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ABSTRACTS
(in alphabetical order)

Creativity as interaction of organism and environment

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Human creativity is generally seen as phenomenon with positive value. Essence of human creativity seemingly appears beyond a simple model of an interaction of organism and environment. Theoretical concept of creativity in psychodynamic psychotherapies attributes creativity polarized values on one end as a manifestation of psychopathology on another end as the necessary condition for healthy living. I try to outline unifying theoretical concept of creativity as flexible both-way interaction between organism, its awareness and environment. Theoretical ground for bringing this model is brief review of four psychodynamic models: Freudian, Rankian, integrative and Gestalt. Creativity can be seen as the process of contact between organism and environment. It is needed to differentiate how the contact boundary between operates in the awareness involving awareness of both sides: the organism and the environment. Neurobiology can theoretically describe how is this happening with the processes of simulations where the neurobiological substrate – the brain itself is seen on the side of the environment in above described interactional model of creativity. On another side of the contact boundary in awareness of organism itself is awareness which can be manipulated via verbal intervention or even another creative process. Above described theory of creativity is attempt at theoretical application of previous knowledge of psychodynamic psychotherapy, which can be used as an effective treatment of mental disorders epidemic of modern times.

Brain cortical activity after high-frequency electromagnetic field exposure and indirect specific absorption rate measurement

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The findings from electrophysiological studies suggest that exposure to high-frequency electromagnetic field (HF EMF) corresponding to mobile phone signals influences brain function but neither the biological nor the clinical significance of the findings is clear at present. The aim of the study was to form a simple method for direct EEG measurement during HF EMF exposure in mice; also to study a possible effect of HF EMF on the spontaneous EEG which is registered simultaneously and to detect SAR (specific absorption rate) in exposed animals, too. EEG recording method is based on the use of gel electrodes (silicon and

glass tubes filled with agar) where the connection with platine electrodes is located out of HF EMF space. The electrocorticogram (ECoG) was measured as two minutes segments from continuously recorded activity either without HF EMF or with it. Final calculation with Fourier analysis and averaging were performed off-line on DISYS-system (Software for data acquisition and analysis). A special exposure chamber for small laboratory animals with a specific absorption rate (SAR) measurement was constructed. This chamber (900MHz) was designed with the following issues in mind: inducing uniform field, eliminating external radiation, determining accurate absorbed power, providing sufficient space for mice and maintaining costs within budget. Because is generally difficult to measure SAR directly in a living biological system, our measurement was indirect; a final SAR value is the difference between value with empty container and container with the animals. In the pilot experiment the average SAR in mouse was 2 – 4 W/kg of b.w. We confirmed a possibility of direct ECoG registration during exposure to HF EMF. This type of radiation influenced spontaneous cortical activity; the shift towards lower frequencies was observed. Using an unique exposure chamber we can able to measure SAR values. *Supported by Grant of EU, COST Action BM 0704: Emerging EMF – Technologies and Health Risk Management.*

Cognitive and non-motor functions of the cerebellum

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Recently published studies demonstrated that the cerebellum and basal ganglia participate in various motor and non-motor task related to prediction. In addition, the cerebellum is activated by a large number of cognitive tasks that are devoid of movements. The basal ganglia impairment in Parkinson's disease is linked with impulsive control disorders including pathological gambling. However, there is a debate as to the role played by these structures. To answer the question about exact role of the cerebellum and basal ganglia in predictive motor timing and impulsive control disorders we studied patients with various movement disorders. In a series of behavioural and functional imaging studies (studying healthy subjects, patients with spinocerebellar ataxia, Parkinson's disease and essential tremor) we demonstrated that: (i) The cerebellum plays an essential role in integrating incoming visual information with motor output when making predictions about upcoming actions. (ii) The cerebellum is an important structure in motor timing and that it was used both by the healthy and spinocerebellar ataxia patients; however the striatum was found active when differentiated more between two groups than the cerebellum. (iii) Both the cerebellum and the basal ganglia are involved in motor timing, in general, with the

cerebellum being associated with the postponement of the action until the right moment, and with both the cerebellum and the basal ganglia needed for successful adaptation in the task from one trial to the next [Bareš *et al*, *Exp Brain Res* 2007, 180(2):355–365; Bareš *et al*, *Cerebellum* 2010, 9(1):124–135; Bareš *et al*, *Cerebellum* 2011, 10(2):233–244; Husárová I *et al*, in revision]. *Supported by the project “CEITEC – Central European Institute of Technology” (CZ.1.05/1.1.00/02.0068) from European Regional Development Fund and by Research Project MSM0021622404.*

Emotional arousal and temporal sensitivity of the visual system

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Emotions influence perceptual processing. An exposure to an emotional stimulus may increase visibility of a neutral target (eg, Ciesielski *et al*, *PLoS One*, 5(11):e13860, 2010). We tested whether emotional arousal alters visual temporal resolution. Specifically, we expected an increase in temporal resolution since emotional information is transmitted by the magnocellular system, tuned to high temporal frequency. To this aim, in healthy human subjects, flicker fusion threshold was assessed after presentation of short videos with negative (threatening) and neutral affective charge. Change in emotional state was verified by measuring skin conductance level. Contrary to our expectation, flicker fusion threshold was unaffected by emotional arousal and was even decreased in subjects who showed long reaction time at basal testing. *Supported by VEGA grant No. 2/0023/10.*

Voluntary activation of sensory-motor system by supplementary information about body tilts in human balance

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Balance impairment seen in elderly is frequently related to a slight sensory deficit. To avoid a following postural instability is recommended to perform exercise and activate their sensory-motor system. It is known that supplementary sensory information about body tilt presented to subject during stance is a common method of balance training. This study examined balance control in subjects of different ages. We tested 10 juniors and 10 seniors during stance in

three sensory conditions: quiet stance with no supplementary feedback, stance with enhanced visual feedback about body tilt, stance with vibrotactile feedback about body tilt. Subjects performed four trials in each of three conditions of stance with eyes open. One trial lasted 50s. Body sway in anterior-posterior and lateral directions was characterized by centre of foot pressure displacement (CoP) and by 2D-accelerometers located on the upper trunk (Th4) and lower trunk (L5). The CoP displacement in both directions showed a slight reduction of amplitude during stance with supplementary visual information about CoP displacement. Vibrotactile information about body tilt sensed by accelerometer at L5 level was not so effective feedback for balance improvement. Contrary, increase of mean CoP velocity occurred during augmented sensory feedback, which indicates voluntary control activation in balance control. Results confirmed the reduction of the body sway in stance conditions with supplementary sensory information, which was more notable with visual than vibrotactile feedback. Analysis of the body segment sway during stance with augmented sensory feedback indicated that it should be useable also for balance training in elderly. *Supported by Slovak grant agency VEGA 2/0186/10.*

Trait anxiety and emotional memories

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Anxiety disorders belong to the most prevalent mental disorders and cause severe suffering to affected subjects. Unfortunately, pathophysiology of anxiety is still little understood. Biased cognition is considered to play a central role in the development of anxiety states. We investigated the mechanisms of long-term memory to a negative thread-arousing stimulus in subject with high or low anxiety. In our experiment, subjects were presented a horror and an emotionally neutral film clips and were asked to recollect these movies one week later. During both sessions electrodermal activity was measured. Compared to individuals with low anxiety, subjects in the high trait anxiety group used more emotionally valenced words while recalling the horror movie. There was no difference between groups in the number of emotional words used to report the memory of the neutral movie. No group difference was found in the number of total facts remembered from either of the movies. In the low compared to high anxiety group, we found stronger positive association between skin conductance level during horror watching and subjective rating of emotional intensity of the memories during recollection. This finding indicates disrupted relationship between bodily arousal and emotional memories in anxious subjects. *Supported by VEGA grant No. 2/0023/10.*

Testosterone and cortisol changes after mental rotation tasks in both sexes (preliminary study)

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Testosterone has a significant effect on brain functions. This work investigated an opposing effect, how intensive mental rotation task influences the hormonal profile. The aim of this study was to analyze the (gender) effects of intensive 3D mental rotation on testosterone levels in young healthy men and women. It was confirmed that men reached higher scores than women. In 8 out of 9 women but not in men testosterone levels decreased after one hour of mental rotation testing. In all women plasma cortisol levels was lower after testing. In men cortisol levels decreased in 7 out of 9 probands. No association between testosterone levels before testing and mental rotation was found in women. In men testosterone and mental rotation correlated positively. Plasma cortisol levels before testing did not correlate significantly with mental rotation in women and correlated negatively in men. No associations were found between the dynamics of hormonal levels and mental rotation scores. In conclusion, there were different hormonal responses in both sexes to the same mental stimuli.

Behavioral effects of increased prenatal testosterone on adult male rats

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Increased prenatal testosterone has previously been hypothesized as a cause of autism and other neurodevelopmental pathologies, as well as a source of physiological variability of behavior. The aim of our study was to describe behavioral changes of adult male rats induced by increased prenatal testosterone and to uncover the underlying molecular mechanism using androgen receptor blocker flutamide. Pregnant female rats were divided into 4 groups: testosterone propionate (TP), flutamide (FLU), testosterone propionate + flutamide (TF) and control group (CTRL). From the 14th day of pregnancy daily until delivery either testosterone in dose of 2mg/kg, flutamide in dose of 8mg/kg, both testosterone and flutamide, or oil were applied intramuscularly. A battery of behavioral tests including elevated plus maze, open field, light/dark box, forced swim test and a modified Morris water maze was performed in male offspring 90 days postpartum to assess anxiety, depression

and spatial memory. No differences were found between TP group and control group. FLU group and TF group showed higher anxiety behavior in elevated plus maze and open field or elevated plus maze, respectively ($p < 0.05$). In the forced swim test rats treated with flutamide were significantly more prone to depression-like behavior in comparison to control rats ($p < 0.04$). No differences in working and reference memory were found in the Morris water maze. In conclusion, prenatal administration of testosterone had no effect on the analyzed behavior. Flutamide blocking the effects of endogenous testosterone induced anxiety and depression-like behavior in the adult male offspring. Further larger studies should focus on prepubertal development and other behavioral characteristics including sociability.

Impact of cognitive task on balance in upright stance

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Postural control in everyday life is generally accompanied by posture-unrelated cognitive activity. When one needs to maintain balance of upright stance while performing a concurrent cognitive task, attention is divided between the sensorimotor and cognitive task. The purpose of this study was to investigate the effect of performing a cognitive task (subtracting 7 from 3-digit number) in healthy young adults ($n=20$; 6 men and 14 women; mean age 23.5 years). The balance was assessed during quiet stance in two conditions: stance on foam with eyes closed (FC) and stance on foam with eyes closed + cognitive task (FCC). The body sway was recorded by force platform as centre of foot pressure (CoP) and by 2 accelerometers attached at upper (Th4) and lower trunk (L5). We evaluated two parameters: velocity in anterior-posterior (V_y) and medial-lateral (V_x) directions and line integral (LI).

The results showed statistically significant increase of LI and velocity in both directions only from upper trunk tilts during dual task condition. In lower trunk statistically significant increase of velocity was occurred in anterior-posterior direction. No statistically significant difference between the single and the dual-task in parameters evaluated from CoP displacements was found. This finding is in agreement with previous studies in which young adults did not show an increase of CoP displacements with increasing cognitive demands. Subjects coped with the increased cognitive demand by increasing of trunk tilts velocity. This suggests that dual-tasking postural control compromises balance performance of upper segments of body. According to these results accelerometer sensors provide more information about postural changes in distal body segments. Supported by VEGA grant No. 2/0186/10.

Polyphenols affect mechanisms of memory and attention

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The nitric oxide cannot be stored in the CNS – it diffuses via cell membranes and acts in localities which are apart from the place of its origin. Like the PC, which boots before starting the complicated programs, the NO triggers certain necessary functions for more complex brain operations. In this sense it plays an important role in neuro-cardiovascular interactions as well. In the nervous system it can affect the sympathetic and parasympathetic tonus and, consequently, the heart rate and blood pressure variability, which can via arrhythmias, hypertension and tachycardia elicit several cardiac events. By means of neuroendocrine regulations the NO can increase the level of catecholamines and cortisol. It can also negatively affect the neuro-inflammatory processes, thrombotic environment namely. The NO may play a role in health damaging behavior also. These endocrine, inflammatory and behavioral effects can lead via atherosclerosis, myocardial ischemia and coronary thrombosis to very dangerous cardiac events also. The experimental data with various NO production influencing substances applied for several weeks support the mentioned scenario. These effects are dose dependent and were demonstrated in animal experiments. The question whether the single dose of the NO production influencing substance may have an effect upon the organism was solved. The polyphenolic compounds from red wines, which affect the blood pressure regulation in laboratory animals, influence also the human space memory function for limited time duration as revealed from higher accuracy of memory-guided saccades after the single dose of it. The cardiovascular, central motor programming and perceptual mechanisms are very probably not responsible for the effect – there are no significant changes in blood pressure, in preparation and execution of saccades as well as in basic encoding of new saccadic landing position. The EEG spectral analysis points to the involvement of memory mechanism and of attention enhancement mainly. *The research was supported by the VEGA grant No. 2/0173/11 and APVV-0742-10*

Performance on the Stroop colour-word test in neurodevelopmental disorders

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The Stroop test was used to study attentional and executive capacities in three neurodevelopmental disorders differing as regards patterns of intellectual ability and impairments of speech and language abilities. The test was individually administered to groups of twenty-three children with developmental dyslexia, to a child with Landau-Kleffner syndrome, to seven adolescents and adults with Williams syndrome and to control groups from the non-clinical population. The following tasks from the Stroop test were employed: reading colour names printed in black ink, naming the colours of rectangular patches, reading colour names printed in coloured ink and the colour-word interference task – naming the colour of the ink in which the colour names are printed (the colours of the print do not correspond with the colour names in the last two tasks). The results revealed different profiles of performance on the tasks employed in the studied disorders. Dyslexics needed more time on all four tasks in comparison with the control group. In the case of Landau-Kleffner syndrome (acquired aphasia with convulsive disorder) the performance did not differ from controls. The performance of the Williams syndrome group, a rare disorder with intellectual disability, did not differ significantly from controls on the reading and naming tasks, but tended to show greater difference between response time to the colour-word interference task and response time to the coloured rectangles task in comparison with the control group. The findings are discussed from the point of view of the specific characteristics of the disorders studied. *Supported by VEGA grants No. 1/0253/09 and No. 2/0023/10.*

Combined adverse effect of behavioral and life-style factors, and occupational environment on total cardiovascular risk

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Background and Objective: The unhealthy occupational environment together with improper behavior and/or nutritional habits could increase total cardiovascular disease risk in workers. The aim of the study was to compare total cardiovascular risk score in the exposed and unexposed samples of employees in the different workplaces.

Methods: 2,690 healthy employees (44.9% men and 55.1% women) in 18 different workplaces (mean age 41.5±9.6 yrs) were examined for cardiovascular risk factors (serum lipids levels, blood pressure, anthropometric parameters on overweight and obesity) and they completed a questionnaire on socioeconomic, demographic and behavioral factors, nutritional pattern, self-reported health status, and mental health. Relative cardiovascular risk was calculated using SCORE chart after the projection to the

age of 60. 393 subjects (53.7% men) exposed to different chemical pollutants in their workplaces were compared with the unexposed subjects. Results: Exposed subjects were significantly younger (39.9 yrs vs. 41.6 yrs; $p=0.0003$), with lower educational level. They declared higher physical and stress load at work (NS), had worse mental health score ($p=0.0431$), and higher relative cardiovascular risk (OR=1.30; 95%CI=1.02–1.64; $p=0.0277$). They reported exposure to second hand smoke at work as well as in privacy and poorer health status more often. Linear regression analysis (adjusted for age) showed positive significant association among SCORE60 and chemical factors exposure ($p=0.0372$), stress load ($p=0.0021$), physical load ($p=0.0003$) second hand smoke exposure ($p=0.0000$), alcoholic beverages consumption ($p=0.0000$) and poorer health status ($p=0.0393$), and negative significant association with educational level ($p=0.0011$), and fruit ($p=0.0001$) and vegetable ($p=0.0340$) consumption. Conclusion: According to our results, there is the possible combined adverse effect of unhealthy working conditions, several lifestyle factors and/or nutritional habits on total cardiovascular risk, together with lower educational level and poorer self-reported health status.

Cortico-cerebellar functional connectivity and sequencing of movements in schizophrenia

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Introduction: Abnormal execution of several movements in a sequence is a frequent finding in schizophrenia. Successful performance of such motor acts requires correct integration of cortico-subcortical processes with a special emphasis on cerebellar functions. Abnormal connectivity between cortical and cerebellar regions with resulting cognitive dysmetria has been proposed as the core dysfunction behind many signs and symptoms of schizophrenia. Examination of cortico-cerebellar connectivity during movement sequencing task would be, therefore, a test of the cognitive dysmetria hypothesis. **Methods:** We examined 29 schizophrenia patients (SCH) and 29 age, sex, and handedness matched healthy controls (HC) using fMRI during a modified finger tapping task. The ability to perform movement sequencing was tested using the Neurological Evaluation Scale (NES-SQ). Parameters of functional connectivity between the motor cortex and cerebellum and the supplementary motor cortex and cerebellum (MC-CRBL, SMA-CRBL)

activated during the motor task were compared between SCH patients with (SQ+) and without (SQ-) movement sequencing abnormalities. Results: SQ+ patients showed a lower level of MC-CRBL and SMA-CRBL connectivity than SQ- patients. The level of MC-CRBL and SMA-CRBL negatively correlated with the magnitude of NES-SQ abnormalities. Moreover, only SQ+ patients had significantly lower cortico-cerebellar connectivity than HC. **Conclusions:** Abnormal cortico-cerebellar functional connectivity is linked with movement sequencing abnormalities in schizophrenia, but not with the diagnosis of schizophrenia per se. It seems that specific patterns of inter-regional connectivity are linked with corresponding signs and symptoms of clinically heterogeneous conditions such as schizophrenia. *The study was supported by a research grant No. NR9855-4 provided by the Ministry of Health, Youth, and Sports of the Czech Republic (MZCR).*

Changes of the myocardial repolarization as a component of the cardiovascular reaction to mental stress

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A large amount of studies was published using mental arithmetic (MA) as a probably most consistent test which involves increased alertness with intellectual and emotional strain. Integrated response of the cardiovascular system mediated via efferent sympathetic pathways, as a component of a complex psycho-emotional stress reaction, was traced mainly by changes of heart rate, blood pressure, cardiac output and skin and muscle blood flow. The aim of the study was to examine the previously unexplored reactive changes of the ventricular depolarization and repolarization body surface potential map (BSPM) parameters carrying information on the direct sympathetic activation of the ventricular myocardium, induced by a mental stress-test. The study is based on investigation of 81 young men, with no history of cardiovascular diseases and with normal ECG. Using PC based electrocardiographic systems, unipolar ECGs were recorded from a grid of torso electrodes, before, during and after a MA test. In 9 subjects recorded continuously and evaluated beat-to-beat, to assess the dynamics of the reaction. The blood pressure (BP) was measured repetitively. In a sequence of integral BSPMs, respective parameters and R-R intervals were evaluated. The stress induced changes began in all subjects with a short latency after initiation of the mental task, usually peaked significantly at 30–60 seconds, returning to the control values to the end of the test, or some heart beats after. The HR rose by 10%, the mean arterial BP by 13%, whereby the main parameter of the integral repolarization BSPM – the QRSTampl fell to 81% of its control value. The pattern of the responses

was inter-individually conformable, however variable in magnitude. It is concluded, that the dynamic changes of the cardiac electric field are explained by patterning of the selective sympathetic activation of the ventricular myocardium in the response to mental challenge. *Supported by a grant VEGA No 2/0084/10.*

Pre-attentive processing of visual motion: mismatch-negativity view

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An interrupting (deviant) event in a perceptual stream of standard events can be detected without an attention and has a specific electrical brain response different from the response to the standard events. A difference between the standard and the deviant brain response called mismatch negativity represents an index of pre-attentive processing and is used in clinical diagnostics. The mismatch negativity (MMN) originally described in the auditory domain was reported also for the other sensory modalities. In our work we recorded the visual MMN over occipital and centroparietal region within interval 145–260 ms [Kremláček *J et al*, *Vision Research*, 2006. 46(4): p. 485–90] when the mismatch negativity paradigm was used for activation of the magnocellular system (an entry gate of the dorsal visual stream). Examination of the visual motion MMN in a group of 24 schizophrenic patients and their paired control subjects showed a reduction of the visual MMN and its negative relationship to level of medication dose in schizophrenic patients [Urban A *et al*, *Schizophr Res*, 2008. 102(1–3): p. 320–8]. Another pilot study of 17 methamphetamine abusers showed a deterioration of the MMN with length of the methamphetamine abuse (Spearman correlation 0.78) and stronger response to deviant stimuli when the abuse was shorter than 5 years [Hosak L *et al*, *Acta Neurobiologiae Experimentalis*, 2008. 68(1): p. 97–102]. These results, however, were not confirmed in an enlarged group of abusers because of a large inter-individual variability of the visual MMN response. From a diagnostic point of view the visual MMN represents an attractive way for selective assessment of the pre-attentive processing; however, a long examination procedure and high inter-subjects variability could limit its neuropsychiatric use. *Supported by Czech Grant Agency – project no. 309/09/0869*

Origin and maintenance of pathogenic belief in panic disorder: one case study

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The aim of the study was to demonstrate how recent research achievements in the neuroscience of emotions can influence practical management of anxiety disorders. Using the data obtained from analysis of psychophysiological mechanisms in one case of panic disorder, the type of threat, key threat stimuli, and the structure of the pathogenic neurotic belief were ascertained and, on this basis, an individually tailored therapeutic procedure was designed. Its application resulted in almost complete dissipation of the neurotic belief, which represented the key pathogenic mechanism in the case studied. The study called attention especially to the importance of detailed diagnostics of memory mechanisms underlying the formation of neurotic belief in the psychotherapy of anxiety disorders. *Supported by grants MSM 0021620849 and MSM 0021622404.*

Role of testosterone in autism pathogenesis

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Impairment of testosterone metabolism is suggested as a key factor in pathogenesis of neuropsychiatric disorders such as autism. Prenatal and postnatal testosterone imbalance was identified in autistic patients. In our study we have analysed postnatal levels of salivary testosterone in autistic patients. 2D:4D digit length ratio was used as a marker of prenatal testosterone. Subjects were genotyped for assessment of genetic basis of androgenic effect. 101 autism spectrum disorder patients and 107 healthy controls of male gender were recruited into the study. Salivary testosterone levels were measured, 2D:4D ratio was assessed. Polymorphisms in gene influencing testosterone metabolism were examined. We have found elevated salivary testosterone in prepubertal ($p=0.0052$) as well as in pubertal autistic boys ($p=0.006$). Patients with autism spectrum have lower 2D:4D ratio ($p=0.008$) suggesting enhanced prenatal testosterone environment. The trend to lower number of CAG repeats in AR gene in autistic patients presuming higher sensitivity of the receptor was found ($p=0.089$). T allele of SRD5A2 polymorphism was significantly more prevalent in autistic patients ($p<0.0001$) indicating enhanced activity of 5-alpha reductase enzyme which converts testosterone to a stronger androgen dihydrotestosterone. C allele associated

with lower aromatase activity was more frequent in autistic patients ($p=0.0004$), suggesting lower rate of testosterone conversion to estradiol. G allele of SHBG indicating lower gene expression was more frequent in autism (ns, $p=0.015$), which may lead to lower SHBG subsequently increasing free testosterone. Our results underline the importance of testosterone in autism pathogenesis and suggest the possible mechanism of stronger androgenic effect.

Effects of prenatal testosterone on learning and memory in young and adult Wistar rats

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Androgens are responsible for sexual differentiation of brain, because of different effects on structural morphology and function of brain during prenatal critical period. Testosterone is a major androgen in processes of differentiation and sex dimorphism of neuroanatomy has also impact on sex differences in cognitive function and spatial abilities. The aim of this study was to evaluate whether prenatal testosterone affects learning and memory in pre-pubertal and adult rat and whether these effects are mediated via the androgen receptors. Male Wistar rats were divided into four groups – control, testosterone, flutamide, and testosterone with flutamide. Testosterone and flutamide were administered to gravid females last week of pregnancy. The doses were 2 mg/kg/day of testosterone and 8 mg/kg/day of flutamide. Before onset of puberty, young male rats (23 days old) underwent behavioral tests to assess spatial learning and memory in Morris water maze. Behavioral testing was done during 11 consecutive days. In adulthood, male rats (112 days old) underwent the same behavioral test again. The levels of testosterone were higher in adult rats with administered testosterone compared to other groups. No significant differences between groups were found in reference memory in pre-pubertal and adult rat. During some days of learning significant differences between groups in youngs and in adults were observed, however there was high variability within groups. Administration of either testosterone or flutamide or their combination improved time learning comparing to control group of adult rats. The similar effect was observed also in youngs. Stages of life affected learning in all groups, but had no effect on reference memory. Young males had higher latency time to achieve platform compared to adults. This study didn't show any significant differences between testosterone, flutamide and testosterone + flutamide groups in spatial learning.

Dynamics of human brain activity related to visual short-term memory

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Visual short term memory (VSTM) stores visual information for a few seconds so that it can be used for ongoing cognitive processing. VSTM relies on several cognitive processes, such as information encoding, maintenance, retrieval and resistance to interfering stimuli. How these processes are related to individual differences in VSTM capacity is hotly debated yet largely unknown. To investigate this issue we recorded event-related potentials (ERPs) from 61 scalp electrodes during a VSTM task in 24 healthy adult human subjects. Temporal-spatial principal component analysis of the ERPs followed by source reconstruction of the extracted components was adopted to determine brain loci constituting specific synchronously active neural networks. We found that VSTM capacity was inversely related to activity within the midcingulate cortex during memory encoding. No significant associations were found with activities supporting other cognitive subprocesses. Our results indicate that efficiency of VSTM is limited mostly by the initial encoding. Recruitment of the midcingulate cortex suggests that less skilled individuals require stronger engagement of executive attention processes to achieve successful encoding. *Supported by VEGA grant No. 2/0023/10.*

Can wisdom be considered as a protective factor of health?

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Wisdom is a complex phenomenon involving multiple dimensions of personality. Its concept was developed in the past, especially in the theory of philosophy and theology. Today, wisdom becomes object of scientific research. In the past decades psychology gives attention to wisdom in connection with increasing age of population and with a focus on the positive aspects of aging, personal growth and the support of psychical resistance. Moreover, in the last decade accrue articles concerning: neurobiology of wisdom, neuroscientific research of meditation as a path to development of wisdom and psychotherapeutic use of wisdom in (psychosomatic) patients with the Post-Traumatic Embitterment Disorder. In our research we therefore focused on the relationship between wisdom and health. We examined wisdom in relation to psychical resistance (hardiness), psy-

chopathological phenomena, age, sex and education. The obtained data were compared between the group of psychosomatic patients and the control group. We used three scales of wisdom: Self-Assessed Wisdom Scale (SAWS), Three-Dimensional Wisdom Scale (3D-WS), Adult Self-Transcendence Inventory (ASTI) and also Hardiness questionnaire (PVS) with Self-Report Symptom Inventory (SCL-90). For a sample of 47 respondents (26 psychosomatic patients and 21 patients of the control group) we found significant difference in values of wisdom between groups, significant positive relationship of wisdom to hardiness and its significant negative relationship to subscales of SCL-90. There was no evidence to link wisdom to age or to education.

Changes in cognitive functions after electroconvulsive treatment

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Electroconvulsive treatment (ECT) is recommended and effective therapy for certain psychiatric disorders. However, deficits in cognitive functions often occur after applying ECT. Commonly seen adverse effects are connected to retrograde, anterograde memory and other non-memory-related cognitive abilities. Our research was focused on changes in selected cognitive functions (memory, attention, psychomotor speed and intellect) detected in patients undergoing electroconvulsive treatment. Changes in cognitive functioning were evaluated in 30 psychiatric patients before and after ECT session. To assess changes in cognitive abilities we have chosen Rey-Osterrieth Complex Figure Test (ROCF, TKF), Attention Concentration Test (TKP), Trail Making Test (TMT) and Intellect Potential Test (TIP). Our results showed significant improvement in short-term memory, psychomotor speed (connected with shifting) and attention after ECT session. Other measurements also reflected improvement but not in significant terms. Insignificant results in long-term memory (which requires more complex processing) correspond with similar results in intellect. Summarizing previous results, we can assume that ECT could be behind the improvement of cognitive functioning. However, further research is required considering also limitations of the study.

Motor resonance based desynchronization of the EEG mu rhythm

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Understanding of the observed motor actions is one of crucial cognitive abilities. The prominent direct-matching hypothesis suggests that the observed action is understood on the basis of partial activation of the motor regions in the observer's brain. Motor resonance can be seen as a result of the activity of mirror neurons that modulates motor areas leading to the desynchronization of mu rhythm. Mu rhythm oscillations can be recorded over the sensorimotor cortex in relaxed state, in the absence of physical or mental movement, and they have been shown to be suppressed both during action execution and the mere observation of the same movement. To test these findings, we ran two preliminary experiments, using g.USBamp 3.0 EEG system and the standard 10-20 system of electrode placement. We recorded EEG from 9 passive electrodes in locations F3-z-4, C3-z-4, P3-z-4, on 4 subjects. Each experiment included 6 conditions: relaxed state (closed eyes), imaginary movement (closed eyes), imaginary movement (opened eyes), observed movement, self-movement and relaxed state (opened eyes). The motor movement involved tapping on the table with an index finger. We focused on frequency range 8–13 Hz known to be relevant for mu rhythms. We expected to find a difference in spectral power density in the relaxed state (opened eyes) and the states involving motor movement (observed, imaginary, and executed), supporting the direct-matching hypothesis. The analysis of measured data matched our expectations in three subjects that showed a significant decrease of the spectral density in the target frequency range, in central and parietal locations, in all action conditions, compared to target relaxed state (opened eyes). Imagined movement also led to suppression, consistently with recent evidence on neural correlates of motor imagery. Conditions with closed eyes showed much higher spectral density, possibly confounded with alpha rhythm. Further experiments are planned to provide deeper insight into the phenomenon.

Psychosocial factors of family in association with children and youth obesity

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Obesity in childhood presents a risk for obesity and obesity related diseases in adulthood. The aim of the study was to evaluate the relationship between selected psychosocial factors of family and obesity in children. Psychosocial data on families (education and occupation of parents, ethnicity and completeness of family, lifestyle factors) were obtained by a questionnaire. The overweight has been assessed as BMI [kg.m⁻²] over 90th percentile and obesity – BMI over 97th percentile of Slovak representative children and youth samples (1991 and 2001, 2–18-year-old, both gen-

ders). The programs Microsoft Excel and S-Plus were used for statistical analysis. In the examined decade the mean value of BMI significantly increased only in 9–15-year-old boys ($0.3\text{--}0.4\text{ kg}\cdot\text{m}^{-2}$, $p<0.001$) and in 7–11-year-old girls ($0.15\text{--}0.4\text{ kg}\cdot\text{m}^{-2}$, $p<0.01$); BMI mean value of boys in the younger and the older age has stagnated and in 12–18-year old girls has significantly decreased. The significant relationship between BMI of children and their parents confirms the impact of family lifestyle on body parameters. Being overweight or obese was negatively associated with parental education and employment. These associations varied according to age and gender. Very close significant negative relationships have been revealed between incidence of overweight and educational level of mother in girls ($p<0.001$). The factors of family completeness and ethnic group did not show associations with BMI of children. Studied socio-economic factors act together with other patterns in the family (nutritional habits, physical activities). The psychosocial factors promotion of health and healthy development in children and adolescents requires knowledge of the wide range of mutual interactions.

The effect of visual attention shifts on dichotic listening

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Spatial attention directs perceptual processes to certain position in space. At the attended location accuracy and speed of detection of the stimuli are increased. However, the exact relationship between spatial attention and sensory process is not clear. Is spatial attention a unified high-level cognitive process that operates over sensory modalities or are there several spatial attention processes instantiated separately and independently within each modality? We investigated this issue by recording dichotic listening performance while visual spatial attention was shifted to the right or left in a saccadic eye movement task. Visual and auditory targets were presented with variable asynchrony in order to investigate at which level the interaction occurs, early auditory encoding vs. late selection of one of the two concurrent auditory representations. Thirty healthy young volunteers participated in the study. We found no effects of shifting visual spatial attention on dichotic listening performance. This indicates that spatial attention may operate independently in auditory and visual modalities. *Supported by VEGA grant No. 2/0023/10.*

Relation between human brain activity during mental rotation and mathematical abilities

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Shepard and Metzler (1971) introduced the concept of a mental rotation and confirmed that there is an increasing linear relation between the reaction times and the angular disparity between the two stimuli. Since then, a huge amount of research was done comparing the reaction times and the error rates among different groups of people (women vs. men, nationalities, artists vs. nonartist etc.). Neuroimaging studies have shown that the mental rotation is mediated primarily by parietal lobes. O'Boyle et al. (2005) demonstrated in their fMRI study that mathematically gifted male adolescents engage different brain structures than those average gifted when performing 3D mental rotation. A set of special stimuli with different complexity was created. Each stimulus consists of basic units (squares or cubes). We presented 200 pairs of 2D stimuli and 200 pairs of 3D stimuli (rotated by multiple of 60°) with an increasing complexity. 3D stimuli were composed in such a way, that the rotation around different axis was needed. The reaction times and the error rates were measured. After the experiment, we used a questionnaire and asked subjects which strategies they had used, what is their mathematical education and abilities, which food additives, nootropics or psychopharmaca they take. For the objective evaluation of the subjects' intelligence, the Wechsler intelligence scale (WAIS-R) was used. We recorded and analyzed an EEG activity during the mental rotation and detected brain structures that discriminate between mathematically gifted people and average ability. Correlation between the EEG activity and subjects' IQ (and stated mathematical abilities) was done. We have focused on comparison with the above mentioned fMRI study. *This research has been supported by CVUT SGS grant No 10/279/OHK3/3T/13 and MSM6840770012.*

Analysis of the event related spectral perturbations within a 3D navigation task

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The method of event related spectral perturbation (ERSP) was introduced by Scott Makeig in 1993. The ERSP measures the time course of changes in the EEG spectrum induced by a set of experimental events. The method is

similar to event related synchronization and desynchronization proposed by Pfurtscheller in 1971. Gramann et al. (2010) adopted independent component analysis (ICA), source reconstruction and ERSP in navigation task based on the traverse through a virtual tunnel to localize neural structures involved in allocentric and egocentric reference frame processing in a horizontal plane. They revealed stronger alpha blocking in BA 17 for subjects adopting an egocentric reference frame in the turned segment of the tunnel and stronger alpha blocking in BA 7 and BA 26, 29, 30 for participants adopting an allocentric reference frame. We administered advanced version of the tunnel task based on the presentation of the upward and downward tunnels to reveal novel findings related to adopting a frame of reference in a 3D environment. The tunnel task consists of traverse through a virtual tunnel and subsequent identification of the origin of the tunnel. The subject's response corresponds to the reference frame he/she adopts as the navigation system. We did the ICA and ERSP analysis of the data (the source reconstruction was skipped because we did not measure high-density EEG) both in horizontal and vertical plane to search for the difference between specific planes. We also compared our result with the Gramann et al. study in horizontal plane. *Supported by GACR grant No. P407/11/P696.*