The Scale of Parental Attitudes and My Family Questionnaire were used. Results showed that child and mother’s chronotype was related in the group of youngest children. It was also shown that mothers of children with evening chronotype showed less adequate expectations for children’s need of independence and presented greater disapproval to allow children to solve the problems by their own. Whereas morning students were perceiving their family as open, creative and flexible in communication that is promoting mutual trust. The main goal of the last study was to investigate differences in the school functioning of morning and evening chronotypes, particularly expressed in the perception of peers and teachers. Data were collected from 687 students (153, 211, 323 from I, II, III level of age, respectively), as well as their classmates and teachers. The rate of popularity among peers was measured by The Scale of Sociometric Acceptance while teachers completed short version of Devereux Elementary School Behavior. In some selected classes there was also investigated, whether the children with the same circadian preference more frequently chose each other. This expectation was confirmed for adolescents from the III level of age (evening oriented types were most popular and chose not only by evening colleagues, but also by other circadian oriented peers). Surprisingly, morning oriented students seemed to be more negatively perceived by teachers, but in fact this matter needs more investigation.

Peculiarities of the Clinical Course of the Osteoarthritis in Shift-Workers: Analysis of Clinical Data and Questionnaires

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Chronic desynchronization is an important factor of progression of osteoarthritis in shift workers. 80 patients with primary osteoarthritis (female:male ratio = 3:1, average age: 57,6 years, average disease duration: 6,4 years, radiological stage: II-III) were examined, 42% reported systematic night shift-work for more than 2 years. Full clinical examination was performed, all patients filled in SF-36, WOMAC questionnaires, marked visual analog scales for estimation of pain intensity and general well-being. Patients who had been exposed to night work had significantly worse clinical course of osteoarthritis marked by more (27,5%, $p < 0.05$) extensive pain syndrome, especially at night hours, (10.00 pm-2.00 am period) and estimated life quality as poorer comparing those working at day time. Osteoarthritis initiation occurred at earlier age in them comparing those who worked in non-shifted regimen. They showed a trend to generalized affliction of a bigger quantity of joint groups, higher frequency of synovitis as well. Shift-workers administered higher doses of non-steroid anti-inflammatory drugs (NSAIDs) and estimated their effect as lower (39,6% average daily relief vs 62,5% in non-shift workers after 10 days of regular application of therapy). Frequency of chronic NSAID-induced gastropathy was 25% higher among night-workers. Shift-workers are predisposed to a worse course of osteoarthritis with marked clinical symptoms, requiring higher doses of NSAIDs and with an inclination towards a bigger frequency of complication. That should be kept in mind while developing individual treatment and secondary prophylaxis strategy.

Hemodynamic and autonomic parameters dynamics during Total Sleep Deprivation in relation to clinical spectrum of hypertension

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The aim of the study was to examine the influence of total sleep deprivation upon hemodynamic and autonomic parameters in 3 subgroups divided based on the clinical spectrum of hypertension at 24, 28, and 32 h of total sleep deprivation (TSD). N=30 otherwise healthy, male participants underwent physical examination and were divided into 3 subgroups: normotensive, pre-hypertensive, hypertensive (age: 31.2 vs 33.5 vs 36.8 years; BMI: 25.2 vs 29.0 vs 26.4 kg/m²). Hemodynamic and autonomic parameters were automatically measured at rest and in a tilted position with a Task Force Monitor. Mixed models with random effects based on two-way ANOVA was used to analyse the parameters' dependence on the time and the group. One-way ANOVA or Kruskal–Wallis test were used to detect differences between subgroups in each time point. Significant interactions of time x subgroup were observed in the normotensive vs hypertensive group at the 32-h of TSD in the sBP (116.2 at baseline vs 120.8 at the 32-h in contrast to 148.5 at baseline vs 140 mmHg, respectively, $p = 0.0006$), cardiac output (6.6 at baseline vs 7.3 at the 32-h in contrast to 6.1 vs 5.4 l/min, respectively, $p = 0.04$). In the hypertensive subgroup, increased delta changes in response to the tilt in HR were observed (11.7 at baseline vs 14 bpm at the 32-h, $p = 0.006$). In the pre-hypertensive group increased vagal outflow indicated by increase of high frequency HRV ($p = 0.02$) and by decreased HR ($p = 0.03$) was observed in the 28-h. In conclusion, changes in hemodynamic parameters during sleep deprivation depend on the clinical spectrum of hypertension and duration of TSD. What is important, a decrease of sBP and dBP during the TSD was noted in pre-hypertensive group after 24, 28-h TSD and in the hypertensive group after 32-h TSD.

Social jet lag may predict suicidal behaviours among students of medical faculty and psychology

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Introduction. Social jet lag (SJL) is defined as a misalignment between biological and social time. It has been associated with increase in alcohol and psychoactive substances consumption and cardiometabolic risk. **Aim.** To assess SJL as a predictive factor of suicidal behaviours among student of medical and psychological faculties in context of the season, psychoactive substances intake and general mental health. **Materials and methods.** 290 students were recruited (N=166 of medical faculty and N=123 of psychology) from February to July 2018. Their task was to complete a set of questionnaires: Suicidal Behaviours Questionnaire (SBQ-R), General Health Questionnaire (GHQ-28), assessing presence of somatization symptoms (A), anxiety and insomnia (B), daily dysfunction (C) and depressive manifestations (D); Alcohol Use Disorders Identification Test (AUDIT) and authors' questions concerning consumption of coffee, energy drinks, drugs use and typical hours of sleep on workdays and free days (to calculate SJL). Subjects who declared use of alarm clock on free days were excluded from the study (N=171 students in the final analysis). A linear regression model was constructed for prediction of severity of suicidal behaviours, i.e. SBQ-R score. **Results.** SJL correlated with severity of suicidal behaviours ($R=0.168$; $p<0.05$). The determination coefficient for the model was $R^2=0.654$. SBQ-R score was predicted by GHQ-D score ($\beta=0.719$, $p<0.001$), GHQ-C score ($\beta=-0.203$, $p<0.001$), use of amphetamine ($\beta=0.094$, $p<0.05$). Two interactions were diagnosed: between day of study and SJL ($\beta=-0.194$, $p<0.05$) and between day of study and GHQ-D ($\beta=0.187$, $p<0.05$). No other statistically significant association was found between variables of interest. **Conclusions.** Seasonal change in severity of suicidal behaviours may depend on desynchronization between social and biological circadian rhythm. High SJL may be a suicide risk factor, particularly at the turn of the winter (time of the end-of-term exams), among students of medicine and psychology.

Age and Experience Related Changes in ECG of Truck Drivers

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The purpose was to reveal the age and experience related changes in ECG of truck drivers working within Europe. Methods. Electrocardiogram was registered during 5 minutes in truck drivers (47 men 28-69 y.o., $M \pm m$: 50 ± 2 ; work experience 8-50 years, $M \pm m$: 29 ± 2 ; driver experience 3-47 years, $M \pm m$: 27 ± 2 ; night work experience 0-45 years, $M \pm m$: 17 ± 2 ; intensive night work experience 0-30 years, $M \pm m$: 6 ± 1) using computer based system. Pearson correlation was used at $p < 0,05$. Results. With an increase in the age and experience a decrease in QRS electrical axis tilt in the frontal plane ($-17^\circ \dots 99,6^\circ$, mean: $29,6^\circ$) and an increase in P and PQ interval duration were found. With an increase in the intensive night driving experience a decrease of P-wave angle in the frontal plane was revealed. Difference between max and min RR-interval duration, SDNN, RMSSD, pNN50, CV, HRVTi, TP, VLF, LF, HF decreased, while mode amplitude and stress-index increased with an increase in the age and experience. With an increase in night driving experience the heart rate slowing and its mode increase were revealed. With an increase in the intensive night driving experience an increase in LFnorm, LF/HF and IC at HFnorm decrease were found, evidencing the relative increase in sympathetic regulation and decrease in parasympathetic effects. Conclusions. Age and experience related shift of heart electrical axis from normal towards horizontal position could be caused with an obesity development in truck drivers as a result of systematic disturbances of daily regime of sleep and meal taking. Delay in excitation conduction in the auricles and atrioventricular node evidences the risk of pathology development. Intensive night driving experience potentiates the development of sympathetic augmentation and parasympathetic attenuation that is the known risk factor of heart preservation decrease. Hence, truck drivers working night hours need preventive measures to maintain health.

Workability and Wellbeing in International Truck Drivers: Effects of Night Work

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The purpose was to reveal the effects of night work on workability and wellbeing in long-distance truck drivers working within Europe. Methods. Heart rate (HR), blood pressure (BP), static balancing (SB), workability (WA), anxiety and felt wellbeing (FW) were studied in 2 groups of drivers: (1) working day and night hours (35 men 29-65 y.o., $M \pm m$: 49 \pm 2), (2) working only day hours (14 men 29-66 y.o., $M \pm m$: 49 \pm 3). Pearson correlation was applied. Results. Truck drivers evaluated their WA quite good (within 0-10 scores overall WA: 9,1 \pm 0,2; within 1-5 scores physical WA: 4,2 \pm 0,1, mental WA: 4,3 \pm 0,1, social skills WA: 4,5 \pm 0,1). Both overall and physical WA were lower in night workers compared to day workers ($p < 0,05$), physical WA decreased with night experience increase ($r = -0,43$, $p < 0,01$). FW was better than age standards: for 10 years – in night workers, for 20 years – in day workers. Night workers showed tachycardia (HR=81 \pm 2 beat/min), day workers - norm HR (75 \pm 3 beat/min). Drivers of both groups showed high norm BP (139 \pm 3/87 \pm 2; 136 \pm 3/86 \pm 2 mm Hg). BP diastolic decreased with night experience increase ($r = -0,33$, $p < 0,05$). SB in night workers was better compared to day workers (28 \pm 6, 13 \pm 6 sec, $p < 0,05$) and increased with night experience increase ($r = 0,31$, $p < 0,05$). Subjects of both groups showed the temperate anxiety. Night workers manifested lower vigilance and higher susceptibility ($p < 0,05$), often complained of difficulty concentrating and needs to use herbal teas ($p < 0,01$). Conclusions. Irrespectively of quite good WA and FW in truck drivers, night work potentiates the decrease in workability, BP diastolic, tachycardia development, increased complaints including difficulty concentrating, which affects safety. Improved blood supply to the brain (increased SB) could reflect night work adjustment for the account of sympathetic augmentation (tachycardia) which does not guarantee the heart safety. To maintain health and safety of truck drivers working at night, preventive measures are needed.

Body composition and blood pressure change by reminding young adults to eat breakfast and to avoid night snack

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Background: Irregular meal habits (e.g. breakfast skipping, nighttime eating) are prevalent in young adults and college students in Taiwan. Objective: This randomized controlled intervention aimed to evaluate the influence of meal recommendations on young adults' and college students' body composition and blood pressure. Methods: Young adults recruited based in a university from Aug 2016-Jul 2017 (n=125) were randomized into 3 groups, every group receiving one of the following meal recommendations: (a) regular breakfast (eating within 2 hours after waking up), (b) no nighttime snacking (after 9PM or within 4 hours before sleep; water intake is not restricted), and (c) both regular breakfast and no nighttime snacking. Participants were asked to join a Facebook club that posted up-to-date research related to the health effects of breakfast or nighttime snacking, corresponding to their intervention assignment. The participants' body composition and blood pressure were measured before randomization and 1 year later. Results: In total, the average fat free mass increased by 0.36 kg in a year, and diastolic blood pressure increased by 2.54 mmHg. The increment in diastolic blood pressure was higher in the group receiving breakfast recommendation and in the group receiving avoiding night snack recommendation, compared to the group receiving both recommendations. Other significant findings were in subgroups that the lack of avoidance of night snack was associated with a greater body weight gain in women and in adults with high physical activity level. In addition, in the low PA group, trunk fat% decreased in groups receiving breakfast recommendation and increased in group receiving recommendation to avoid night snack. This suggest that the fat at the trunk was affected by the meal recommendation for physically inactive people. Conclusion: This study suggests the effectiveness of meal recommendations on young adults' body composition and blood pressure.

Effects of chronotype and time of day on mood responses to CrossFit training

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Morningness-eveningness, time of day, and physical exercises have been shown to influence mood states. Two studies aimed to test whether impact of physical exercise on mood depends on time of day and chronotype. In the first study, ninety-four participants (age 32 ± 6 years; 34% females; weekly training volume 4 ± 1 hours) filled the Composite Scale of Morningness and reported their current mood using the UWIST Mood Adjective Checklist before and after a 60-minute long CrossFit training session which took part in the morning (beginning at 6:30 or 7:45) or in the evening (beginning at 19:30 or 20:45). In this quasi-experiment the measurements were taken by the occasion of the participants' usual training, in their preferred hours. There were only a few evening-types in the studied sample, while morning and intermediate chronotypes were over-represented. Participation in CrossFit training resulted in mood improvement consisting of increase in energetic arousal and hedonic tone and reduction of tense arousal all significant at $p = 0.001$. Furthermore, CrossFit training during morning hours boosted energetic arousal in the intermediate/evening chronotype group to the levels observed in morning chronotypes. The second study (conducted on a sample of $n=33$ athletes) applied a repeated-measurement design, with the same CrossFit athletes performing their trainings and reporting their moods both in the morning and in the evening. In that study, the mood elevation effects were similar to those obtained in study 1, however the chronotype*time of day interaction effect was observed for another mood dimension, namely: hedonic tone. We conclude that participation in intense physical exercise, such as CrossFit training, may allow compensation for the negative effects of non-optimal time of day on experienced moods, particularly in the case of neither/evening-types.

Personalized Response of Glaucoma Patients to Melatonin Administered to Ameliorate Disrupted Circadian Rhythms

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Objectives. Body temperature (BT) and intraocular pressure (IOP) circadian rhythms were found to be specifically compromised in patients with stable (S) or advanced (A) primary open-angle glaucoma (POAG). The present study aimed at investigating whether such changes can be reversed by daily melatonin ingestion. **Methods.** BT and IOP were measured for 3 days, each at 3, 8, 11, 14, 17, 20, 23-h before and after 3-months of melatonin (*Circadin*, 2mg) administration at predefined time (22:30) in patients with S-POAG (n=65, mean age 67.6 ± 7.6); and A-POAG (n=50, 69.9 ± 8.2). **Results.** Melatonin affected BT circadian rhythm depending on both time and group with significant time*group interaction ($p=.0005$). Due to the time-dependent effect, melatonin increased BT circadian amplitude and percentage rhythm in S-POAG ($p<.001$), but not in A-POAG group. Melatonin provided a greater gain in 24-h BT amplitude in those with higher initial depression (BDI, Beck Depression Inventory) score ($p=.01$). Melatonin also affected IOP depending on time and group with significant time*group interaction ($p<.0001$). IOP decreased (IOP \downarrow) most prominently at 17 and 20 h, i.e. shortly before melatonin ingestion, pointing to indirect mechanisms realizing the IOP \downarrow . Melatonin restored a dampened (by comparison to healthy peers) 12-h rhythm, though only in the S-POAG group. Overall IOP \downarrow was greater in A-POAG group (24h mean IOP \downarrow : -1.6 ± 1.2 vs. -0.99 ± 0.90 in S-POAG, $p=.002$). Degree of IOP \downarrow under melatonin also correlated with initial phase angle between BT and IOP 24-h rhythms and with 24-h amplitude IOP% (relative to mean) ($r=.371$; $p<.0001$): IOP \downarrow was greater in those with lower IOP% 24-h amplitude, indicating that melatonin provided better IOP \downarrow in those with more compromised IOP circadian rhythm. **Conclusions.** Benefits of melatonin administration in POAG patients depend on individual circadian rhythms parameters.

Dynamics of changes in heart rate variability after prolonged exposure to dark

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Aim was to evaluate the influence of long exposure of dark on heart rate variability (HRV) in young people. This method is currently used in psychology with an improvement of mental health in people under constant stress. So far, no evidence of changes in autonomic nervous system function were measured after a long term stay in the dark. 29 students (19 to 26 years) were placed into a room with max. darkness for 96 h. The room met all the requirements for stay, (quiet, socially isolated place). The participants received food and drinks without using of any device emitting light or showing the actual time. Orthostatic test was used for measuring power LF, HF and LF/HF ratio. The first measurement was performed the day before starting the therapy, next measurement was taken 30 minutes after completing the session, followed by two more measurements in the fourth and the seventh day after exiting the chamber. The power HF showed a significant change between the first and the second measurement (increasing activity of HF) in the horizontal position ($p \leq 0,05$), with a similar trend observed during consecutive measurements. The LF/HF ratio pointed non-significantly to a modulatory influence of sympathetic and parasympathetic nervous system during the test. 96 h. of therapy and subsequent time disorientation likely influenced the parasympathetic nervous system regulation after completing the therapy. This discovery was further supported by a lowered heart rate which can also affect cardiovascular system.

Morningness-Eveningness and well-being association: the role of Time Perspectives

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Recently Drezno, Stolarski and Matthews (2018) showed that personality traits may act as mediators in the relationship between chronotype and life satisfaction. However, in their study consciousness and emotional stability accounted only for 34% of the effect, and the association remained significant after controlling for these personality features. Thus, some other possible mediators are plausibly responsible for said relationship. In the present study we draw upon research demonstrating vital associations between Morningness-Eveningness (M-E) and Time Perspectives (TPs) and the fact that TPs were shown to be powerful predictors of subjective well-being. In our study, conducted on a substantial sample of adults (n>500) we replicated effects obtained by Drezno et al. (2018) – emotional stability and consciousness partially mediated the morningness-satisfaction association. However, after Past-Negative and Future-Positive TPs were introduced to the model the mediating effects of personality traits were no longer significant. Moreover, the mediation model comprising the two TP's as mediators explained more than 80% of the effect, leaving the chronotype – well-being association no longer significant. We conclude that elevated levels of Future-Positive and lesser Past-Negative, characteristic for people with elevated morningness, may be the key factors responsible for the well-established positive link between morning preference and greater life satisfaction.

Can chronotype and social jet lag predict burnout among physical therapists?

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Burnout syndrome can be described as a set of psychologic and somatic responses to chronic stress resulting from professional work. The aim of this study was to verify whether chronotype and social jetlag are predictors of burnout symptoms among physical therapists. The studied sample consisted of 61 physical therapists from Central Poland. The variables of interest included raw results of psychometric tools: Link Burnout Questionnaire (LBQ), Chronotype Questionnaire (CQ), Pittsburgh Sleep Quality Index (PSQI); and authors' questions concerning the age of the participant, coffee, energetic drinks and alcohol consumption per week and data required to calculate pack/years of smoking and SJL. Linear regression models were constructed for prediction of the LBQ dimensions scores. Rise in Psychophysical exhaustion score was associated with fall in CQ Morningness-Eveningness (ME) score, rise in CQ Distinctness of the rhythm (DI) score and fall in SJL. Also, the score was higher for subjects who described their sleep quality in PSQI as fairly bad compared to those who assessed it as very good. An interaction was diagnosed between SJL and ME. Rise in Sense of professional ineffectiveness was predicted by fall in SJL. Association between chronotype or SJL and Relationship deterioration was no statistically significant. Rise in Disillusionment score was associated with rise in DI score and PSQI Sleep disturbances score of two compared to those scoring zero. Eveningness predicted high Psychosocial exhaustion as a dimension of burnout syndrome, but only in presence of high SJL. High distinctness of the rhythm was associated with high burnout indices in two dimensions. Thus, both chronotype and SJL may prove useful risk factors of certain aspects of burnout among physical therapists, but should be considered together.

Are the evening owls more prone to develop asthma/allergic symptoms than the morning larks?

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Background: Asthma and other allergic diseases are known to follow circadian rhythmicity, whether these are associated with individual circadian preference/chronotype (CT), has not been explored systematically. Objective: We aimed to estimate the association between allergic responses and chronotype among adolescents. Methods: From the database of the Prevalence and Risk Factors of Asthma and Allergy-related Diseases among Adolescents (PERFORMANCE) study¹, we took the data of 1680 Indian adolescents (aged 13-14 years) among whom estimated the prevalence of asthma, wheeze, rhinitis, and rhinoconjunctivitis by administering the English-back Bengali version of the International Study on Asthma and Allergies in Childhood (ISAAC) questionnaire. We estimated the chronotypes of the adolescents using a validated Bengali-translated version of the reduced Morningness-Eveningness Questionnaire (rMEQ)² and were categorized into morning (MT), evening (ET) and neither types (NT). Results: Among the participants, 9% belonged to ET while 49 and 42% were NT and MT, respectively. Compared to the non-asthmatics, asthma was more prevalent among the Evening-types (8% vs. 18%) and neither-types (48% vs. 59%) but not among the morning-types (44% vs. 23%) (chi-squared $p < 0.001$). Similarly, participants with a lifetime history of rhinitis was higher among the ETs and NTs than those without rhinitis. In logistic regression models taking NTs as the reference category and adjusting for sex and parental atopy/asthma, ETs had higher odds of having asthma [aOR: 1.9; 95%CI: 1.2-3.2] and lifetime history of rhinitis [aOR: 1.7; 95%CI: 1.1-2.7]. Conclusion: Evening owls are more prone to develop asthma/allergy than the morning larks. References: 1. Bhattacharjee S, et al. Prevalence and Risk Factors of Asthma and Allergy-Related Diseases among Adolescents (PERFORMANCE) study: rationale and methods. ERJ Open Research 2018. 2. Haldar P, et al. Chronotype assessment of the Bengalese adolescents: an observational study using a Bengali version of the reduced Morningness-Eveningness Questionnaire (rMEQ). Biological Rhythm Research 2019.

Why do evening people think they are smart?

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The current study examined the relationship between chronotype, objectively assessed intelligence and subjectively assessed intelligence. The extant research indicates that there is null or weak association between chronotype and objective intelligence, typically with evening people scoring slightly higher on IQ tests. On the other hand, morning type is usually associated with higher conscientiousness, lower neuroticism and generally higher well-being comparing to evening type. It has been shown that subjectively assessed intelligence manifests similar to morningness pattern of associations. However, the results of the current study (n = 255) revealed, paradoxically, that evening people perceive their intelligence higher than morning people. Furthermore, they tend to overestimate their intelligence, because the relationship between eveningness and subjective intelligence holds after controlling for objective intelligence measured with standard tests. Subsequent analyses revealed that grandiose narcissism mediates the relation between eveningness and subjective intelligence. Thus, it seems that evening individuals demonstrate positive illusions about their intelligence.

Photoperiodism in dwarf hamsters (Genus *Phodopus*) – effects of circadian rhythm disturbances and geographic origin

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At northern latitudes, animals are faced with dramatic seasonal changes in their natural habitats. Particularly in winter time, they must cope with harsh climatic conditions and food shortage. Part of animals exhibits endogenous circannual rhythms which are synchronized by the photoperiod. Others use seasonal changes of the photoperiod as an external cue to be prepared in time for adverse environmental conditions. In Djungarian hamsters, various morphological and physiological changes can be observed. The body mass is highest in summer and ~44 % lower in winter, smaller animals then needing less food energy despite their higher metabolism to body mass ratio. The hamsters have a very dense winter fur, to compensate the increased temperature loss. Also, they increase their thermogenetic capacity and the efficiency of thermoregulation. By the end of summer, Djungarian hamsters cease their reproduction until next spring. These seasonal changes are controlled by the photoperiod and can be observed also in the laboratory at room temperature. However, a functioning circadian system is essential. Arrhythmic hamsters and those with a compromised ability to entrain their circadian rhythms to the LD cycle do not respond to changes of the photoperiod. Similar changes can be observed in the closely related Campbell hamster. However under seminatural conditions, when animals were kept in cages though under naturally changing photoperiod and environmental temperature, they showed a delayed response compared to Djungarian hamsters despite of a similar critical photoperiod obtained in the laboratory. Presumably for Djungarian hamsters, photoperiod is a sufficient cue as photoperiodic changes closely correlate with seasonal climatic changes in their natural habitat. Campbell hamsters on the other hand inhabit regions with more variable climatic conditions. As a consequence, they must consider not only changes of photoperiod but also of environmental temperature.

Seasonal changes in sleep habits in children of Northern Russia.

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The objective of our study was to measure excessive sleepiness for upcoming studies in Russian-speaking children, using the Pediatric Daytime Sleepiness Scale. The following tasks were resolved in our study: translation, validation and analysis of psychometric properties of the Russian version of the Pediatric Daytime Sleepiness Scale (PDSS-RUS) by classic theory tests. After the linguistic validation of the PDSS-RUS with a multi-step translation methodology we conducted its psychometric validation. A total of 400 children aged 7-12 years (44.8% boys) of public elementary schools located North Russia completed the PDSS-RUS and Munich Chronotype Questionnaire Test to estimate sleep parameters in the classroom during the official sessions. Response rate was 90 %; excluded cases contained no data. Further, 20% completed the PDSS-RUS in 3 months interval to evaluate the test-retest reliability. Cronbach's alpha coefficients were calculated to examine internal consistency, confirmatory factor analysis (CFA) was used to test factorial validity, whereas concurrent validity and test-retest reliability were examined via intra-class coefficient. Internal consistency of the PDSS scale in the full sample was high (Cronbach's $\alpha = 0.8$). The construct validity of the PDSS-RUS was supported by classical test theory (factor loadings from confirmatory factor analysis [CFA] = 0.438 to 0.727) and the test-retest reliability demonstrated by the intra-class coefficient was 0.76. The total PDSS-RUS score was independent of sex and normally distributed. The mean total value of PDSS-RUS was significantly different for summer and winter. Higher scores on PDSS were negatively associated with sleep duration. We conclude that the construct validity of the PDSS-RUS remains is reliable and could be used for Russian-speaking youth samples in the evaluation of daytime sleepiness.

Seasonal Effects upon Healthy and Obese Adults with Particular Reference to Selected Hormones and Lifestyle

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The biological significance of the seasonal and daily environmental rhythms has long been appreciated. Humans, like other organisms, have evolved an internal timing system that consists of self-sustained oscillators that are reset by various synchronizers. The light-dark cycle is a key agent for the entrainment of the body clock to the periodic environment. Cortisol and melatonin secretion provides diurnal and seasonal photoperiodic information to the organism and shows seasonal changes. It has been demonstrated that short photoperiods contribute to seasonal affective disorder, which is associated with increased appetite, sleep disturbances and hypercortisolism. Seasonal changes may affect individuals' feeding habits and other activity. In humans living in modern societies, the impact of seasonality has somewhat diminished, after the introduction of artificial lighting and heating and air-conditioning systems, which reduce exposure to fluctuations in ambient temperature and light. However, ignoring completely seasonal changes may cause an increased risk of mismatches between artificial indoor conditions and endogenous rhythms, and these misalignments may lead to alterations in metabolism and thermoregulation that promote obesity.

Seasonal differences of melatonin concentration and clock gene expressions in obese men

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Obesity is a significant health problem in the world and it has been rapidly increasing over the past decades. Obese people have an increased risk factors for developing cardiovascular, renal, and hormonal diseases and sleep disorders. These incidences were increased in winter season in cold environmental temperature and during short days. We investigated the seasonal differences of melatonin concentration and clock gene expressions in obese men. We measured saliva melatonin concentration by ELISA; the clock gene expression of Clock, Bmal1, Per1, Cry2, Rev-erb- α and Rev-erb- β by real-time PCR. In the results, melatonin concentrations during sleep in obese subjects were significantly lower than those in non-obese subjects in the winter; clock gene expressions of Bmal1, Per1 and Rev-erb- β were significantly decreased in obese men than those in non-obese men. Bmal1 and Rev-erb- β were also significantly decreased more in winter than those in summer. It is suggested that seasonality has the important aspect of the circadian clock system in men.

Circadian Rhythms and Seasonality in Our Own Species and Animal Models

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Drosophila melanogaster and our own species share the history of relatively rapid out-of-Africa dispersal. In Eurasia, they had faced a novel adaptive problem of adjustment of their circadian rhythmicity and night sleep episode to seasonal variation in day length and air temperature. Hot summer temperature belongs to the most powerful natural factors causing the profound disturbances of the human sleep-wake cycle. In our epidemiological study of month-to-month variation in sleeping problems (Putilov, 2017, 2018), more than a half of native residents and newcomers of a region with hot summer temperatures reported a rise in summer months of each of four studied symptoms of sleep disturbance (daytime sleepiness, difficulties falling and staying asleep, and premature awakening). Such a response differed from the responses observed in northern regions where only three of these symptoms increased in winter or summer months. In *Drosophila* too sleep pattern is very sensitive to heat. It is usually reorganized by thermal stress in a way that is very similar to response of human sleep-wake pattern to heat, i.e., nighttime sleep and daytime activity are decreasing whereas daytime sleep and early night activity are increasing. Therefore, it is enticing to utilize this animal model for exploring circadian sleep-wake behavior under hot temperature. We documented the circadian patterns of sleep in bi-directional female and male crosses between two strains (Canton-S and Harwich) kept at 20°C and 29°C. The results confirmed the existence of remarkable similarity between responses of human and fly sleep-wake patterns to thermal stress. Additionally, they suggested significant differences between cross directions in the sleep-wake patterns and their responsiveness to thermal stress. We recommended such an animal model for experimental exploration of the genetic underpinnings of the mechanisms underlying responses of an organism to summer-induced rise of ambient temperature.

Exploring the role of midpoint sleep in the context of work psychology.

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A substantial gap exists in the literature regarding the associations between chronotype, social jetlag and well-established constructs from work and organizational psychology area, such as burnout, work engagement or organizational citizenship behaviour (OCB). Therefore, the aim of this presentation is to report the initial associations between aforementioned constructs, drawn from an exploratory study in which 247 employees took part. Burnout was measured with Copenhagen Burnout Inventory, work-engagement with Utrecht Work Engagement Scale and OCB with Organizational Citizenship Behaviour Questionnaire, whereas midpoint sleep and social jetlag were measured with Munich Chronotype Questionnaire. Conducted regression analyses, controlling for age and gender, showed adverse associations between later midpoint sleep and OCB, as well as one of the subscales of work engagement, namely: dedication. In addition, later midpoint sleep predicted greater burnout, particularly in its work-related subdomain. The magnitude of social jetlag predicted lower OCB, however the effect was no longer significant when midpoint sleep was introduced into the model. The present results provide initial evidence that chronotype may be a vital construct in the field of work and organizational psychology.

Effect of low-frequency electromagnetic radiation emanating from base transceiver station (BTS) might affect sleep quality and rest-activity rhythm in humans

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In the current study, we evaluated the effects of low-frequency electromagnetic radiation (LF-EMR) from mobile phone base transceiver station (BTS) on sleep quality (SQ) and rest-activity rhythm (RAR) in humans. We selected two BTSs that include one Ground Based Tower (GBT) and another Roof Top Tower (RTT). We identified four zones, i.e., Inter-Tower (A), 0-150 m (B), 150-300 m (C) and 300-500 m (D) around those towers. We had 1303 subjects (Mean age = 35 ± 0.34 y) with the following zone wise distribution: Zone 1 [N = 237], Zone 2 [N = 340], Zone 3 [N = 296], and Zone 4 [N = 295]; and 135 subjects as controls from an area without BTS installation. We measured electric field strength using NBM-550 instrument with probe EF0-391 at each subject's residence. We assessed sleep quality (SQ) of all subjects using Pittsburgh Sleep Quality Index (PSQI) and rest-activity rhythm (RAR) of 50 subjects using Actiwatch device. Data were analyzed using SPSS version 20.0. Cosinor Rhythmometry technique was used for the time series data. Results of ANOVA demonstrated statistically significant differences in E-Field strength among different zones. A significant effect of LF-EMR was validated on sleep variables, such as sleep inertia on work days & free days, average weekly sleep duration, mid sleep on work days & free days, duration of sleep, sleep disturbance, day dysfunction due to sleepiness, overall sleep quality, and PSQI total. Further, all subjects exhibited statistically significant circadian rhythm in rest-activity, irrespective of the zones. We found that LF-EMR produced statistically significant effect on rhythm parameters, such as amplitude, acrophase, circadian quotient, and amplitude as percent of Mesor. We concluded that radiation from mobile towers might modulate SQ and RAR of subjects inhabiting around the BTS. However, further confirmatory studies are warranted involving more subjects living near more BTSs.

Sleep assessment during shift work in Korean firefighters: a prospective observational study

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Background: This prospective observational study assessed the sleep quality with the ActiGraph and investigate the relationship between the parameters of sleep assessment and the type of shift work in Korean firefighters. **Methods:** The subjects were 363 firefighters: 65 day workers (control group) and 298 shift workers (shift work group: 77 3-day shift, 72 6-day shift, 67 9-day shift, and 82 21-day shift, respectively). Sleep assessments were performed with the ActiGraph (wGT3X-BT) for 24 hours during day shift (control and shift work group) and night shift and rest day (shift work group). The subjects recorded bed time and sleep hours during measurement period. This research was supported by the Field-oriented Support of Fire Fighting Technology Research and Development Program funded by National Fire Agency (“MPSS-Fire safety-2017-87”). **Results:** Sleep efficiency, time in bed, and total sleep time were lower in shift work group than control group ($p < 0.05$). Sleep efficiency was decreased in night shift and increased in rest day, whereas wake after sleep onset (WASO) was increased in night shift and decreased in rest day ($p < 0.05$). Among shift work groups, sleep efficiency of 6-day shift was higher in day shift, and sleep efficiency of 21-day shift was lower in night shift than other shift groups ($p < 0.05$). **Conclusions:** We found that the sleep quality in night shift of shift work group was poorer than control group. As to the type of shift work, sleep quality was good in 6-day shift and poor in 21-day shift. So fast rotating shift like 6-day shift may be recommended to improve the sleep quality of the firefighters.

Model-based simulations of weekday-weekend shift in sleep times debunk the myth of weekend catch-up sleep

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People work a week of long hours due to early wakeups. It is natural that they want to catch up on their sleep on the weekend. Therefore, when the Friday-Saturday night comes, they sleep as long as they need. To our surprise this belief in extension of sleep on the weekend for compensating its reduction during the preceding weekdays has never been supported with simulations based on a circadian rhythm model. Our modified version (Putilov, 1995) of the two-process sleep-wake regulating model (Daan et al., 1984) was applied in the present simulation study to answer the question “Can people catch up on sleep during weekends?” Sleep times reported in the literature for 250 samples with mean ages varying from 0.5 to 60 years were averaged and simulated with this model. Weekend risetime and bedtime and weekday risetime were utilized as initial times of the model. The simulation accurately predicted amount of advance of weekday bedtime and the extent of reduction of weekday sleep duration. The result suggested that, in the typical condition of weekly alternation between 5 weekdays and 2 weekends, people simply are not able to sleep on the weekends longer than normal and that the reduction of weekday sleep cannot be translated into a longer sleep and delayed risetime on the weekends. It was concluded that the model-based simulations debunked the myth of weekend catch-up sleep.

Methods and analytical tools for chronobiologic investigations

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Analysis of biological systems is increasingly dependent on understanding the rhythmic structures inherent in the system. A diverse network of oscillating processes and chemicals coordinate biological systems to maintain synchronization with cycles in the natural environment: processes as diverse as sleep, memory consolidation, cell repair, body temperature, blood pressure, and gene expression. CATkit, a package of rhythm analysis software is now available to map individual and population rhythm parameters and to compare them among two or more populations. CATkit is a free, open source program, built in R, and available on CRAN. R packages can run on any system: PC, Mac, Unix. CATkit offers flexibility to study multi-frequency rhythms, from ultradians to circadians and infradians, as separate components or as more complex models. Since cosinor rhythmometry is based on least squares, CATkit can handle missing or non-equidistant data and also has the capability to analyze non-stationary time series. The software capabilities will be illustrated in relation to two different areas that are currently in the forefront of medical research. One application deals with ambulatory blood pressure monitoring: abnormal circadian variability, assessed in the light of time-specified reference standards qualified by gender and age, is shown to be associated with an increase in adverse cardiovascular outcomes; benefits from personalized chronotherapy will also be documented. Another application deals with effects of time-restricted feeding: restricting caloric intake to part of the 24-hour day has been shown to make the difference between life and death in mice and to have different effects on body weight in humans; differential relative phase shifts among different variables may be part of mechanisms underlying physiological effects. In both applications, CATkit offers a rigorous (statistical) assessment of rhythm alteration, within physiological range, that enables the institution of prophylactic measures before overt disease becomes manifest.

Composite Scale of Morningness: results of adaptation into Ukrainian

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The Composite Scale of Morningness (CSM) was translated into Ukrainian using parallel blind method, and the agreed final version of the scale was put into the google-form with the help of which all the data were collected. The participation in the study was voluntary with possibility to receive individual results on email. Participants were 776 Ukrainians living in different regions of Ukraine and abroad (24% males) aged between 15 and 65 ($M = 24.79$, $SD = 7.65$). Only those living in Ukraine ($N = 750$) participated in calculation of cutoff scores for morning and evening types. The data were distributed normally, so applying accumulated percentile distribution the cutoff score for evening type (lower 10%) was set at 22 points, and for the morning type (upper 10%) at 43 points. The check of internal consistency of the scale was performed with Chronbach's alpha calculation and resulted in 0.874 showing the high level of reliability of Ukrainian CSM. To test the criterion validity there was computed the correlation between CSM score and MSF score (mid sleep on free days) derived from MCTQ – Munich ChronoType Questionnaire which was also translated into Ukrainian using parallel blind technique. The MSF scores were distributed normally, so the Pearson correlation analysis was applied resulting in coefficient $r = -0.584$, $p < 0.001$, and showing high level of validity of the scale. Using principal component analysis (PCA) the structure of the scale was proved. PCA results showed two statistically significant components with eigen values 5.31 and 1.32, accounting for 51.06% of the total variance. Thus, the results of adaptation show that Ukrainian version of CSM is a reliable and valid psychodiagnostic tool to be used in scientific research and other diagnostic purposes.

Do Composite Scale of Morningness items exhibit DIF depending on gender and average sleep duration of subjects?

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The aim of the study was to investigate whether items of Composite Scale of Morningness (CSM) function in a differentiate way depending on the gender and average sleep duration of the subjects. These two characteristics are quite important because some studies show their relationship with the chronotype. This raises the hypothesis that perhaps some other traits, different than chronotype, manifest themselves in the process of CSM items answering so this scale is not "pure" measure of morningness. Responses in CSM of 1600 people were analyzed using the Generalized Partial Credit Model, which fitted the data quite well. Furthermore, an occurrence of Differential Item Functioning (DIF) was checked using the newly developed algorithm by Schauburger and Mair (2019). It turned out that the answers to only a few CSM items depend in part on gender and average sleep duration. This may explain why some studies show links between gender, average sleep duration and chronotype. The removal of items that reveal DIF should result in a scale free of these distortions, and thus being a "pure", sex independent measure of chronotype.

Assessment of Social Jet lag

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Social jet lag (SJL) describes discrepancy of social and biological times. I argue that the original formula $SJL = |MSF - MSW|$ captures both circadian misalignment and sleep debt accumulated on workdays, subsequently slept off on free days. I propose to adopt the sleep-corrected formula for social jet lag, which takes the form of the difference between the sleep onset on free days and workdays in majority of subjects, who are characterized by a sleep-wake patterns with longer sleep and later (or equal) sleep onset on free days compared to workdays. In some cases I propose to use a formula that takes the form of the difference between the sleep offset on free days and workdays for subjects with longer sleep and earlier (or equal) sleep offset on workdays compared to free days.

Abstracts of Poster Presentations

Sex differences in pH and blood respiratory gases in zoletil-anaesthetized rats in the dependence on LD cycle

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Although it is generally assumed that females are not significantly more variable than males, there are studies that have demonstrated that differences may be quite large. The aim of the present *in vivo* study was to determine the effect of zoletil anaesthesia on the status of pH, paO_2 and $paCO_2$ in spontaneously breathing rats of both sexes in dependence on the light-dark cycle (LD cycle). The experiments were performed using zoletil-anaesthetized (30mg/kg [intraperitoneal], Virbac, France) female and male Wistar rats, after a four-week adaptation to a light-dark (LD) cycle (12h:12h). The animals were divided into four experimental groups according to sex and light period (n=20). The comparison revealed that although sex differences exist, as well as sex-related differences between the light and dark period, both females and males exhibited the same tendency toward changes to acidosis, hypoxia and hypercapnia but only in light period. The most unfavorable status in the followed parameters was exhibited in males during the light period. The optimal status of pH, paO_2 and $paCO_2$ occurred during the dark period in males. The LD differences in paO_2 and $paCO_2$ were eliminated in females but not in males.

Association between rest-activity patterns and frailty in Japanese elderly persons

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Frailty is well documented in recent ageing researches, implicated in a high mortality, a high incidence of falling down, daily functioning disability, cognitive impairment and depression. Although a relationship between frailty and some factors including physical, cognitive and social function is commonly recognized in researches so far, little has been reported on rest-activity patterns in elderly individuals with frailty or pre-frailty. The objective of this research was to investigate rest-activity patterns in elderly community-dwellers with pre-frailty. One hundred three participants over 60 years old were recruited from nine regions in Akita prefecture, JAPAN, between June 2018 and December 2018. The demographic data were collected, including age, gender, a use of benzodiazepine class sleep medication and the midpoint of sleep in free days (MSF) indexed in Munich Chronotype Questionnaire-Japanese version. According to criteria of frail phenotype reported in National Center for Geriatrics and Gerontology Study of Geriatric Syndromes, the participants were divided into non-frail group (N = 58) and pre-frail group (N = 45). To measure nonparametric rest-activity rhythm parameters, Actiwatch Spectrum Plus (Philips Respironics, Inc.) was worn on the participants' non-dominant wrists for continuous seven days without removal. The nonparametric parameters were comprised of interdaily stability (IS), intradaily variability (IV) and relative amplitude (RA) over the average 24-hour profile. A result of binominal logistic regression analysis indicated that a presence of pre-frailty was significantly associated with grip strength (Beta = -0.18; odds ratio, 0.84; 95% confidence interval, [0.76, 0.93]; $p = 0.001$) and RA (Beta = -8.66; odds ratio, 0.0001; 95% confidence interval, [0.00, 0.15]; $p = 0.012$), with percentage of correct classifications of 68.9 %. Consequently, a relative change between rest and active statuses as indexed in the RA may be potentially characterized in elderly individuals with pre-frailty, as well as physical domains.

Altered circadian rhythm in the Snord116- deleted mouse, an experimental model of PraderWilli syndrome

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Prader-Willi syndrome (PWS) is a genomic imprinted disorder that is characterized by brain developmental, behavioral and metabolic abnormalities. Snord116 is a small nuclear RNA that controls the expression of many genes, including different clock genes in the suprachiasmatic nucleus. Snord116 is also a main regulator of sleep symptoms associated with PWS. Here, we analyzed the effects of the loss of paternal expression of Snord116 in the circadian rhythms of mice during light-dark (LD) and dark-dark (DD) where they express the capability of entrainment and freerunning respect to external events, respectively. We found that loss of paternal expression of Snord116 in mice alters the circadian period during free-running, when the animals run according to their internal clock. In particular, mutant mice present with a reduced shortening of their circadian period in DD in comparison to their wild-type littermates. On the other hand, the circadian period during LD shows an unaltered circadian rhythm in mutants compared to wild-type mice. Our study indicates that Snord116 is involved in the regulation of circadian rhythms in mice and points out a new endophenotype for pre-clinical investigation into the pathomechanisms of PWS. Moreover, this research promotes the knowledge of how imprinted genes can contribute to the alteration of circadian rhythms.

Academic achievement in Motor Science School in Milan: effect of chronotype

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The expression of circadian rhythms differs among individuals, so defining three chronotypes: Morning- [M], Evening- [E], and Neither- [N] type. M-types achieve the activation peak timing in the first part of the day, and generally are more conscientious and achievement-oriented. Conversely, E-types reach their best during the second half of the day. In Italy, university schedules are often not compliant to evening preferences and could compromise E-type students' academic performance. To date, little attention has been given to N-types university performance. Aim of the study was to detect the relationship between chronotype and academic performance on students attending the Motor Science School in Milan, also distinguishing between theoretical and practical disciplines. A total of 423 university students (290 males; 133 females) were enrolled and categorized in M-, N, and E-types based on the Morningness-Eveningness Questionnaire (MEQ) score. After recollecting for each participants the grades for three theoretical and three practical exams, we obtained a mean theoretical and a mean practical score. M-types attain better grades than E-types and N-types both for theoretical and practical exams. In theoretical exams, NT students obtained the lower mean grades, while E-types collected the lowest in practical exams. The trend is the same considering all the students or in the stratification by gender, with females always tending to obtained higher grades compared to males. This Italian analysis confirmed the academic advantage for M-types students that are more aligned with university planning. On the other hand, the E-types students obtained the worst results compare to M- and N-types but only in practical exams, while in theoretical exams they partially recover this disadvantage, obtaining better results than N-types, although they cannot reach the grades obtained by M-types students.

Analysis of selected circadian gene polymorphisms in breast cancer - searching for their functional significance

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Circadian rhythm is a central oscillator, which allows to adjust numerous internal processes to external environmental factors through management processes in each cell, like genomic stability, DNA repair mechanism, apoptosis. In breast cancer (BC), these cell functions are frequently disrupted. One of the supposed mechanisms that may lead to BC is a disruption of the molecular circadian clock caused by exposure to light at night. Accordingly, the main objective of the study was to search for significant genetic variants of crucial circadian genes *CLOCK* (rs1801260), *BMAL1* (rs2279287), *CRY1* (rs8192440), *CRY2* (rs10838524), *PER3* (rs10462020), *PER1* (rs2735611), *PER2* (rs934945, rs2304672), *NPAS2* (rs2305160), *TIMELESS* (rs2279665) in the process of mammary gland carcinogenesis, also in relation to circadian gene expression. Selected polymorphisms were analysed for the risk of BC and the association of the clock genes expression database of BC tissue to demonstrate the functionality of genetic variants. The associative study included genomic DNA samples from BC tissue of 106 patients from Medical University of Gdansk and genomic DNA from white blood cells of 196 healthy women collected at Nofer Institute of Occupational Medicine. Genotyping of selected clock genes SNPs was carried out by using TaqMan fluorescence-labeled probes in Real-Time PCR system. The study showed a relationship between *NPAS2* SNP and the BC risk. Alterations were observed at the level of gene expression depending on the genotype of tumor as well as adjacent-non tumor tissues for polymorphisms of *BMAL1*, *PER1*, *PER3*, *NPAS2*. Elucidation of the molecular mechanisms in BC development, in the future may have the key significance in understanding of mechanisms and pathways of carcinogenesis, open up new options for cancer prevention and may also enable accurate diagnosis and prediction of treatment progress of BC. This work was supported by the National Science Center (Grant No. 2014/15/N/NZ5/01671) and Internal grant IMP 14.4/2018.

How disruption of circadian rhythm by newborn affects parents' time perspective and quality of life. Systematic review

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Knowledge about factors affecting the quality of life of newborn parents is of great theoretical and practical importance. In this study review, we analyse the relationship between activity-rest rhythm of neonates, activity-rest rhythm of their parents and time perspective and quality of parents life. We performed a systematic search of articles using PsycARTICLES, PsycINFO, PubMed, MEDLINE, Scopus, Cochrane and DARE. The results of previous studies indicate significant relationships between the activity-rest rhythm of newborn parents and the quality of their life. The ability to cope with changes in everyday rhythm is one of the basic conditions for a satisfying experience of motherhood and paternity. We emphasized psychological factors that increase this ability.

Low-temperature reprogramming induces changes in circadian transcriptome

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Core clock gene regulatory network (GRN) exists in almost all cells in the body and it regulates processes such as metabolism, growth and differentiation of these cells, feeding and sleep. Rhythmic changes in the environment, like light and dark cycle are known to cause shift in the phase of the circadian cycle, whereas the circadian period remains unchanged. We conducted a temporal RNA-seq analysis of the fat body in *Drosophila melanogaster* under two temperature conditions. We show that although the core clock GRN retains the same cycling period (~24hrs) irrespective of the temperature, there is a significant shift in the circadian phase of the core clock, as *Clk*, *tim* and *vri* exhibit a stable phase advance. We observe the set of oscillating genes changes significantly between baseline and low-temperature conditions, including an emergence of unique, low-temperature de-novo cycling genes. Computational analysis of the temperature-dependent reprogramming of circadian transcriptome shows novel gene-level interactions and broadens understanding of the underlying regulatory mechanisms, emerging in circadian regulatory circuits, in response to environmental cycles. This work is supported by a grant from the Simons Foundation/SFARI (597491-RWC) and the National Science Foundation (1764421).

Altered light regimes affect physiology, adult life span and reproductive output in a serious Lepidopteran pest, *Spodoptera litura* (Fabr.)

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In insects, like in other organisms, the environmental factors such as changes in the daily photoperiod, temperature, humidity affect behaviour and physiology, including circadian clock governed activity, feeding and mating etc. However, little is known about the influence of light on oviposition, fecundity, fertility and longevity. Here, we investigated the effects of photoperiod variation on life span and reproductive behaviour of a serious lepidopteran nocturnal insect, *Spodoptera litura*, which shows circadian clock gene oscillations both under 24 h light: dark cycles and constant light or dark condition. We exposed insects to constant light (24L: 0D, LL) and constant darkness (0L: 24D, DD), with controls on 12 h light: 12 h darkness (12L: 12D), for a period of four weeks. There were significant alterations in the food intake, larval body weight, egg laying behaviour, fertility, fecundity and longevity under LL and DD, as compared to the control group. However, we found no correlation between food intake and larval body mass, as food intake was higher under DD and larval body mass was significantly increased under LL. LL and DD females showed reduced and delayed oviposition as compared to LD females. Also, LL female showed reduced reproductive output, i.e. decrease in fertility and fecundity than LD and DD. However, LL, as compared to LD and DD, influenced the adult life span of virgin males. These results suggest that altered light conditions can disrupt feeding and affect body mass and reproduction in nocturnal moths. These findings could have implications for devising some ecosafe pest control measures by manoeuvring the environmental conditions.

Effects of night work on chronic fatigue development and its relation to biological wellbeing in telephonists

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The purpose was to reveal the effects of night work on chronic fatigue development and its relation to psychological and physiological parameters of wellbeing in telephonists. Methods. Chronic fatigue (CF - by Leonova-Shishkina), heart rate (HR), blood pressure (BP), static balancing (SB), felt wellbeing (FW) and biological ageing tempo (BAT - by Voytenko) were studied in 2 groups of telephonists: (1) working day, afternoon and night shifts (51 women 30-55 y.o., $M\pm m$: 41 ± 1), (2) working day and afternoon shifts (42 women 30-52 y.o., $M\pm m$: 42 ± 1). TTEST and Pearson correlation were applied. Results. Night and day workers manifested CF of different stages in 43% and 48% of subjects correspondingly ($p<0,05$), while strong or pathological CF - in 22% and 12% ($p<0,01$). Night workers complained that it became harder to work, more often than day workers ($p<0,05$). BP and HR were within physiological norm in both groups. SB was better than age standards: for 7 years – in night workers, for 4 years – in day workers. FW and BAT corresponded to the age standards in both groups. CF increased with an increase in BAT and FW in both groups ($r=0,367$, $p<0,01$ and $r=0,830$, $p<0,0001$; $r=0,507$, $p<0,001$ and $r=0,760$, $p<0,0001$ - in night and day workers correspondingly). CF increased with a decrease in systolic BP and SB in night workers only ($r=-0,320$, $p<0,05$ and $r=-0,405$, $p<0,01$). Conclusions. Among telephonists, night work potentiates the development of strong and pathological CF, and also development of CF under strong bond with systolic BP decrease and deterioration in the blood supply to the brain (SB decrease) that is a risk factor for pathology development. Relatively less prevalence of CF and better SB among night workers could reflect the natural occupational selection effect. Hence, telephonists working night hours, need preventive measures to maintain their health and workability.

Chronopsychological Changes in Personal Qualities of Surgeons Working 24-Hour Duties

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The purpose was to reveal the age and experience related changes in personal qualities of surgeons working 24-hour duties. Methods. Lusher 8-color test was used to study the personal qualities of surgeons (59 men, 24-60 y.o., night work experience (NWE) up to 39 years). Pearson correlation was applied. Results. With an increase in surgeon age and NWE, a decrease in the role of basic needs of an individual (aspiration for achievements, satisfaction) was revealed when choosing a course of action ($r=0,263...0,334$, $df=57$, $p<0,05$). This occurs due to a shift in the group predominance of color preferences from red, green, violet, blue (24-40 y.o.) to brown and gray (40-60 y.o.) - i.e. from the active implementation of basic needs to experiencing physical discomfort, illness, losses or stress, fatigue and non-involvement. With an increase in NWE the suppressed needs in the 24-40 y.o. group, the rejection of that does not relate to basic needs realization becomes more frequent ($r=0,524$, $df=25$, $p<0,01$). Most often - due to the non-acceptance of being detached from being (predominant position of black), or due to the non-involvement rejection and realization of involvement, participation, responsibility (grey). In the 40-60 y.o. group, such a relationship is not revealed by increasing the frequency of blue occurrence in the "suppressed needs" position, reflecting the emotional dissatisfaction, probably due to the inability to realize the basic need of night sleep. Conclusions. With an increase in surgeon age and experience, a decrease in the role of basic needs was revealed when choosing a course of action. Before 40 y.o. the NWE increase is manifested in an aversion of that does not relate to the implementation of basic human needs. Beyond 40 y.o., this aversion shifts towards emotional dissatisfaction. Hence, preventive measures are required to preserve the psychological comfort of surgeons working 24-hour duties.

Lifestyle and chronotype among medical students at Poznan University

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The aim of the study was to investigate whether aspects of lifestyle impacted on body weight in medical students. The study examined the sleep patterns, diet, physical activity and chronotype. In the study a questionnaire was answered by 136 students. It was answered on four successive days (including two weekdays and a weekend) by the medical students. The volunteers answered questions regarding their sleep times, food and fluid intakes, and the amount of physical activity undertaken. The questionnaire was in four parts and took about 15 minutes to answer. The parts of the questionnaire were: 1) General questions about age, gender, height and weight; chronotype 2) Questions about sleep pattern; 3) Questions about dietary habits and physical activity. Advice to improve sleep hygiene and diet, with the aim of reducing the likelihood of becoming overweight or obese, is important. Aiming such advice at young adults is important also because they are beginning to become independent, and so need to develop a "healthy lifestyle". We asked our respondents about their lifestyle, which indicates the chronotype. We have divided 14 larks, 99 owls and 56 mixed types among medical students. Differences among the students were noted between the way of spending time during week and weekend - the differences apply sleeping and sitting, not other variables. The higher the health status score correlates the poorer are sleep lengths during the weekdays and the weekends. Students eat more during the weekdays. Both females and males tend to eat more at the weekdays, and females are likely to eat more than males at both times. Better knowledge about proper habits of diet is associated with less fried food and more fluid intake.

Test timing of memory and reading comprehension in adolescents: relations with chronotype

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Introduction: Adolescence is characterized by late sleeping and waking times which may conflict with the students' morning school schedules and also may interfere with memory processes. Objective: Compare cognitive performances in morning- and afternoon-shift middle school Brazilian students. Methods: 51 students (26 females, aged 12-14) attending morning (7:00 to 12:00) or afternoon (12:30 to 17:30) school schedule were subjected to a reading comprehension test (Cloze), verbal and visuospatial working memory tests (Digit Span and Corsi Block) and Declarative Episodic Memory (DEM: short and long term). Chronotype was determined by Horne and Östberg's questionnaire and sleepiness was assessed with the Karolinska Sleepiness Scale (KSS). Participants were evaluated once: 22 students at 7:15 am (14 morning-shift and 8 afternoon shift-students) and 29 at 4:45 pm (11 morning-shift and 18 afternoon-shift students). Results: Morning-shift students tested in the morning felt sleepier than those tested in the afternoon ($t_{(23)} = 4.10$, $p < 0.001$). Afternoon shift had higher scores on the digit span test than those tested in the morning ($F_{(1,46)} = 4.28$, $p < 0.05$). A marginal difference was also observed in the Cloze test ($F_{(1,46)} = 3.91$, $p = 0.05$) morning-shift students tested in the afternoon (27.00 ± 0.91) showed higher performance than afternoon-shift students (24.31 ± 0.88). Chronotype was an important predictor of differences in KSS and DEM test. LSP was an important predictor of differences in Digit span, DEM and Cloze tests. Students with higher LSP also had high scores on these tests. Conclusion: Evening type students were sleepier and had lower scores in this test than morning type students. Afternoon testing allows for improved performance in verbal working memory for both morning- and afternoon-shift students and a marginal difference was observed in the Cloze test.

School schedules and biological rhythms in teachers

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Introduction. School schedules may affect daily routines of teachers, inducing desynchronization of their biological rhythms and consequent health problems. Objective. Evaluate adaptation of teachers to school schedules linking their morningness-eveningness preferences to degree of satisfaction with their working conditions. Methods. We studied 25 teachers (4 males and 21 females) aged 28-49 years old, working at two public school in the metropolitan area of São Paulo, Brazil. The following instruments were applied : daily activities diary (28 consecutive days), Karolinska Sleepiness Scale (23 consecutive days at four time points, every 4h), Morningness-eveningness preferences with the Horne and Östberg's questionnaire, Satisfaction at work questionnaire and focal group interviews. Results. Sleepiness was detected in the week-ends but not on week days, with greater values at night (KSS=5.9±2). Sleep durations varied between 6:09±0.2h for working days and 8:45±0.2h for week-ends, an evidence of social jet lag in this population. Chronotype scores varied between 30 and 65 points, with a significant negative correlation with sleep duration ($r=-0.50$, $p=0.01$), eveningness associated with greater social jet lag. Subjects with eveningness preferences complained of worse sleep quality when compared to those with morningness preferences. Subjects complained of their low salaries, reduced participation in school decisions and excessive amount of work. Positive aspects were related to social interaction, knowledge and motivation. Inadequate food consumption was also mentined in the interviews. Conclusion. School schedules influence temporal organization of teachers affecting their sleep, health and quality of life.

Chronotype influences physical performance in adolescent soccer players

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Circadian rhythms influence daily behavior, psychological and physiological functions, as soon as the physical performance [1]. People typically display preferences for activity at certain time of day. These differences allow to distinguish three Chronotypes: Morning, Evening and Neither Types (M, N and E). The propensity toward diurnal or evening preferences can vary in different life periods and typically a shift towards eveningness [2]. Generally, soccer workouts take place during the afternoon or evening. Aim of the study is to verify whether physical performance differs related to Chronotype in adolescent soccer players. 100 male soccer players filled in the Morningness-Eveningness Questionnaire (MEQ) for the assessment of Chronotype. 75 participants, subdivided in M-types (n=25), E-types (n=25) and N-types (n=25), performed three tests (*Sargent Jump Test*, *Illinois Agility Test* and *6 Minutes Run Test*) at two training sessions, (9:00 am and 6:00 pm). Mixed ANOVA was used to investigate if the three Chronotypes showed differences in test execution during morning and evening sessions. In particular, for all the tests, E-types showed an higher performance during the evening than the morning session ($p < .05$). By contrast, M-types performed better in the morning than in the evening session ($p < .05$). No differences were shown for N-types. These findings show that physical exercise practiced in a favourable circadian period could lead to improved performance. References. [1] Thomas Reilly et al., (2007) Diurnal Variation in Temperature, Mental and Physical Performance, and Tasks Specifically Related to Football (Soccer), *Chronobiology International*, 24:3, 507-519. [2] Montaruli A. et al., (2017) The circadian typology: role of physical activity and melatonin. Published online on *Sport Sciences for Health*.

The impact of the chronotype on the effect of the dietary restriction among obese patients - preliminary report

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A chronotype is an individual, internal biological rhythm, concerning different preferences of the time of day, which depends equally on the properties of the individual biological clock and lifestyle. It is divided into the morning ("lark"), evening ("owl") or mixed type. It has been observed in previous studies, that the evening type of chronotype is closely associated with obesity. The study aimed to assess the chronotype's impact on the effect of low-calorie diet treatment in patients with excessive accumulation of adipose tissue in the body. The study consisted of 24 obese patients, who underwent a three-week diet treatment. The patient's weight was collected before and after dietary modification. Blood lipid and glucose levels were also assessed. Furthermore, a chronotype evaluation questionnaire was carried out to evaluate the biological rhythm of each patient. A majority of respondents presented a "lark" chronotype. The low-calorie diet allowed indirect results to be achieved in this group, which included both weight reduction (mean of 5.3 kg) and average fat loss. The study observed only one person with the "owl" chronotype and found that his weight loss was significantly larger, compared to the "lark" chronotype, and amounted to 8.5 kg. However, the lowest effectiveness of the implemented diet was noted in individuals with the mixed type of chronotype. The preliminary results presented are based on a small group of patients. The study is currently being continued and will ultimately include a group of around 200 people. We believe that the final results will allow us to clearly show the correlation between a given chronotype type and the effectiveness of a low-calorie diet.

Murine Chronotoxicity to Pharmaceutical Wastewater

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The present study was undertaken to report the modeling of the dosing-time-dependent adverse effects of both untreated and biological-treated untreated pharmaceutical wastewater in mice. The mice were housed in a room controlled at 24°C under a 12 h/ 12 h dark-light cycle (light 7:00 to 19:00 hr) for two weeks before initiating the experiments and allowed free access to food and water. A single dose of pharmaceutical or bio remediated effluent, was administered intraperitoneally (10 mL/kg) to mice divided in six circadian stages [1, 5, 9, 13, 17 and 21 Hours After Light Onset (HALO)]. The surviving treated mice exhibited a significant circadian variation in body weight loss ($P < 0.001$). Pharmaceutical wastewater dosing at 17 HALO resulted in -6.5 % weight loss whereas drug dosing at 9 HALO was +1.2 % (19.42 HALO \pm 1.25 h, $P < 0.01$). Only on the dark span the proportion of dead mice was dosing time dependent ($\chi^2 = 12.7$; $P < 0.001$). Pharmaceutical wastewater dosing at 17 HALO resulted in poorest (67%) survival rate; whereas, the best survival was noted in the rest span with 100%. Troughs of motor incoordination were located at the administration times of 9 and 21 HALO (16% of animals affected), whereas peaks were located at 5 and 17 HALO (38% and 55% of animals affected, respectively). A statistically significant ultradian component rhythm with a trial period = 12h, was detected by cosinor ($P < 0.009$) the 17.00 HALO \pm 1.70h modulo 12h. Toxicity was totally removed when mice were treated by the bio remediated effluent. This indicates that *P. putida* was able to completely detoxify the toxic pharmaceutical effluent. With regards to these data the optimal tolerance to untreated pharmaceutical wastewater occurred in the light-rest span of mice.

Sleep quality of student-athletes – the role of chronotype, stress and life satisfaction

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Background: Sleep is vital for the proper functioning especially among athletes, but there are many internal and external factors that can affect its deterioration. The adopted model of relations between the chronotype, stress, life satisfaction and sleep quality was verified in the study. Sleep quality was treated as the main outcome, along with the chronotype as the primary predictor and perceived stress and life satisfaction - as mediators. **Methods:** The study included 207 individuals involved in sport activities (student-athletes) who filled out the following questionnaires: the Pittsburgh Sleep Quality Index (PSQI), the Morningness-Eveningness Questionnaire (MEQ), the Perceived Stress Scale-10 (PSS-10) and the Satisfaction With Life Scale (SWLS). **Results:** The path analysis was used to verify the theoretical model of relations between variables. It revealed that the model presents good model fit. Chronotype has a direct negative influence on sleep quality (the closer to the eveningness, the worse the quality of sleep) and on perceived stress (the stress is greater when the scores in MEQ are lower). Direct relationship was also present between stress and sleep quality (greater stress is related to lower sleep quality) as well as between stress and life satisfaction, only assumed impact of life satisfaction on sleep quality was insignificant. Additionally chronotype indirectly influenced the life satisfaction by perceived stress. Mediation analysis indicate that perceived stress partially mediates the relationship between one's chronotype and sleep quality. **Conclusions:** The results suggest that sleep quality should not be considered without taking into account the circadian preferences. Moreover, effective coping with stress may be a buffer helping to reduce sleep problems in student-athletes.

Biological Rhythm Disruption and Mental Conditioning

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Biological rhythms prove the temporal and spatial order governing the concordance and synchronicity of endogenous and external events. In accordance with biological time-keeping mechanisms, social timing patterns developed that induce, modulate, disturb or reset brain control and mental conditioning to various periodical rest-activity and sleep-wake schedules. Such time cues generally follow and influence innate circadian and seasonal rhythms. However, these dynamic reflexes equally depend on superimposed social periodicities, one of which is the daylight saving time, that engenders phase advancements. Concurrently, as a regular time change implemented in almost a quarter of the human population, these seasonal phase shifts represent a sort of cohort chronobiological experiment that indirectly evaluates human synchronization to natural daylength, dawn and dusk. Associated to global warming, disrupted rhythms are supposed to alter strange attractors of the body, perturbing biological oscillators that control redox balance, microbiota (second genome) composition, defense mechanisms. As our previous experiments proved, in rats entrained to constant light and constant darkness respectively, for time intervals varying from 48 hours to 14 days, the adaptive response involved oxidative stress, assessed by antioxidant levels (glutathione, glutathione peroxidase, superoxide dismutase, catalase) and inflammatory processes expressed by increased white blood cell count, diminished phagocytic capacity, impaired serum complement activity. The relationship that regulates redox clock ("redoxome"), microbiome and inflammasome cycles would be targeted by further research. In humans, mental conditioning would undoubtedly improve adaptive behavioural patterns since mind control can be instrumental in better coping with enduring environmental challenges, potentiating echronism and allochronism, while reducing dyschronism rate. The limits and risks of these compensatory phenomena that impact on circadian clock systems and their seasonal modulation should be clearer determined in the long run. From a bioethical perspective this is also why the European Commission proposed to Member States to stop the bi-annual clock changes in 2019.

Thalamus activity during working memory task correlates with circadian phase

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The human thalamus plays important role in numerous processes including the regulation of arousal and sleep-wake cycles as well as motor control and cognition. Here we investigated whether its activity is related to circadian melatonin phase. The study was conducted in the evening – between 6.30pm and 11.30pm. Twenty-two healthy, young participants (15 females) without sleep problems performed an auditory n-back task while being scanned in the 3T MR scanner. Saliva samples were collected every hour for assessment of circadian melatonin phase. Performance of n-back task was at high level (above 85% correct responses). fMRI data were preprocessed and general-linear model was used to assess the map of activity linked to working memory (contrast 2-back vs. 0-back). Level of thalamic activity was extracted for each subject for further analysis. Dim light melatonin onset (DLMO) was calculated using the hockey-stick method. The timing of the DLMO and the activity level for the thalamus entered correlation analysis. The results showed a significant, positive correlation between those two measures ($r=0.47$, $p<0.05$, i.e. the later circadian melatonin phase the higher thalamic activity). Since the higher thalamic activity also correlated with longer time awake ($r=0.54$, $p<0.05$) but no significant correlation was found for DLMO and time awake, we have evidence that a late circadian phase and not enhanced sleep pressure led to enhanced thalamus activity related to working memory performance. Our data provide new insight into understanding the link between thalamic activity and human circadian rhythms.

Season-dependent differences in actigraphy recordings and daytime sleepiness

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Even if the modern urban lifestyle masks their effects, the seasons are still important for human physiology and behaviour. The difference in daily light exposure between seasons of the year may affect the sleep-wake rhythm and general level of energy or daytime sleepiness. Are those phenomena reflected in actigraphy recordings gathered at various times of the year? 104 one-week registrations obtained with MotionWatch8 devices were analysed, roughly divided into 'warm-' and 'cold-season' data, according to spring and autumn equinox. The difference in average length of natural light exposure amounts 4 hours 58 minutes at the latitude in which the data was collected (Krakow, Poland). Healthy volunteers taking part in this study were 18-35 years old (mean 24.9 ± 5.4 yrs); there were 59 females among them. The following parameters were taken into account: fell asleep and woke-up times, time in bed, actual sleep time, actual wake time, sleep efficiency, sleep latency, and fragmentation index. The circadian rhythm features were estimated with non-parametric-circadian-rhythm-analysis (NPCRA module) and comprised relative amplitude, intra-daily variability and interdaily stability. Additionally, daytime drowsiness was assessed with Epworth Sleepiness Scale. Sleep analyses did not show seasonal differences in most parameters, although individuals examined in October-March tended to spend more time in bed (18 min on average; $p=0.059$) and showed significantly later wake times by 36 minutes ($p=0.012$). Also, ESS scores were significantly higher then ($p=0.04$). The circadian rhythm characteristics seem to be similar all year long. There was an important gender effect – women used to asleep a bit earlier ($p=0.076$) and to sleep longer (by 29 minutes; $p<0.001$); their sleep was less fragmented than men's sleep ($p=0.002$). MANOVA did not show any significant interaction effect (gender \times season) but the difference in sleep length between warm- and cold-season data was much more visible in women than in men.

An epidemiological study of sleep-wake timings in school children from 4 to 11 years old: insights on the sleep phase shift across development, and implications for the school starting times' debate

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Objective: It has been assumed that during adolescence there is a strong shift towards eveningness, while children's sleep is relatively stable. Several studies have focused on the conflict between school start times and adolescents' circadian rhythms; however, few studies have been conducted on younger children. The objective of this study was to examine sleep durations, schedules and sleep phase shift in preschool and school age children. **Methods:** Data for sleep patterns on school and free-days was obtained by questionnaires (Children ChronoType Questionnaire) for 3155 Portuguese children aged 4-to-11 years old. **Results:** As children grow older and school grade level increased, we found later bedtimes and sleep onsets on both school and free-days ($p < .001$); and later wake-times only on free-days ($p < .001$). By contrast, wake-times were progressively earlier ($p < .001$), imposed by school start times. There was a progressive reduction in the amount of sleep on school-nights as grade level increased ($p < .001$). Greater social jet lag ($p < .001$), later middle point of sleep ($p < .001$) and higher restriction-extension patterns ($p < .001$) were found across development. **Conclusion:** The displacement of bed and wake-times for later hours on free-days starts at an early age. Delaying school start times could adjust social demands to the biological rhythm of children and adolescents.

Presenting the Research Project "True Times - Morningness-eveningness and time-of-day effects on cognitive performances and emotional states: new lessons from children and adolescents"

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It is our aim to present and discuss an ongoing research project focused on the interaction effects of morningness-eveningness x time of day on cognitive and emotional variables. Literature search shows that a rising number of studies have tested the “synchrony effect” that refers to better performances when people are tested at their peak times of the day (e.g., early hours for morning-types, versus afternoon for the evening-types) and hindered performances at off-peak times. Surprisingly, a reverse counterpart, or asynchrony effect, has also been documented. The explanation for conflicting findings seems to reside in the type of cognitive resources recruited by different tasks. For example, sync effects seem to be present in tasks involving verbal fluency, which require explicit memory and controlled processes. On the contrary, tasks mainly based on implicit processing and automatic processes, which benefit from an attenuation of the inhibition processes, may result in better performances in non-optimal hours. However, this hypothesis remains to be duly operationalized and tested. Moreover, the topic is virtually unexplored in children. Hence, it seems appropriate to fill this gap and consider three different age-groups for a fine probing of the controlled/automatic processes dichotomy, as executive control is known to develop across childhood, and schooling induces changes in the level of automatization of tasks recruiting scholastic skills. We also aim to explore whether (a)synchrony effects are extendable to emotional states which may interact with cognitive processes. We propose to systematically probe the relation between core cognitive processes and time-of-day x diurnal type crossings, by using a comprehensive set of neurocognitive tests and emotional states measures. We will adopt a randomized and blind design, to test diurnal types in different times of the day inspired in the chronotype-based paradigm and chronopsychology research. Note: Research Grant PTDC/PSI-ESP/32581/2017|CENTRO-01-0145-FEDER-032581, funded by FEDER, PT2020, CENTRO2020, FCT.

Experimental study of chronotoxicity of the anticancer agent « Ifosfomide »

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Ifosfomide (IFS) a chemotherapeutic agent chemically related to the nitrogen mustards and a synthetic analog of cyclophosphamide. It's used in the treatment of several form of cancer including lymphoma, sarcoma and advanced forms of solid organ cancer. Two studies were undertaken. A total of 120 male Swiss mice, 8-10 wks old and synchronized for 3 weeks by a light-dark schedule (L/D : 12/12). In study 1, a potentially lethal dose of IFS (520 mg/kg) was injected by i.p. route at each of six circadian times (1, 5, 9, 13, 17 and 21 hours after light onset - HALO). Three variables were assessed for host tolerance: rectal temperature, body weight change and survival. In study 2, a toxic dose (500mg/kg, i.p.) of IFS was injected at four circadian times (1, 7, 13, and 19 HALO). The Histopathology of main target tissues (Bladder, Liver and Kidney) as well as plasma transaminase activities (ALAT, ASAT) were studied according to the circadian-time sampling in controls and treated mice. Cosinor method and χ^2 test were used for statistical analyses. The survival rate was dosing-time dependent. IFS administration at 13 and 9 HALO resulted respectively in best (67%) and least (21%) survival. The histological lesions in studied tissues as well as plasma ALAT and ASAT activities varied according to IFS circadian dosing-time. Keywords: ifosfomide, toxicity, tolerance, circadian rhythm, mice.

Circadian control of ORE1 by PRR9 positively regulates leaf senescence in *Arabidopsis*

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The circadian clock coordinates the daily cyclic rhythm of numerous biological processes by regulating a large portion of the transcriptome. In animals, the circadian clock is involved in aging and senescence and circadian disruption by mutations in clock genes frequently accelerates aging. Conversely, aging alters circadian rhythmicity, which causes age-associated physiological alterations. However, interactions between the circadian clock and aging have been rarely studied in plants. Here, we investigated potential roles for the circadian clock in the regulation of leaf senescence in plants. Members of the evening complex in *Arabidopsis* circadian clock, EARLY FLOWERING 3 (ELF3), EARLY FLOWERING 4 (ELF4), and LUX ARRHYTHMO (LUX), as well as the morning component PSEUDO-RESPONSE REGULATOR 9 (PRR9), affect both age-dependent and dark-induced leaf senescence. The circadian clock regulates the expression of several senescence-related transcription factors. In particular, PRR9 binds directly to the promoter of the positive aging regulator *ORESARA1* (*ORE1*) gene to promote its expression. PRR9 also represses *miR164*, a post-transcriptional repressor of *ORE1*. Consistently, genetic analysis revealed that delayed leaf senescence of a *prp9* mutant was rescued by *ORE1* overexpression. Thus, PRR9, a core circadian component, is a key regulator of leaf senescence via positive regulation of *ORE1* through a feed-forward pathway involving post-transcriptional regulation by *miR164* and direct transcriptional regulation. Our results indicate that, in plants, the circadian clock and leaf senescence are intimately interwoven as are the clock and aging in animals.

Sleeping and activity patterns correlations with symptoms and course of affective disorders.

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Affective disorders are severe and common in general population psychiatric illnesses. Major depression has the lifetime prevalence of 16%, whereas the prevalence of bipolar spectrum disorders is 4.5%. The symptoms of affective disorders are associated with disrupted circadian rhythms. Predisposition to affective disorders and rhythmic physiological processes both have an important genetic background. The aim of this study was looking for an association between sleep and activity patterns and clinical course of affective disorders. We included 46 female patients (bipolar disorder diagnosis n=23 and MDD n=21) and 71 controls into study. For clinical assessment SCID and OPCRIT questionnaires were used, Epworth, PSQI and MEQ questionnaires provided a description of circadian behavior patterns. Kruskal-Wallis test, Mann-Whitney U test and Spearman correlation computations were applied with Statistica software. Main positive findings are: 1) significant differences between euthymic affective patients and healthy controls in sleep duration, sleep latency, medicine-induced sleep, PSQI and Epworth total scores, BMI; 2) correlation of sleep disturbances with BMI and with a history of suicidal attempts, daytime dysfunction with age and with age of onset of illness, subjective sleep quality with course of the disorder (full/partial remissions or chronic course) and with illness duration; 3) correlation of sleep latency with irritability, distractibility and talkativeness, daytime dysfunction with number of manic and hypomanic episodes, medicine-induced sleep and PSQI total score with the number of hypomanic episodes. No associations of chronotype (eveningness, intermediate or morningness) with traits of interest were found. Sleeping problems are commonly present in affective patients, not simply during acute episode, but also in euthymic state. Sleep disturbances and related symptoms are linked with more severe course of the disorder in terms of recurrency, numerous symptoms and suicidal behavior. The findings may indicate important goals for the prophylactic treatment. The research was supported by grant no. 2016/23/B/NZ5/02634, financed by the National Science Center.

Which analytical techniques allow discovery and documentation of circadian rhythm of spontaneous oscillatory peptidization with biogenic amino acids?

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One can assume that circadian phenomena are considerably more common in the world of chemical and biochemical reactions than we are currently aware of it. In despite of a steadily growing performance of analytical instrumentation, difficulties with discovery and documentation of such phenomena seem to result in the first instance from the lack of precise enough analytical tools. Our research group has discovered and documented circadian rhythm of spontaneous oscillatory peptidization with selected biogenic amino acids dissolved in abiotic media (i.e., in aqueous or aqueous-organic mixed solvents) [1-3]. Special importance of this research is due to the fact that biogenic amino acids are the elementary building blocks of all living matter. The aforementioned discovery was made possible with use of high-performance liquid chromatography (HPLC) hyphenated with the evaporative light scattering detector (ELSD). The main concept of this approach is to record concentration changes of the monomeric amino acid in the function of time and to apply the Fourier Transform function to these data, in order to establish periodicity of the observed oscillatory peptidization process. In our presentation, we will introduce the consecutive steps of this approach, emphasizing its advantages as well as its drawbacks. Special attention will be paid to a possible failure of the assumed analytical approach to establishing the circadian rhythm of peptidization in such cases, when it in fact might occur.

Knock down Bmal1 triggered different colon carcinoma cells fates by altering the delicate equilibrium between AKT/mTOR and P21/P53 pathways

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Bmal1, a core mammalian circadian gene, forms a heterodimer with CLOCK to drive the rhythmic genes expression and regulate cell activities under circadian clock. The objective of our research is to evaluate how knock down Bmal1 influences human colorectal cancer cell behavior in vitro. Our results revealed knock down Bmal1 enhanced AKT/mTOR activity of three clone cancer cell lines in varying degrees: a more evident increase of AKT/ mTOR activity in primary adenocarcinoma cell lines (HCT116 and SW480) and only a minor increase of AKT activity in SW620, a metastatic colon cancer cell line. Simultaneously, knock down Bmal1 also increased p21 expression in HCT116 and SW480 but not significantly in SW620. However, compared to their corresponding control, no significant increase of p53 was detected in three Bmal1 knock down cell lines though an increased nuclear p53 was found in SW480shBmal1 cell, which indicated potential p53 activation. This p53 activation in SW480shBmal1 cell was then confirmed by increased DNA double-stranded breaks which resulted in histone γ - H2AX phosphorylation; and increased expression of MDM2, one of the first characterized p53 target. The increased mTOR activity, accompanied by p53 activation and p21 upsurge in SW480shBmal1 cell, leading to increased cell senescence identified by b-galactoses coloration. In contrast to SW480 which possessed a muted p53, HCT116 possessed a wild type p53 which activation induced apoptosis and p53 activated HCT116shBmal1 cells were deleted just after lentivirus transduction. Subsequently, the stable Bmal1 knock down HCT116 cell obtained after one week Puromycin selection presented only a higher AKT/mTOR activation but no p53 activation and finally exhibited a higher proliferation rate. So, knocking down Bmal1 could alter the delicate equilibrium between mTOR and p53/p21 pathway in colon carcinoma cell lines, which could finally trigger the different cell fate based on distinct p53 rule of different cell lines.

Dietary intake by BMI category in nurses working rotating shift

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Background: Shift work has been associated with increased body mass index (BMI), metabolic disruption and increased chronic disease risk. Typically, these reports compare individuals who work the day shift to those who work the night shift. Because shift assignment is not random, differences may reflect other, unmeasured characteristics that account for outcome differences. In this study, we compare individuals who work rotating shifts by BMI category (BMI < 25 kg/m² vs. BMI ≥25 kg/m²). Objective: To compare dietary intake on days the participant worked the night shift to days she worked the day shift; and to compare these difference by BMI category in a population of female nurses who work rotating shifts at a hospital. Methods: This cross-sectional study recruited 132 female registered nurses who work rotating shifts in surgical or internal medicine departments. Dietary intake was ascertained using food diaries and analyzed on Tzameret Nutrition Analysis Software (Israel Ministry of Health). Demographic and anthropometric variables were also recorded. Results: Compared to dietary intake on a day the nurse worked the day shift, intake of the following nutrients increased significantly on the day she worked the night shift: energy; protein; carbohydrates; total fat; saturated fat; and calcium. However, this difference was driven by nurses with BMI < 25 kg/m²; nurses with BMI ≥ 25 kg/m² did not alter their dietary intake by shift. Discussion: A significant increase in calorie, macronutrient and calcium intake on days nurses worked the night shift compared to days they worked the day shift was demonstrated; but driven by differences among nurses with BMI < 25 kg/m². The mechanism for this is not clear but may represent voluntary inhibition among overweight nurses. Prospective follow-up can reveal whether this pattern predicts weight gain over time.

Study of the Association between Work at Night and Women's Bone Mineral Density – Background, Aims and Methods

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Irregular working and sleeping hours associated with rotating night shift work may have significant impact on workers' health. During the recent years many epidemiological studies demonstrated that night shift work is linked to various chronic diseases. Disturbance of the endocrine functioning including decrease of melatonin synthesis are the key components contributing to the etiology of night shift work related diseases. Given that melatonin is important for bone metabolism it has been hypothesized that nightshift work may affect bone strength and further increase the risk of osteoporosis and bone fractures. This hypothesis has been supported by several epidemiological studies so far, although, the research is still limited in this field. The main aim of our study is to investigate the association between night shift work and bone mineral density among female blue-collar workers. The cross-sectional study included 195 women aged 40 years or more, without previously diagnosed osteoporosis, cancer or rheumatoid arthritis (91 working on rotating night shift and 104 working only during the day). The subjects were employed in four industrial plants producing stockings or cosmetics localized in the suburban area of Lodz in Poland. In all of these industrial plants the work is organized in three shifts, with five consecutive shifts per week. The study procedures included: self-administered questionnaire, anthropometric measurements, spine and femoral bone densitometry, blood and urine samples collection. Estradiol, parathyroid hormone and calcium concentration were determined in blood. Densitometry measured Bone Mineral Density (BMD) [g/cm²] and T-score was calculated for every participant (T-score compares the patient's BMD to that of a young-adult sex-matched reference population). The results of our study will extend the knowledge on potential association between night shift work and osteoporosis.

Dispositional Mindfulness amongst Chronotypes

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Recently, a few studies displayed an association between chronotype and mindfulness. The direction of the association appears to be consistent, with morning types being more mindful across the studies, whereas the nature of this relationship remains unexplored. As different options are being discussed, it seems possible that there might be another variables involved in this relation. One of the factors that have not been empirically examined yet in the context described above is sex. Its role in chronotype-mindfulness association seems worth consideration since it is connected to both chronotype and mindfulness variability. Research findings reveal higher mindfulness levels in males as well as more frequent evening orientation in males than in females. The poster presents a questionnaire study that aimed to take a deepened insight on the chronotype-mindfulness relationship by examining the role played by sex in this relation. It was conducted on 320 participants, using Munich ChronoType Questionnaire and Mindful Attention Awareness Scale. The results indicate that sex moderates the relationship between chronotype and mindfulness. There was an association between chronotype and mindfulness level in males (morning-oriented types were more mindful than evening-oriented ones), but not in females.