NEURONUS 2015

IBRO & IRUN NEUROSCIENCE FORUM

APRIL 17-19 2015, KRAKOW, POLAND

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Michał Ślęzak - Laboratory of Glia Biology, VIB, Leuven, Belgium
Michał Kuniecki - Psychophysiology Laboratory, Jagiellonian University, Krakow, Poland
Wioleta Walentowska - Psychophysiology Laboratory, Jagiellonian University, Krakow, Poland & Psychopathology and Affective Neuroscience Laboratory, Ghent University, Belgium
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Joanna Golec, Monika Halicka, Błażej Pędzich
Jagiellonian University's Psychology students, Krakow, Poland

Website design

Szymon Jeziorko
http://szymonjeziorko.com

Conference poster and booklet graphic design

Barbara Lubas

Booklet editors

Anna Chrzanowska, Błażej Pędzich

Contact

neuronusforum@gmail.com

APRIL 17, 2015 (Friday)			
10.00	- Main Hall - Registration opens		
11.00 – 13.00	- Large Aula A - **Anthony Newman** ***How to Write a Great Research Paper, and Get It Accepted by a Good Journal*** (Life Sciences Department, Elsevier, Amsterdam, the Netherlands)		
13.00 – 13.30	Coffee break		
13.30 – 13.45	- Large Aula A - **Opening Ceremony**		
13.45 – 14.45	- Large Aula A - Opening Lecture: **Dame Pamela J. Shaw** ***A translational neuroscience approach to the problem of motor neurone disease*** (University of Sheffield, UK)		
15.00 – 16.30	- Large Aula A - Session I **<u>Neuroimmunology</u>** chaired by: **Asya Rolls** (Israel Institute of Technology, Haifa, Israel) 1. **Asya Rolls**: It takes a nerve to control immunity *(IBRO Alumni Lecture)* 2. **Magdalena Kostrzewa**: Endocannabinoid system and pain due to osteoarthritis pain	- Medium Aula A - Session I **<u>Neuroeconomics - neural mechanisms of decision-making</u>** chaired by: **Barbara Fryzeł** (Jagiellonian University, Krakow, Poland) & **Jan Rodriguez Parkitna** (Polish Academy of Sciences, Krakow, Poland) 1. **Philippe Tobler**: Separating reward from salience in the brain 2. **Zsofia Hangebrauk**: Combined effects of	- Medium Aula B - Session II **<u>Advanced EEG Signal Analyses</u>** chaired by: **Boris Gutkin** (Ecole Normale Superieure, Paris, France) 1. **Boris Gutkin**: Selective roles of multiple oscillatory bands in flexible control of working memory 2. **Paweł Matusz**: Learning occurs in multisensory environments: Individual differences, developmental trajectories, consequences

	3. **Daria Gendosz**: Pre-Chiasmatic Subarachnoid Hemorrhage leads to disintegration of Blood-Brain Barrier, by Tight Junctions proteins disassemblance 4. **Dominika Luptáková**: Neurodegeneration, blood-brain barrier disruption and neuroinflammation as a consequence of hypoxic-ischemic insult to newborn rats	cortisol and noradrenaline cause decreased loss aversion 3. **Tina Strombach**: The neural underpinnings of performance-based incentives 4. **Marcin Jaracz**: Economic decision-making and neurocognitive performance in schizophrenia and bipolar disorder 5. **Jan Rodriguez Parkitna**: The role of neuronal plasticity in the dopamine system in reward-driven learning	3. **Dania Gutierrez**: Modeling a learning process through functional analysis-of-variance of brain rhythms 4. **Rob van der Lubbe**: Two sides of the same coin: ERP and wavelet analyses in a Go\NoGo paradigm with emotional facial expressions
16.30 – 18.00	Coffee break		
16.30 – 18.00	- Exhibition Room - Poster Session I	- Medium Aula - Commercial Presentation (**Neuro Device**)	
18.15 – 19.45	- Large Aula A - Plenary lectures: **Tom Johnstone** ***The neural basis for a balanced emotional system*** (University of Reading, UK) **Paul Whalen** ***Face to Face with the Emotional Brain*** (Dartmouth College, USA & Leverhulme Trust Visiting Professor at the University of Reading, UK)		
20.00	Welcome Reception		

APRIL 18, 2015 (Saturday)			
8.30	- Main hall - Registration opens		
9.00 – 10.30	- Large Aula A - Session II **<u>Learning and Memory</u>** chaired by: **Katarzyna Radwańska** (Nencki Institute of Experimental Biology, Warsaw, Poland) 1.**Katarzyna Radwańska**: A mechanism for long-term memory formation when synaptic strengthening is impaired 2. **Magdalena Robacha**: The role of CamKII autophosphorylation in fear memory extinction 3. **Joanna Gołębiowska**: Effects of acute and chronic pharmacological manipulations of the serotonergic system on cognitive judgment bias in rats 4. **Adrian Podkowa:** The comparison of the effects of donepezil and rivastigmine on memory and learning	- Medium Aula - Session III **<u>Pain and the Brain</u>** chaired by: **Tineke van Rijn** (Radboud University Nijmegen, the Netherlands) & **Emanuel Van den Broeke** (Catholic University of Louvain, Belgium) 1**. André Mouraux:** Neuroimaging of pain: current concepts and misconceptions 2. **Giulia Liberati**: Is the posterior insula specifically involved in pain perception? 3. **Elisa Carlino**: Event-related potential and placebo effect 4. **Flavia Mancini:** Mapping spatial acuity for pain	- Seminar Room - Session VI **<u>Multisensory Processing in Clinical and Healthy Population</u>** chaired by: **Salvatore Campanella** (CHU Brugmann-Université Libre de Bruxelles, Belgium) 1**. Salvatore Campanella:** The P300 and the NoGo-P300 event-related potentials: biological markers of abstinence vs. relapse in alcohol dependence? 2. **Katarzyna Żarnowiec**: Encoding of temporal regularity in the human auditory brainstem 3. **Bartosz Michałowski**: The goal within the grasp: an fMRI study of intention-dependent modulations of grasp-related cortical activity 4. **Elisabeth Colon:** EEG frequency-tagging to explore the crossmodal links in spatial attention between vision and touch 5. **Sylvie Nozaradan:** Isolating the neural entrainment to segregated

	abilities using Morris water maze and two-day radial-arm water maze in mice		sound streams with frequency-tagging
10.45 – 11.45	- Large Aula A – Plenary lecture: **Kia Nobre** ***Premembering Perception*** (Oxford Centre for Human Brain Activity, UK)		
11.45 – 12.15	Coffee Break		
12.15 – 13.45	- Large Aula A - Session III **<u>Neuroplasticity</u>** chaired by: **Gilles van Luijtelaar** (Radboud University Nijmegen, the Netherlands) 1. **Annemie Van der Linden**: Magnetic Resonance Imaging of Brain Plasticity in Songbirds 2. **Patrycja Brzdąk**: Matrix metalloprotease 3 inhibitor differentially affects long-term NMDARs function in basal vs apical dendrites of CA1 hippocampal region 3. **Rosanne Rietveld**: Mapping the cortical motor areas with EEG-source localization: developing an alternative for fMRI and TMS	- Medium Aula - Session V **<u>Affective Neuroscience</u>** chaired by: **Gilles Pourtois** (Ghent University, Belgium) 1.**Gilles Pourtois**: Early sensory processing in V1 waxes and wanes depending on mood and attention 2. **Valentina Rossi**: Reward and punishment associations show plasticity in visual cortex at different processing stages 3. **Annekathrin Schacht**: Modulation of visual sensory processing by associated valence – Evidence from event-related brain potentials 4. **Matthias Wieser**: Sensory facilitation of threat-predictive (social) cues – Evidence from steady-state visual evoked potentials	- Seminar Room - Session I **<u>Interactive Session of Medical Case Reports</u>** chaired by: **Dame Pamela J. Shaw** (University of Sheffield, UK) 1. **Alena Škutchanová**: Bedside consciousness: Evaluation of patients with chronic disorders of consciousness – goals and possible traps in search for purposeful behaviour (case series) 2. **Kamila Miętkiewska**: Diagnostic difficulties in Susac syndrome patient resulting from cognitive impairement 3. **Agata Średnicka**: Neurologic involvement in patient with Localized Scleroderma 4. **Bartosz Kapustka**: MoCap method in the assesment of common symptoms presented in patients with Parkinson's

	4. **Nikolaos Priovoulos**: Structural changes in the corticospinal tract as a predictor of behavioral changes in adolescents with unilateral Cerebral Palsy: an fMRI informed probabilistic tractography approach		Disease treated with deep brain stimulation (DBS) surgery
13.45 – 14.30	Lunch		
14.30 – 15.45	- Exhibition Room - Poster Session II	- Medium Aula - Commercial Presentation (**Elmiko**)	
16.00 – 17.30	- Large Aula A - Session IV **<u>Neurophysiology</u>** chaired by: **Christian Henneberger** (University of Bonn Medical School, Germany) 1. **Christian Henneberger**: Astrocyte control of NMDA receptor signalling in the hippocampus 2. **Vadim Grubov**: Intrinsic frequency of sleep spindles in EEG in WAG/Rij rats with absence epilepsy 3. **Konrad Juczewski**: Bad Touch: Somatosensory Processing Studies on a Mouse Model of Disease 4. **Steffen Kandler:** Population activity in mouse primary visual	- Medium Aula - Session VI **<u>Aged 50 and still to be explored yet:</u>** **<u>The P3 component of event-related potentials</u>** chaired by: **Rolf Verleger** (University of Lübeck, Germany) 1. **Rolf Verleger**: Bridging events and actions: P3b reflects activation of stimulus-response links 2. **Siri-Maria Kamp**: P300 and episodic encoding – under which conditions do we observe a P300 “subsequent memory effect”? 3. **Eligiusz Wronka**: Relationship between P3 and individual differences in cognitive abilities	- Seminar Room - Session II **<u>Neurology</u>** chaired by: **Wojciech Turaj** (Jagiellonian University Medical College, Krakow, Poland) 1. **Harjot Kaur Grewal**: Illicit Drug Use in Hospitals 2. **Katarzyna Kowalska**: Acute post – stroke/TIA depression and anxiety impair executive functioning 3. **Zofia Ślosarek**: Risk factors of cerebral vasospasm after aneurysmal subarachnoid hemorrhage – how to predict the forthcoming silent killer

	cortex during explorative behavior	4. **Francisco Barceló**: Putting P300 in context: Its role in the updating of sensory versus sensorimotor representations during cognitive task-set switching 5. **Tristan Bekinschtein:** Surfing a wave of attention: The P3 as a neuroboard for conscious access	
17.30 - 18.00	Coffee break		
18.00 - 19.00	- Large Aula - Plenary lecture: **Mark Hübener** ***Learning to See: How Sensory Experience and Learning Change Neurons in the Visual Cortex*** (Max Planck Institute of Neurobiology, Germany)		
19.00 – 20.00	- Large Aula A - Meet Your Speaker – Future of Neuroscience		
21.30	Social Event: party for all participants		

APRIL 19, 2015 (Sunday)

9.30 – 10.30	- Large Aula A - Plenary lecture: **Niels Birbaumer** ***Brain-Machine-Interfaces (BMI) in Paralysis and behavioral disorders*** (University of Tübingen, Germany)	
10.45 – 12.15	- Large Aula A - Session V **<u>Neuropsychiatry</u>** chaired by: **David Enbglom** (Linköping University, Sweden) 1. **David Enbglom:** Feeling sick: How inflammation controls dopaminergic circuits 2. **Federico Moro**: Acute and chronic N-acetylcysteine on cue-induced nicotine-seeking behavior 3. **Maria Nalberczak**: The role of Arc/Arg3.1 in the regulation of alcohol-addiction related behavior 4. **Magdalena Zygmunt:** Identification and classification of cocaine-induced transcriptional variants and non-coding RNAs in the mouse striatum	- Medium Aula - Session VII **<u>Clinical Affective Neuroscience</u>** chaired by: **Claudia Schulz** (University of Münster, Germany) 1. **Claudia Schulz:** Emotional face learning in social anxiety disorder tracked by event-related potentials 2. **Artur Marchewka**: Too disgusting to forget – the effect of basic emotions on directed forgetting 3. **Łukasz Okruszek**: Attentional engagement with social and non-social emotional stimuli in schizophrenia 4. **Berna Sari:** Processing emotional faces in relation to cognitive load: An event-related potential study 5. **Jarosław Michałowski:** Differentiating brain responses to phobic pictures in spider and social phobia individuals: a simultaneous EEG-fMRI study
12.15 – 13.45	Coffee break	

12.15 – 13.45	- Exhibition Room - Poster Session III	- Medium Aula - Commercial Presentation (**BioTech Europe**)
13.45 – 14.30	Lunch	
14.30 – 16.00	- Large Aula A - Session VI **<u>Neurode(re)generation</u>** chaired by: **Antonella Consiglio** (University of Barcelona, Spain) 1. **Antonella Consiglio**: Modeling Parkinson's disease with patient-specific induced pluripotent stem (iPS) cells 2. **Roger Torrent**: GDNF prevents dopaminergic neurodegeneration in iPS cell-based models of familial and sporadic Parkinson's disease 3. **Andrzej Cwetsch**: Advantages of in vivo genetic manipulations of the rodent brain innovative by site-directed in utero electroporation with a triple-electrode probe 4. **Shovan Naskar**: Sequential Development of Glutamatergic and GABAergic Synapses on Principal Neurons in the Rat Neocortex	- Medium Aula - Session VIII **<u>Language and Semantic Processing</u>** chaired by: **Marcin Szwed** (Jagiellonian University, Krakow, Poland) 1. **Marcin Szwed:** The visual cortex is not exclusively visual, and plays a critical role in tactile Braille reading. fMRI, resting-state fMRI and TMS evidence from sighted Braille readers 2. **Katarzyna Jednoróg**: Neural basis of phonological awareness in beginning readers with familial risk of dyslexia - results from shallow orthography 3. **Anna Beres**: Electrophysiological basis of production and comprehension of words and pictures: an ERP investigation in Basque-Spanish bilinguals 4. **Marianna Boros**: Is the VWFA doing all the job? Dorsal stream deficit in dyslexia 5. **Carsten Bundt**: Automatic motor activavtion on the basis of spatial information: a TMS study
16.15 – 17.15	- Large Aula A - Closing lecture: **Bassem Hassan** ***Signalling mechanisms of axonal growth, injury and regeneration*** (VIB, KU Leuven, Belgium)	

17.15 - 17.30	**Closing remarks** (with awards for the best oral and poster presentations)

April 17, 2015 (Friday)

OPENING LECTURE:
13.45 – 14.45

A translational neuroscience approach to the problem of motor neurone disease

Dame Pamela J. Shaw

University of Sheffield, UK

Neuroimmunology

15.00 – 16.30
chaired by: Asya Rolls (Israel Institute of Technology, Haifa, Israel)

1. ***It takes a nerve to control immunity*** **(IBRO Alumni Lecture)**

Asya Rolls

Israel Institute of Technology, Haifa, Israel

Common knowledge and extensive scientific evidence suggest that the brain affects the immune system. This relationship is manifested by responses such as increased disease prevalence following stress or cure following treatment with a placebo pill. Although we have reached significant comprehension of the effects of stress on immunity, we are limited in our understanding of the specific neuronal networks regulating the immune system and the modes through which this activity is transmitted to the immune system. Our groups studies how does the brain regulate immunity in order to leverage the networks underlying this communication toward the design of new therapeutic strategies to centrally regulate immune responses. In this talk I will discuss some of our recent findings indicating that the brain's reward system, which is involved in positive expectations and hope, affects immunity.

2. ***Endocannabinoid system and pain due to osteoarthritis pain***

Magdalena Kostrzewa, Agnieszka Pająk, Natalia Małek, Katarzyna Starowicz

m.kos@if-pan.krakow.pl

Laboratory of Pain Pathophysiology, Department of Pain Pharmacology, Polish Academy of Sciences, Krakow, Poland

Evidence from preclinical studies supports the interest of the endocannabinoid system as an emerging therapeutic target for osteoarthritis pain. We have investigated a role of endocannabinoid system at different developmental stages of OA in the sodium monoiodoacetate (MIA) animal model.
Degenerative changes in male Wistar rats were induced by injection of 3 mg of MIA into the knee joint. Rats were monitored for OA-related pain symptoms. By the means of qPCR method we evaluated the mRNA expression of endocannabinoid system in response to OA development (0-28 days).
OA was accompanied by an increase of the mRNA levels of AEA receptors and metabolic enzymes in lumbar spinal cord. Most interestingly we have observed an increase in Cb2 mRNA level in spinal cord at day 7, which was correlated with attenuation of OA pain symptoms. At later stages of OA we observed substantial upregulation of Cb1 receptor and enzymes involved in endocanabinoids' metabolism.
Our studies highlight a link between the development of osteoarthritis and the endocannabioid system and support their therapeutic value for osteoarthritis management. Upregulated CB2 in spinal cord correlates with pain symptoms attenuation, thus application of CB2 agonists would be profitable.
Supported by the SONATABIS/NCN/2012/07/E/NZ7/01269 grant and statutory funds.

3. ***Pre-Chiasmatic Subarachnoid Hemorrhage leads to disintegration of Blood-Brain Barrier, by Tight Junctions proteins disassemblance***

Daria Gendosz, Kamila Dębska, Halina Jędrzejowska-Szypułka, Joanna Lewin-Kowalik

dariagendosz@gmail.com

Medical University of Silesia, Chair and Department of Physiology

Aims: Our aim was to develop model of arterial bleeding into the pre-chiasmatic cistern resembling subarachnoid hemorrhage (SAH) from aneurysm rupture in the anterior part of the circle of Willis and to explore different aspects of its effect on Tight Junctions proteins and extracellular matrix proteins, upon adjacent as well as distant areas of rat brain.
Methods: Pre-chiasmatic SAH (pSAH) was produced by injection of 200uL of fresh autologous arterial blood into pre-chiasmatic cistern in rat brain. 24 hrs following the surgery, animals were perfused transcardially and whole brains were collected. Coronal sections were immunostained to visualize Zonulin-1, Occludin and Claudin-5, EMMPRIN, MMP-9.
Results: In order to investigate effects of SAH on BBB, we focused on alterations among blood vessels morphology, according to TJ proteins. We found numerous blood vessels around the site of blood application as well in more distant areas, where we found essential alterations in immunostaining patterns of Zonulin-1, Occludin and Claudin-5, comparing to controls. Moreover we provided tests against MMP-9 and its extracellular activator EMMPRIN. We found EMMPRIN and MMP-9 present among blood vessel endothelium, what may suggest its contribution to degradation process of BBB.
Conclusions: Obtained results indicate that administration of arterial blood directly to pre-chiasmatic cistern leads to serious affections of BBB integrity.
Project has been financed by Polish National Science Centre grant "Preludium" nr DEC-2013/11/N/N27/01643.

4. ***Neurodegeneration, blood-brain barrier disruption and neuroinflammation as a consequence of hypoxic-ischemic insult to newborn rats***

Dominika Luptáková, Joy H. Hoskeri, Kateřina Plachá, Ivo Juránek

dominika.luptakova@savba.sk

Institute of Experimental Pharmacology and Toxicology, Slovak Academy of Sciences

Background: Neonatal hypoxic-ischemic encephalopathy develops progressively with the activation of neuroinflammatory processes that occurs as a response of the initial wave of cell death. In this study, we evaluated the activity of matrix metalloproteinases MMP-2 and MMP-9 associated with development of brain edema (BED), and presence of neurodegeneration due to hypoxic-ischemic insult (HII) to rats.
Methods: 7 days old Wistar rat neonates were exposed to HII by unilateral carotid artery ligation and 90 min exposure to 8% O2. BED was evaluated by the wet-dry brain weight method. Association of MMP with blood-brain-barrier disruption was assessed by gelatin zymography of blood plasma. Neurodegeneration was detected by Fluoro-Jade-B (FJB) staining.
Results: This study revealed that BED progressively developed from 3h and peaked at 24h after HII. Zymographs showed significantly elevated MMP-2 plasma activity from 1 h and with the maximum at 72 h after HII; MMP-9 plasma activity was significantly increased only after 24 h from HII. FJB staining revealed time-dependent neurodegeneration with markedly affected striatum, thalamus, hippocampus, cortex, dentate gyrus, habenula and amygdala regions.
Conclusion: Increased plasma activity of MMP-2 and evolution of BED showed potential presence of neuroinflammation and blood-brain-barrier disruption; HII strongly affected multiple brain regions by marked neurodegeneration.

Neuroeconomics – neural mechanisms of decision-making

15.00 – 16.30

chaired by: Barbara Fryzeł (Jagiellonian University, Krakow, Poland) & Jan Rodriguez Parkitna (Polish Academy of Sciences, Krakow, Poland)

1. *Separating reward from salience in the brain*

Philippe Tobler[a], Thorsten Kahnt[b]

phil.tobler@econ.uzh.ch

[a] Department of Economics, University of Zurich, Switzerland
[b] Northwestern University, IL, USA

Reward and salience motivate behavior. While reward (and punishment) guides actions (e.g. in decisions to approach good outcomes and avoid bad outcomes), salience primarily energizes (e.g. quickens) behavior. The theoretical definition of reward has traditionally been clearer than that of motivational forms of salience. Moreover, the two concepts have sometimes not been disentangled in studies of the neural basis of reward. In this talk I present two ways in which salience can be formally defined (elemental versus global) and show that one of them (elemental) affects behavior and brain activity more than the other. At the neural level we have found a dissociation of reward and salience, e.g. with reward signals in the striatum, the orbitofrontal cortex and the dorsal parietal cortex and salience signals in the anterior cingulate cortex and the ventral parietal cortex. This dissociation may be useful in preventing highly energized approach of bad outcomes. The reward signals in the orbitofrontal cortex constitute a common neural code for good and bad outcomes, which is a requirement for computing value as suggested by neuroeconomic theories.

2. *Combined effects of cortisol and noradrenaline cause decreased loss aversion*

Zsofia Hangebrauk[a], Nave, G.[b]; Strombach, T.[a], van Wingerden, M.[a], Joels, M.[c], Schwabe, L.[d], Kalenscher, T.[a]

zsofia.hangebrauk@gmail.com

[a] University of Düsseldorf, Germany
[b] Department of Computation & Neural Systems, California Institute of Technology, US
[c] Brain Center Rudolf Magnus Universitair Medisch Centrum Utrecht, NL
[d] Department of General Psychology: Learning and Memory, Institute for Psychology, University of Hamburg, Germany

Acute stress is associated with increased levels of the hormones cortisol and noradrenaline. So far, most studies investigating the effects of acute stress on economic decision making have used behavioral means to induce stress, which makes it difficult to infer a direct, causal relationship between changes in hormone levels and the investigated behavior. The aim of our study was to use direct, pharmacological manipulation using Hydrocortisone and Yohimbine, an alpha 2-adrenoceptor antagonist, to investigate how the two hormones affect risk- and loss aversion in a financial decision making task. Participants (N=80) either received a placebo, one of the two substances separately or a combination of the two and completed a financial lottery task. In the task participants had to make a decision between a safe outcome (e.g. €5), or an option with an equal chance of winning or losing certain amounts (e.g. win: €7, loss: €6). Results showed that participants who received both substances simultaneously exhibited decreased loss aversion compared to the other groups, while risk taking did not differ between the different treatment conditions. Our results complement prior findings that demonstrated the effects of behaviorally induced acute stress on risk aversion and reward sensitivity.

3. *The neural underpinnings of performance-based incentives*

Tina Strombach[a], Marco Hubert[b], Peter Kenning[c]

tina.strombach@hhu.de

[a] Comparative Psychology, University of Düsseldorf, Germany
[b] Chair for Innovation and Entrepreneurship, Zeppelin University, Friedrichshafen, Germany
[c] Chair of Marketing, University of Düsseldorf, Düsseldorf, Germany

Pay-for-performance is commonly applied to modulate behavior in a favorable way and to increase performance. However, the omission of an incentive leads to a significant decrease in performance. In the current study, we investigate the neural underpinnings of this effect. We hypothesize that an increase in monetary incentives is reflected

by the dopaminergic reward system, while the omission of the reward leads to a decrease, reflecting a devaluation of the task itself. We used fMRI to study the neural correlates of the effect of performance-based incentives. While lying in the fMRI scanner, subjects were asked to solve arithmetic calculations. The experiment consisted of three subsequent blocks. After the first baseline block, subjects received a monetary reward for every correctly solved calculation. In the third block, the incentives were omitted again. Thus, the task itself did not change throughout the experiment. We found that incentives indeed increased activation in reward related brain regions, but not in task-related regions. Interestingly, BOLD activity increased during the incentivized block in the vStr, which is associated with reward prediction errors and decreases in the vmPFC representing the subjective value of the task. Thus, monetary incentives seem to modulate the cognitive processing of a given task.

4. ***Economic decision-making and neurocognitive performance in schizophrenia and bipolar disorder***

Marcin Jaracz, Alina Borkowska

marcinjaracz@gmail.com

Nicolaus Copernicus University Torun, Poland
Chair of Clinical Neuropsychology, Collegium Medicum Bydgoszcz, Poland

Introduction: Efficient economic decision-making is dependent on the integrity of the dorsal prefrontal and ventral prefrontal networks in the brain, the former being associated with cognitive and the latter – with motivational aspects of decision-making. Disruption of these circuits in schizophrenia and bipolar disorder has been reported. Clinical and neuropsychological data indicate that, while both disorders encompass motivational deficits, schizophrenic patients show poorer cognitive functioning, which may result in different decision making.
Methods: 30 schizophrenic patients, 30 bipolar patients and 30 healthy controls were enrolled in the study. All Decision making was assessed with Iowa Gambling Task (IGT). Working memory and executive functions were assessed with Wisconsin Card Sorting Test (WCST) and Trail Making Test (TMT).
Results: Both groups of patients, especially the schizophrenic group, preferred decks of cards involving disadvantageous ratio of number of wins and losses in IGT. This was accompanied by poorer performance in tests assessing working memory and executive functions. Decision making in bipolar patients was related to other neuropsychological and clinical variables, whereas no such relationship was found in the schizophrenic group.
Conclusions: Above findings may reflect different mechanisms shaping decision making process in both disorders.

5. ***The role of neuronal plasticity in the dopamine system in reward-driven learning***

Jan Rodriguez Parkitna

janrod@if-pan.krakow.pl

Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

Dopamine projections from the ventral midbrain to the basal ganglia and prefrontal cortex signal salience and energize behavior towards actions that offer best expected outcome. Bursts of activity of dopamine neurons may encode a prediction error, which would provide an elegant mechanism for updating expectations based on recent and previous outcomes. To study the role of dopamine neuron activity in reward-driven behavior we use genetically modified mice with selective and inducible inactivation of NMDA receptors on dopamine neurons. In absence of NMDA receptors the bursting activity is reduced, however the behavioral consequences are relatively limited. The mutation causes no apparent deficits in associative learning, however conditioned reinforcement is abolished. Conversely, in mice with inactivation of NMDA receptors in dopaminoceptive neurons, an opposite phenotype is observed; potential deficits in associative learning but normal conditioned reinforcement. Interestingly, the effects of the mutations on performance in probabilistic reversal or delay discounting was limited, if any. In conclusion, the data indicates that different forms of plasticity in discrete parts the dopamine system have specific behavioral outcomes and a smaller than expected impact on the ability to assess reward probability or discount delay.

Advanced EEG Signal Analyses

15.00 – 16.30

chaired by: Boris Gutkin (Ecole Normale Superieure, Paris, France; Centre for Cognition & Decision Making, National Research University Higher School of Economics, Moscow, Russia)

1. *Selective Roles of Multiple Oscillatory Bands in Flexible Control of Working Memory*

Boris Gutkin[a b], Mario Dipoppa[c], Nikita Novikov[b]

boris.gutkin@gmail.com

[a] Group for Neural Theory, Ecole Normale Superieure, Paris, France
[b] Centre for Cognition & Decision Making, National Research University Higher School of Economics, Moscow, Russia
[c] University College London, UK

Cognitive effort leads to a seeming cacophony of brain oscillations. For example, during tasks engaging working memory (WM), specific oscillatory frequency bands modulate in space and time. Despite ample data correlating such modulation to task performance, a mechanistic explanation remains elusive. We propose that flexible control of neural oscillations provides a unified mechanism for the rapid and controlled transitions between the computational operations required by WM. We show in a spiking network model that modulating the input oscillation frequency sets the network in different operating modes: rapid memory access and load is enabled by the beta–gamma oscillations, maintaining a memory while ignoring distractors by the theta, rapid memory clearance by the alpha. The various frequency bands determine the dynamic gating regimes enabling the necessary operations for WM, whose succession explains the need for the complex oscillatory brain dynamics during effortful cognition.

2. *Learning occurs in multisensory environments: Individual differences, developmental trajectories, consequences*

Paweł J. Matusz

pawel.matusz@gmail.com

Lausanne University Hospital - University of Lausanne, Switzerland

Multisensory processing are known to dramatically impact instantaneous perception, but its interplay with learning and object recognition is far from being understood. I will first discuss results showing that multisensory semantic congruence facilitates recognition of unisensory objects following single encounters with them in a multisensory context (image of a cat accompanied by a 'meow'). The brain processes such unisensory objects preferentially at early perceptual stages, does so despite task-irrelevance of the multisensory context and irrespective of which sensory modality is the task-relevant one. Contrastingly, the efficacy of single-trial memories based on meaningless audio-visual associations is more variable across individuals; however, we can now predict it using an electrical neuroimaging framework. I will then demonstrate the importance of more attention-dependent multisensory processes for object processing. Peripheral distractors matching target identity interfere with visual search most strongly when they are audiovisual, and do so irrespective of increasing task demands. Using a developmentally-inspired design we revealed the critical role of experience in the automation of this process: Increased task-demands paradoxically 'shield' younger school-aged children from such multisensory interference. These findings highlight how individual-differences approach advance our understanding of object processing in real-world environments that are multisensory in nature and vary in task demands.

3. *Modeling a learning process through functional analysis-of-variance of brain rhythms*

Dania Gutierrez, Mauricio Ramirez

dgtz@ieee.org

Cinvestav Monterrey, Mexico

We propose a model to assess the acquisition of a new skill through electroencephalographic (EEG) measurements. In particular, we propose an experiment to monitor the process of learning to type using the Colemak keyboard layout during a series of lessons in which the power spectral density (PSD) of various EEG rhythms are measured. Then, we use functional analysis-of-variance (functional ANOVA or FANOVA) to model changes of PSD through different stages of the learning process and for different typing difficulty levels. FANOVA is an extension of the classical ANOVA for testing the significance of functional global trend and functional fixed effects in time series. In addition, our model takes into account the engagement of the volunteers to the training by using a probabilistic measure of the cognitive

state, which corresponds to the engagement measure of B-Alert's memory and alertness profiler (advancedbrainmonitoring.com). Our preliminary results from seven volunteers show that through the proposed FANOVA model we can observe significant changes in PSD of the beta and gamma brain rhythms during times of high engagement in the training process. Furthermore, those changes are highly correlated with the volunteers' improvement in typing.

4. *Two sides of the same coin: ERP and wavelet analyses in a Go\NoGo paradigm with emotional facial expressions*

Rob H.J. Van der Lubbe[a b], Iza Szumska[a], Małgorzata Fajkowska[c], Agata Wytykowska[d]

r.h.j.vanderLubbe@utwente.nl

[a] Cognitive Psychology, University of Finance and Management, Warsaw, Poland
[b] Cognitive Psychology and Ergonomics, University of Twente, Enschede, The Netherlands
[c] Institute of Psychology, Polish Academy of Sciences, Warsaw, Poland
[d] University of Social Science and Humanities, Warsaw, Poland

In the last decades, it has regularly been argued that the standard approach of averaging the electroencephalogram (EEG) to create event related potentials (ERPs) implies that dynamical changes in brain activity are left out. It has also been proposed that ERPs may be considered as the superposition of evoked oscillations that are already present as spontaneous fluctuations in the raw EEG. Given these ideas, a combined approach estimating both ERPs and determining the presence of specific oscillations in both the raw EEG and ERPs seems a fruitful approach. In the current study, this approach was applied on the EEG data of 130 individuals that took part in a Go/NoGo paradigm with emotional facial expressions. Conditions were examined in which a specific facial expression required a response, while other expressions required no response. ERP results revealed occipital P1, N1, and P2 components with an enlarged N1 component for Go stimuli. Wavelet analyses on ERPs revealed early maxima in the theta, alpha and beta bands at occipital sites. Increased power in the alpha and beta bands for Go stimuli accounted for the effect on the N1 component. Wavelet analyses on the raw EEG showed comparable results but also revealed that the initial increase in the alpha and beta bands was followed by a strong suppression. It was additionally explored to what extent baseline activity predicts individual differences on the outcome of wavelet analyses on ERPs. Implications of the latter findings will be discussed.

PLENARY LECTURES:
18.15 – 19.45

The neural basis for a balanced emotional system

Tom Johnstone

University of Reading, UK

Emotions serve important roles in guiding our decisions and preparing us for action, particularly in contexts of great personal relevance. Yet an emotion system that dominates can disrupt behaviour and ongoing cognitive activities. The human brain has thus evolved to support control systems that allow us to fine tune the balance between emotion and cognition. In this lecture I will present the different experimental approaches that we have used to investigate the interplay between emotion and cognition. Mechanisms of emotion regulation, from the highly automatic, largely unconscious example of extinction learning, to more controlled processes such as those examined with flanker and modified stroop tasks, through to cognitively elaborate reappraisal of emotional stimuli will be compared. Several possible common neural mechanisms will be discussed, along with promising approaches to unify sometimes disparate theory and research into emotion regulation, conditioning and extinction, and cognitive control.

Face to Face with the Emotional Brain

Paul Whalen

Dartmouth College, USA & Leverhulme Trust Visiting Professor at the University of Reading, UK

I will present brain imaging data in human subjects recorded while they viewed the facial expressions of others. I am most interested in the responses of the amygdala and prefrontal cortex to facial expressions of ambiguous valence (i.e., surprise) and source of threat (i.e., fear). For example, neural responses to fearful facial expressions can be interpreted as a response to the lack of predictive clarity associated with these expressions, in addition to a response to negative

valence per se. This source ambiguity gives rise to numerous possible interpretations of a fearful expression observed in another person. For example, from the viewer's perspective, a fearful expression might mean that they themselves are in danger (anxious interpretation). Alternatively, this expression could be interpreted by the viewer as a call for help (empathic interpretation). Finally, the viewer may perceive that this expression is in response to their dominance in this situation (dominant interpretation). I will describe behavioral and neuroimaging data addressing how the amygdala and prefrontal cortex handle facial expressions of ambiguous predictive value (generally), as well as the multiple meanings of fear (specifically).

April 18, 2015 (Saturday)

Learning and Memory

9.00 - 10.30

chaired by: Katarzyna Radwańska (Nencki Institute of Experimental Biology, Warsaw, Poland)

1. *A mechanism for long-term memory formation when synaptic strengthening is impaired*

Katarzyna Radwańska

Department of Molecular and Cellular Neuroscience, Nencki Institute of Experimental Biology, Warsaw, Poland

Long-term memory (LTM) formation has been linked with functional strengthening of existing synapses as well as other processes including de novo synaptogenesis. However, it is unclear whether synaptogenesis can contribute to LTM formation. Here, using alpha-calcium/calmodulin kinase II autophosphorylation-deficient (T286A) mutants, we demonstrate that when functional strengthening is severely impaired contextual LTM formation is linked with training-induced PSD95 upregulation followed by persistent generation of multiinnervated spines (MIS), a type of synapse that is characterized by several presynaptic terminals contacting the same postsynaptic spine. Both PSD95 upregulation and contextual LTM formation in T286A mutants required signaling by the mammalian target of rapamycin (mTOR). Furthermore, we show that contextual LTM resists destabilization in T286A mutants indicating that LTM is less flexible when synaptic strengthening is impaired. Taken together, we suggest that activation of mTOR signaling, followed by overexpression of PSD95 protein and synaptogenesis, contributes to formation of invariant LTM when functional strengthening is impaired.

2. *The role of CamKII autophosphorylation in fear memory extinction*

Magdalena Robacha, Kacper Łukasiewicz, Anna Trąbczyńska, Magdalena Ziółkowska, Kasia Radwanska

mrobacha@nencki.gov.pl

Nencki Institute of Experimental Biology, Laboratory of Molecular Basis of Behavior, Warsaw, Poland

Calcium/calmodulin-dependent protein kinase II (CaMKII) is a major protein of glutamatergic synapses of the brain. It plays a significant role in memory formation and rearrangement. CaMKII autophosphorylation-deficient heterozygote mice (CaMKII-T286A +/-) exhibit impairments in fear memory extinction. They can extinguish fear memory only after long extinction training. Here, using heterozygous T286A (T286A +/-) and WT mice with Thy1-GFP mutation, we investigate the molecular and morphological basis of memory extinction when CaMKII autophosphorylation is prevented. Mice were trained with classical fear conditioning and subsequently underwent 20min fear extinction protocol. c-Fos expression was investigated in different brain regions by immunostaining. Dendritic spine morphology was examined in the CA1 hippocampus. We show that after long extinction training both WT and T286A +/- mice extinguish fear memory. At the same time they show very different pattern of expression of neuronal activity marker, c-Fos protein. c-Fos expression is upregulated in CA1 area of the hippocampus after extinction training in WT but not T286A +/- mice. Surprisingly, the lack of c-Fos expression does not prevent upregulation of spine density upon extinction training observed both in WT and T286A +/- mice. Thus our data suggest an alternative mechanisms for fear memory extinction when CaMKII autophosphorylation is impaired.

3. ***Effects of acute and chronic pharmacological manipulations of the serotonergic system on cognitive judgment bias in rats***

Joanna Gołębiowska, Jakub Kręgiel, Rafał Ryguła

golebiowska.joanna@gmail.com

Affective Cognitive Neuroscience Lab, Department of Behavioral Neuroscience and Drug Development, Institute of Pharmacology Polish Academy of Sciences, Krakow, Poland

Serotonin has long been implicated in the modulation of affective and cognitive processing and has been linked to depression, anxiety and negative mood. In the present study, we investigated the effects of different manipulations of the serotonergic system on the valence of cognitive judgment bias in rats. For this, the animals received either injections of escitalopram or parachlorophenyloalanine. The effects of drugs were investigated after acute and chronic administration. For the evaluation of cognitive judgment bias, we used the ambiguous-cue interpretation paradigm. The rats were trained to press one lever in response to one tone to receive a reward and to press another lever in answer to a different tone to avoid punishment. Cognitive judgement bias was than tested by measuring the pattern of animals' responses to a tone of intermediate frequency (ambiguous-cue). We demonstrated no significant effects of neither acute nor chronic treatment with escitalopram. Treatment with parachlorophenyloalanine caused positive shift in cognitive judgment bias, suggesting that serotonin depletion may have pro-optimistic effects. The data are discussed in terms of neurochemical action of tested compounds.
This work was supported by the National Science Centre (Research grant: Sonata bis dec-2012/07/E/NZ4/00196) and the statutory funds of the Institute of Pharmacology PAS.

4. ***The comparison of the effects of donepezil and rivastigmine on memory and learning abilities using Morris water maze and two-day radial-arm water maze in mice***

Adrian Podkowa, Kinga Sałat, Anna Więckowska, Barbara Malawska, Szczepan Mogilski, Anna Ziora, Natalia Malikowska, Anna Furgała, Barbara Filipek

adrian.podkowa@uj.edu.pl

Jagiellonian University, Faculty of Pharmacy, Cracow, Poland

Methods: Morris water maze (MWM) and radial arms water maze (RAWM) were conducted. Scopolamine (1 mg/kg, ip) was used to induce spatial learning deficits and memory impairments.
Results: In the MWM mice treated with rivastigmine presented better learning abilities than mice treated with donepezil. In the RAWM both rivastigmine- and donepezil-treated mice made less errors during searching for the target arm containing the hidden platform compared to the scopolamine-treated control.
Conclusions: In the present study the impact on memory processes of donepezil and rivastigmine was shown. The action of rivastigmine was more potent than donepezil, hence dual inhibitory activity towards two enzymes degrading acetylcholine arguably results in a more efficacious improvement of memory and cognitive functions in mice.
This work was financially supported by National Science Centre grant (DEC-2012/05/B/NZ7/02705) and Jagiellonian University Student Grant No. 1.

Pain and the Brain

9.00 – 10.30

chaired by: Tineke van Rijn (Radboud University Nijmegen, the Netherlands) & Emanuel Van den Broeke (Catholic University of Louvain, Belgium)

1. ***Neuroimaging of pain: current concepts and misconceptions***

André Mouraux

andre.mouraux@uclouvain.be

Institute of Neuroscience (IONS), Universite catholique de Louvain, Belgium

Pain may be defined as a primarily aversive sensation that is vital for survival, as it incites the individual to respond to stimuli constituting a real or potential menace. When becoming chronic and not serving the purpose of escaping potentially dangerous stimuli, pain also represents a major healthcare issue, undermining the health and welfare of millions of individuals. How does the brain process noxious stimuli, and how does this lead to the perception of pain? In humans, using functional neuroimaging techniques such as EEG or fMRI, a great number of studies have shown that

transient noxious stimuli elicit activity within a widespread network of cortical regions, sometimes referred to as the "pain matrix", and including the primary and secondary somatosensory cortices, the insula and the anterior cingulate cortex. However, the functional significance of these brain responses, as well as their actual involvement in the perception of pain remains largely unknown. In fact, recent studies have suggested that these responses could be entirely unspecific for pain and involved mainly in the reorientation of attention that is necessarily triggered by the occurrence of salient events. In this presentation, I will review what we know and do not know about the cortical representation of pain in humans.

2*. Is the posterior insula specifically involved in pain perception?*

Giulia Liberati, Anne Klöcker, Marta Safronova, Susana Ferrao Santos, André Mouraux

giulia.liberati@uclouvain.be

Université catholique de Louvain, Belgium

Because lesions of the posterior insula and adjacent operculum can alter pain perception, and because electrical stimulation and epileptic seizures in this region can generate pain-related experiences, it is generally believed that the posterior insula plays a specific role in pain perception. Moreover, depth recordings in humans have shown that nociceptive stimulation elicits robust local field potentials (LFPs) in this region, often considered to reflect early stages of nociceptive processing specifically related to pain. However, the insula is involved in the processing of a wide range of non-nociceptive sensory inputs, and contributes to a large number of cognitive, affective, and homeostatic functions. The objective of this presentation is to revisit the role of the insula in pain perception, taking into account recent data acquired in our lab. Specifically, I will present results obtained using depth EEG recordings of the human insula, which demonstrate that nociceptive stimuli elicit LFPs at the same locations as non-nociceptive vibrotactile, auditory, and visual stimuli, thereby indicating that these responses are unspecific for pain. However, I will also show that nociceptive stimuli, but not non-nociceptive stimuli, elicit an increase in gamma-band oscillations (GBOs) within this region, possibly reflecting nociceptive-specific activity.

3. *Event-related potential and placebo effect*

Elisa Carlino, Giulia Guerra, Alessandro Piedimonte

elisa.carlino@unito.it

Dep. of Neuroscience, University of Turin, Italy

A placebo is defined as an inert substance given to please a patient. However this definition is not entirely correct. Indeed, a placebo is not an inert substance alone, but rather its administration within a set of sensory and social stimuli that tell the patient that a beneficial treatment is being given. Different psychological models have been proposed to describe this phenomenon. The first model explains the placebo effect as the consequence of a learning process, whereas the second considers the importance of high level cognitive processes such as expectations. High temporal resolution techniques have been used to determine when expectation of analgesia and learning processes exert their psychophysical effects. For example, in different studies on laser-evoked potentials, early nociceptive components were found to be affected by placebos suggesting that late cognitive reappraisal of the significance of pain and/or late neuronal activity influenced by report bias cannot be responsible for this early modulation. More recently, also slow potentials related to pain anticipation were found to be modulated by placebos. On the whole, these data suggest that the effect of expectations and learning processes on pain can be objectively measured before and after a painful experience using event-related potentials.

4. *Mapping spatial acuity for pain*

Flavia Mancini, P. Haggard, G.D. Iannetti

f.mancini@ucl.ac.uk

Department of Neuroscience, Physiology, Pharmacology, University College London, UK

Tactile spatial acuity is routinely tested in neurology to assess the state of the dorsal column system. In contrast, spatial acuity for pain is not assessed, having never been systematically characterised. Here, we provide the first systematic whole-body mapping of spatial acuity for pain. We evaluated the two-point discrimination thresholds for both nociceptive-selective and tactile stimuli across several skin regions.
We discovered that (1) the fingertip was the area of highest spatial acuity, for both pain and touch, and (2) on the hairy skin of the upper limb, spatial acuity for pain and touch followed opposite proximal-distal gradients. Furthermore, by testing spatial acuity for pain in a rare patient completely lacking fibers signalling touch, we demonstrate that spatial

acuity for pain does not rely on a functioning system of tactile primary afferents.
Importantly, peripheral innervation density does not explain the high spatial acuity for pain on the fingertips, because skin biopsies revealed that the density of nociceptive fibers was lower in the fingertips than in the hairy skin. However, the high spatial acuity for pain on the fingertip is consistent with our recent discovery of fine-grained maps of nociceptive input to individual digits in somatosensory cortex.

Multisensory Processing in Clinical and Healthy Population

9.00 – 10.30
chaired by: Salvatore Campanella (CHU Brugmann - Université Libre de Bruxelles, Belgium)

*1. **The P300 and the NoGo-P300 event-related potentials: biological markers of abstinence vs. relapse in alcohol dependence?***

Salvatore Campanella

salvatore.campanella@chu-brugmann.be

Laboratoire de Psychologie Médicale et d'Addictologie, ULB Neuroscience Institute (UNI), CHU Brugmann-Université Libre de Bruxelles (U.L.B.), Belgium

Introduction: The relapse rate for psychiatric disorders is staggeringly high, indicating that current treatment methods are not entirely effective. Impaired inhibitory control triggers relapse in alcohol dependence, as failures in response inhibition weaken the ability to stop alcohol consumption. Also, repeated alcohol consumption leads to mesocorticolimbic sensitization resulting in heightened salience of alcohol stimuli. Therefore, we created two cognitive tasks aiming to screen recently detoxified alcoholic patients to individualize those who would be particularly at risk to relapse.
Method: After a three-week detoxification cure, thirty patients were confronted through ERPs with (1) a contextual Go-Nogo task; and (2) a visual oddball task, including deviant stimuli, related or not to alcohol. A three-months follow-up was pursued to verify whether patients relapsed or not.
Results: Data suggest that (1) the higher difficulty for inhibition indexed by a higher NoGo P300 in relapsers may be a good predictor of relapse in alcohol dependence; and (2) a devaluation of the motivational significance of stimuli related to alcohol, indexed by a decreased P300 in abstainers, could protect from a relapse within three months following detoxification in alcohol dependent patients.
Conclusion: Programs aiming at increasing cognitive control and decreasing motivation towards alcohol cues should be developed.

2. ***Encoding of temporal regularity in the human auditory brainstem***

Katarzyna Żarnowiec, Jordi Costa-Faidella, Carles Escera

katarzyna.zarnowiec@ub.edu

Institute for Brain, Cognition and Behavior (IR3C), University of Barcelona, Catalonia-Spain
Cognitive Neuroscience Research Group, Department of Psychiatry and Clinical Psychobiology, University of Barcelona, Spain

The temporal regularity of sensory stimulation is of prime importance for our online behavior, as it helps to optimize detection and processing of incoming events. The mismatch negativity (MMN) of the human event-related potentials is elicited by violating a regular stimulus onset asynchrony (SOA) of auditory sequence. Importantly, deviance-related responses can be also find in the middle-latency response (MLR) range, circa 30-40 ms from the deviance onset. The aim of the study was to examine the effects of fine-grained violations in the rhythmic structure of auditory stimulation in the human brainstem using frequency-following responses (FFR). We presented amplitude modulated sine waves in a multi-oddball paradigm. Standard stimuli were presented at a constant rate of 3.21 Hz, whereas 8 equiprobable deviants ($p = 0.16$) in order to break the temporal pattern were presented at different phases of the presentation cycle, i.e., with SOAs 156, 195, 234, 273, 351, 390, 429 and 468ms. A sequence not entailing a rhythmic organization was used as a control condition. Our results showed that the mean amplitude of FFR was smaller in oddball vs. control condition ($p = 0.008$), suggesting that the human brainstem can encode the temporal regularity of auditory landscape.

3. *The goal within the grasp: an fMRI study of intention-dependent modulations of grasp-related cortical activity*

Bartosz Michałowski[a b], Agnieszka Kubiak[b], Grzegorz Króliczak[b]

michalowski.bart@gmail.com

[a] Faculty of English, Adam Mickiewicz University, Poznań, Poland
[b] Action & Cognition Laboratory, Institute of Psychology, Adam Mickiewicz University, Poznań, Poland

Adoption of an appropriate hand posture during interactions with manipulable objects depends crucially on the goal of the grasping agent, e.g., whether his or her intention is to properly use or simply displace the object. We used functional magnetic resonance imaging (fMRI) to directly compare neural activity associated with the control of grasping actions driven by such disparate goals. Brain activity was measured in a block design while 20 right-handers – using their dominant and non-dominant hands – performed pantomimed grasping of visually presented tools with the following intentions in mind: to subsequently use them according to their functions, or to move them by grasping and putting the tool aside. The stimuli were selected to induce "action conflict" whereby different hand pre-shaping and postures are required for using and for moving the same object. A contrast of grasping-to-use vs. grasping-to-move run across both hands showed greater bilateral signal modulations in lateral temporal/occipital, superior parietal, and the left inferior frontal cortices. The inverse contrast revealed modulations limited only to the right inferior parietal lobule. These results provide evidence for differential engagement of the key subdivisions of the praxis representation network with respect to the distinct action goals concerning the same object.

4. *EEG frequency-tagging to explore the crossmodal links in spatial attention between vision and touch*

Elisabeth Colon, Valéry Legrain, André Mouraux

elisabeth.colon@uclouvain.be

Institute of Neurosience, Université catholique de Louvain, Belgium

Although we are sometimes exposed to stimuli belonging to a single modality, perception of events in the environment is often multimodal. Here we studied crossmodal links in spatial attention between touch and vision using frequency-tagging of steady-state evoked-potentials (SS-EP). We hypothesized that a visual stimulus approaching the left or right hand orients spatial attention towards the approached hand and, thereby, enhances the processing of vibrotactile input originating from that hand. Trains of vibrotactile stimuli (4.2 and 7.2 Hz) were applied simultaneously to the left and right hand, concomitantly with a punctate visual stimulus blinking at 9.8 Hz, approached towards one of the hand. The hands were uncrossed or crossed. When the visual stimulus approached one of the hands, the amplitude of the vibrotactile SS-EP elicited by stimulation of that hand was enhanced, regardless of whether the hands were uncrossed or crossed. These results show that a sustained visual stimulus delivered close to a given body part is able to selectively enhance the concurrent processing of somatosensory input originating from that body part, taking into account knowledge of the relative position of the limbs in external space. Importantly, this enhancement already involves early stages of cortical processing in somatosensory-specific cortical areas.

5. *Isolating the neural entrainment to segregated sound streams with frequency-tagging*

Sylvie Nozaradan[a], Marion Cousineau[a], Andre Mouraux[b]

sylvie.nozaradan@uclouvain.be

[a] Institute of Neuroscience, UCL, Belgium; BRAMS, Canada
[b] Institute of Neuroscience, UCL, Belgium

Auditory streaming refers to the perceptual parsing of auditory flux into distinct, behaviorally relevant, streams. Here, we provide first evidence that auditory streaming is related to the emergence of a specific neural entrainment dissociated from the bottom-up response to the flux. A novel EEG frequency-tagging approach was used to capture this streaming-specific neural entrainment while participants listened to sequences of repeated AAAAB tones. Three sequences were used, in which the frequency contrast between tones A and B (i) could not be discriminated, (ii) was discriminated but not large enough to induce streaming, and (iii) was discriminated and large enough to induce streaming. In addition to the cortical activity elicited at a relatively high rate by the three sequences (8 Hz), a neural entrainment emerged specifically in the streaming sequence at 8 Hz/5, thus at the rate of the B tones while perceived as a stream segregated from A stream. This activity did not me rely emerge with frequency contrast, but also with an illusion of spatial source contrast between A and B. This study shows how the frequency-tagging approach helps understanding perceptual parsing, by facilitating the objective isolation of the percept-related dynamic neural activities.

PLENARY LECTURE:
10.45 – 11.45

Premembering Perception

Kia Nobre

Oxford Centre for Human Brain Activity, UK

The illusion that we apprehend the external world completely and immediately as it unravels over time is almost unshakable. Yet, decades of empirical research teach us that our perception is highly limited, with at most a handful of items coming to occupy our mind and guide our actions at any given moment. Furthermore, we tend to believe perception starts outside, with energy streaming in through our senses, and our brain progressively constructing our internal, mental representations. But, instead, what we perceive is continuously and proactively shaped by the memories of what we experienced in the past and by our current task goals. These endogenous factors inject predictions into the sensory channels, often ahead of the events to unfold, to guide perception and subsequent learning. So, perception proceeds through a dance between our internal states and the external sources of energy. In my talk, I will illustrate how we go about investigating these mechanisms in the human brain, and review some of our findings to date.

Neuroplasticity

12.15 - 13.45
chaired by: Gilles van Luijtelaar (Donders Centre for Cognition, Radboud University Nijmegen, the Netherlands)

1. ***Magnetic Resonance Imaging of Brain Plasticity in Songbirds***

Annemie van der Linden

Bio-imaging lab, Universiteit Antwerpen, Belgium

Songbirds represent an outstanding model for studying both critical period and adult neuroplasticity, vocal communication, brain steroid hormone action and lateralization of brain function. For several decennia the model has been the focus of many behavioral and molecular studies aiming at unraveling its specific and exclusive features. The recent unraveling of the zebra finch genome has fostered many discoveries and will allow future translation of data from this exciting model system to humans. For a long time the songbird model has been deprived from in vivo neuroimaging investigations which on the contrary were used already decennia ago in rodent models and to a large extend in parallel with the unraveling of the mouse genome and the subsequent development of a variety of transgenic mice models for studying basic mechanisms in health and disease.
The Bio imaging lab has initiated in vivo neuroimaging in songbirds and developed over the years a songbird customized in vivo micro Magnetic Resonance Imaging (MRI) toolbox that proved to enable detection and quantification of structural and functional plasticity in songbirds (1).
The most important asset of in vivo neuroimaging remains the capacity of repeated measurements permitting to follow individuals over time with repeated assessment of brain structure and function while observing the functional outcome in the animal's behavior. Voxel based image analysis of repeated measurements of the same individual bird led to assumption free discoveries of brain regions involved in seasonal plasticity and this has headed new discoveries of seasonal structural changes in brain regions beyond the highly investigated song control system, more specifically the social behavioral network, the visual and the auditory system (2). With the intrinsic capacity of imaging to speed up temporal assessment of structural brain changes we are currently moving in the direction of linking temporal patterns of brain changes with behavioral changes and investigate the causality of sex hormones in this interaction. We are also monitoring structural and functional changes in the zebra finch brain during ontogeny, disentangling when and where in the brain tutor song discrimination, recognition and learning evolves. Other neuroplasticity studies required rather higher spatial resolution using specific in vivo MR imaging tools allowing to unravel functional changes in the smallest sensory system representation in the songbird brain; the olfactory system. This way we revealed seasonal changes in olfactory discrimination capacity for relevant odor cues in starling (3). Another advantage of repeated measurements and voxel based analysis is to study brain activity upon differential successive stimuli in the same bird enabling to spot brain regions with specific discrimination capacity by subtracting stimulus specific activation maps. This led to discoveries of lateralization of birds own song - and heterospecific song recognition in the zebra finch brain (4) and to assessment of fast hormone induced neuromodulation of auditory discrimination of specific socially relevant vocalisations in starling (5).

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2. ***Matrix metalloprotease 3 inhibitor differentially affects long-term NMDARs function in basal vs apical dendrites of CA1 hippocampal region***

Patrycja Brzdąk[a b], Mozrzymas J.W.[a b], Wójtowicz T. [a]

patrycja.brzdak@uni.wroc.pl

[a] Laboratory of Neuroscience, Biophysics Department, Wroclaw Medical University, Poland
[b] Laboratory of Cellular Neurobiology, Department of Animal Molecular Physiology, Wroclaw University, Poland

Memory consolidation requires reorganization of extracellular matrix (ECM) and synaptic structure and function. Matrix metalloproteases (MMP) were shown to support this process, but the underlying mechanisms are poorly understood. Here by using field potentials technique we studied the impact of MMP-3 inhibitor NNGH (10 μM) on long-term potentiation of pharmacologically- isolated NMDAR-mediated signals (LTP-NMDA) in hippocampal CA1 region in mouse (P30-P60) acute brain slices. We found that LTP-NMDA recorded in apical dendrites 1 hour following 4x100Hz stimulation was completely abolished when NNGH was bath applied before tetanization (144.7±16% of baseline and 74.2±2.9%, CTR and NNGH, respectively, n=6 slices, $p<0.05$). However, the same inhibitor applied 30 min after tetanization did not interfere with LTP-NMDA (140.5±10%, n=6, $p>0.05$). In contrast, NNGH application never interfered with LTP-NMDA recorded in basal dendrites (124.5±15% of baseline and 123.7±13%, CTR and NNGH respectively, n=6 slices, $p<0.05$). Altogether, our data show that synaptic plasticity within layers of CA1 region may have profoundly different requirement for MMP activity most probably due to diferent molecular composion of postsynaptic sites.
Research supported by the Polish National Science Center (NCN), decision N0. DEC-2014/13/D/NZ4/03045 and Project „Academy of Development as the key to strengthen human resources of the Polish economy“ co-financed by the EU under the European Social Fund.

3. ***Mapping the cortical motor areas with EEG-source localization: developing an alternative for fMRI and TMS***

Rosanne Rietveld[a], Rob H.J. van der Lubbe[b c], Anne-Marie van Cappellen[a d] van Walsum, C. Marjolein Baas [e], Nikos Priovoulos[a], Pauline Aarts[f] , Bert Steenbergen[e], Clementine M. van Rijn[a], Marijtje L.A. Jongsma[e]

rcg.rietveld@gmail.com

[a] Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, the Netherlands
[b] Cognitive Psychology & Ergonomics, University of Twente, Enschede, the Netherlands
[c] Department of Cognitive Psychology, University of Finance and Management, Warsaw, Poland
[d] Department of Anatomy, Radboud University, Medical Centre Nijmegen, the Netherlands
[e] Behavioural Science Institute Radboud University Nijmegen, the Netherlands
[f] Department of Pediatric Rehabilitation, Nijmegen, the Netherlands

In adolescents with unilateral cerebral palsy (uCP) the cortical representation of the affected hand can be located at the ipsi- or contralateral hemisphere. This location may be predictive for the effectiveness of rehabilitation therapy. To optimize therapeutic outcomes it is therefore relevant to map the cortical representation in advance. This study assesses the possibility of using EEG to map hemispheric areas involved in controlling the affected hand as an affordable and child friendly alternative for fMRI. We compared EEG source information obtained during a motor task, to fMRI activation acquired during a similar task. EEG and functional MRI data were obtained from adolescents with uCP (n=10). For the EEG analysis we first optimized an EEG source model of motor preparation preceding hand movement in a control group of adult volunteers (n=14). This model was used to analyze individual EEG recordings of our uCP group. EEG sources were then compared to fMRI activation. By comparing fMRI and EEG data on a single participant level we intend to develop a reliable EEG protocol which will be easy accessible for a large group of patients and will add to a rational choice of the type of rehabilitation therapy, leading to better clinical outcomes.

4. ***Structural changes in the corticospinal tract as a predictor of behavioral changes in adolescents with unilateral Cerebral Palsy: an fMRI informed probabilistic tractography approach***

Nikolaos Priovoulos[a], Marijtje Jongsma[b] , Marjolein Baas[b], Rosanne Rietveld[a], Bert Steenbergen[b], Tineke van Rijn[b], Anne-Marie van Cappellen van Walsum[c]

n.priov@gmail.com

[a] Donders Institute for Brain, Behavior and Cognition, Radboud University, Nijmegen, the Netherlands
[b] Behavioural Science Institute, Radboud University Nijmegen, the Netherlands
[c] Radboud UMC, Nijmegen, the Netherlands

In patients with unilateral Cerebral Palsy (uCP), the Corticospinal Tract (CST) is one of the main tracts affected. The question is how predictive the structural integrity and plasticity of the CST is of behavioral skills and therapeutic outcomes in adolescents with uCP. In this study we measured a group of uCP adolescents (n=9) before and after summer holidays with an fMRI motor task, DTI and T1, as well as several behavioral measures and questionnaires (CHEQ, box and blocks, reaction time). Since the primary motor cortex (PMC) is commonly displaced in uCP adolescents, the fMRI was used for localizing the PMC. We then employed fMRI informed probabilistic tractography to determine the anatomy of the CST. Pre- and post measurements were compared to study plastic changes of the CST. Preliminary data will be presented at the conference. This study will pave the way towards the development of a marker based on CST for patients with uCP. Such a marker might add to a rational choice of the type of rehabilitation therapy, probably leading to better clinical outcomes.

Affective Neuroscience

12.15 – 13.45
chaired by: Gilles Pourtois (Ghent University, Belgium)

1. ***Early sensory processing in V1 waxes and wanes depending on mood and attention***

Gilles Pourtois

gilles.pourtois@ugent.be

Psychopathology and Affective Neuroscience Laboratory, Department of Experimental Clinical & Health Psychology, Ghent University, Belgium

Attention provides human organisms with a powerful selection mechanism enabling to extract relevant information in the environment, while suppressing or filtering out irrelevant information. This process has been extensively characterized in the past, with a focus on the role of structural and cognitive factors. While the former refers to the spatial or temporal properties of the stimulus, the latter pertains to subject's expectations or beliefs. However, what has been less explored systematically is the putative role of concurrent emotional state factors on attention selection mechanisms. In this presentation, I will review recent neurophysiological/EEG studies that have explored effects of mood (either positive or negative) on attention brain mechanisms. These studies emphasize that mood is not simply a nuisance, but instead, it dynamically influences attention selection mechanisms in order to comply with the current needs and goals of the participant. Moreover, these modulatory effects of mood on attention can be observed rapidly following stimulus onset in the (primary) visual cortex. Hence, these results dovetail with the assumption that the selection of relevant information in the environment is not only governed by bottom-up or top-down (cognitive) factors exclusively, but also by the current mood state of the participant.

2***. Reward and punishment associations show plasticity in visual cortex at different processing stages***

Valentina Rossi[a], Naomi Vanlessen[a], Mareike Bayer[b], Annika Graß[b], Annekathrin Schacht[b], Gilles Pourtois[a]

valentina.rossi@ugent.be

[a] Psychopathology and Affective Neuroscience Laboratory, Dept. Experimental-Clinical and Health Psychology, Ghent University, Belgium
[b] Courant Research Centre Text Structures, University of Göttingen, Germany

Motivationally relevant stimuli (e.g., stimuli coupled with positive or negative outcomes) typically attract attention and receive preferential processing. Capitalizing on the high temporal resolution of event-related brain potentials (ERPs), we set out to test if these attentional effects had a similar time-course during early visual processing (starting at the level of the C1 component of the Visual Evoked Potentials).

We implemented a learning task in which participants had to associate three classes of stimuli to a respective response button. One class of stimuli was consistently coupled with monetary reward, one with monetary loss and one with zero outcome. ERPs were recorded while participants learned the stimulus/response/outcome associations, underwent a consolidation period (10 blocks) and then were tested in an old/new judgment, where no reinforcement was presented anymore.
Behavioral results show faster learning for reward-related stimuli associated with reward compared to loss or zero outcome. However, during consolidation and recall, the C1 had the largest amplitude for loss-related stimuli, while the P300 was augmented by reward.
These results suggest that reward and punishment trigger plasticity in the visual cortex during learning, though at different latencies and through different mechanisms.

3. ***Modulation of visual sensory processing by associated valence – Evidence from event-related brain potentials***

Annekathrin Schacht, Mareike Bayer

aschach@uni-goettingen.de

Institute of Psychology, University of Goettingen, Goettingen, Germany

Stimuli of emotional content are preferentially processed because of their high intrinsic salience for the organism. This processing advantage has been shown already for initial stimulus analyses at a sensory level much before conscious recognition or elaborate appraisal, as reliably indicated by modulations of event-related brain potentials (ERPs) at short latencies. Interestingly, such early effects are not restricted to the processing of evolutionary or socially relevant stimuli but occur even for symbolic and arbitrary stimuli like written words of emotional content. While sometimes interpreted as an indicator of extremely fast access to inherent meaning, recent research suggested that these effects might instead origin from associative learning mechanisms, particularly in the verbal domain. I will present evidence from ERP studies that directly examine this assumption by employing reinforcement-learning paradigms. These studies provide evidence that newly acquired valence can effectively boost sensory processing of symbolic stimuli at different sub-stages, depending on whether or not they convey inherent meaning. Importantly, these effects do not occur under cross-modality learning conditions, indicating the relevance of the sensory percept in the acquisition of new valence. Taken together, these findings strongly suggest associative learning as a potential source of early emotion effects in visual stimulus processing.

4. ***Sensory facilitation of threat-predictive (social) cues – Evidence from steady-state visual evoked potentials***

Matthias Wieser

wieser@psychologie.uni-wuerzburg.de

Department of Psychology, University of Würzburg, Germany

Sensory facilitation of cues that predict harm is a useful mechanism for efficient detection of threat in the environment. Recent studies employing steady-state visual evoked potentials (ssVEPs) demonstrated that low-level visual cues previously paired with aversive events lead to enhanced sensory gain in early visual cortex. So far, this has been mainly investigated in classical fear but not in social conditioning where faces constitute the CS and social cues constitute the US. In this presentation, I will review recent studies on social conditioning, and emphasize the utility of the ssVEP 'frequency-tagging' approach for addressing issues such as temporal dynamics of cortical facilitation and competition of context and cues in conditioning. These studies show that sensory gain is enhanced by social threat-predictive cues, face features such as gaze may lead to different time courses in visuocortical experience-related short-term plasticity, and predictability of threat leads to different effects of sensory facilitation of cues and context. Together, these results point at the significance of visuocortical facilitation in aversive learning and the feasibility of ssVEP methodology as a promising research avenue for investigating trial-by-trial cortical dynamics and multiple stimuli processing at a time in aversive learning.

Interactive Session of Medical Case Reports

12.15 – 13.45

chaired by: Dame Pamela J. Shaw (University of Sheffield, UK)

*1.**Bedside consciousness: Evaluation of patients with chronic disorders of consciousness – goals and possible traps in search for purposeful behaviour (case series)***

Alena Škutchanová MD., Prof. Sániová Beata, MD., PhD

askutchanova@gmail.com

Jessenius Faculty of Medicine, Comenius University, Bratislava, Slovakia
University Hospital in Martin, Department of Anaesthesiology and Intensive Medicine, Slovakia

Introduction: Between complete unresponsiveness, and stable conscious behaviours, there are patients with signs of intermittent purposeful behaviour - relatively newly established as minimally consciousness state (MCS).
Objective: On bedside examination of three patients diagnosed as "coma vigile" or "apallic state" we demonstrate possible subtle signs of purposeful behaviour and conscious awareness, and if they meet criteria for MCS. We explore possible difficulties, false positives and false negatives.
Methods: We chose three patients from our study group with different ability of purposeful behaviour as a sign of consciousness. During examination, we offered patients simple stimuli (tactile and verbal contact, plush toy, and mirror during day in hospital ward, one patient home) and observed their reaction on stimuli and environment. We assessed from patient`s vitals to clearly purposeful reactions on stimuli and environment – from muscle tone to command following.
Results: Behaviour of patients diagnosed as "coma vigile" or "apallic" may vary from not clearly ratable as purposeful, to patients with complex behaviour and command following, with bedside assessment mostly limited with their own will not to cooperate. Other limitation is our understanding of behaviour in people with severe sensomotor and cognitive impairment.
Keywords: Bedside, evaluation, consciousness, alert, stimuli, reaction, purposeful, behaviour

2. ***Diagnostic difficulties in Susac syndrome patient resulting from cognitive impairement***

Kamila Miętkiewska, Sławomir Michalak

kamila.mietkiewska@gmail.com

Poznan University of Medical Science, Poland

Background. Susac's syndrome is a rare vasculopathy that leads to symptoms resulting from central nervous system lesions, as well as cochlear and retinal microangiopathy. It is predominantly observed in young women and manifests with headache, neurological disorders, visual or hearing disturbances.
Methods. The diagnosis of Susac's syndrom is based on neuroimaging (magnetic resonance imaging, MRI), retinal fluorescein angiography, audiometry, cerebrospinal fluid (CSF) examination and other laboratory tests.
Results. The presented case of 34-years-old man experienced sudden-onset vertigo and left-sided hearing loss. After 2 months he manifested memory disturbances, disorientation and somnolence. Neurological examination revealed auto- and allopsychical disorientation, short-term memory impairement, behavioral and emotional disturbances. Brain MRI demonstrated multiple lesions in corpus callosum, paraventricular areas, thalamus and cerebellar lobe.CSF examination showed lymphocytic pleocytosis and enormously high protein concentration. Audiometry showed hearing disturbances. Although the patient had no visual complaints, retinal fluorescein angiography was performed and showed retinal branch microangiopathy and multiple segmental occlusions in branch retinal vessels. The patient do not reported visual problems because of cognitive impairement.
Conclusion. Susac's syndrome should be considered in patients with encephalopathy and corpus callosum involvement in MRI, even without visual or auditory complaints, which may be obscured by cognitive impairement.

3. ***Neurologic involvement in patient with Localized Scleroderma***

Agata Średnicka[a], Katarzyna Ochyra[a], Elżbieta Klimiec[b], Katarzyna Kowalska[b], Aleksandra Klimkowicz-Mrowiec[b]

agata.srednicka@gmail.com

[a] Jagiellonian University Medical College, Krakow, Poland
[b] Department of Neurology University Hospital in Krakow, Poland

Localized Scleroderma (LS) is a rare group of diseases that is characterized by sclerosis of the skin and underlying tissues without internal organ involvement. Neurologic involvement including neurological symptoms and brain MRI changes can be present in LS. It is mainly observed in subtypes affecting the head, for example in Parry-Romberg Syndrome (PRS). A 23 year old woman with LS was referred to Neurology Outpatient Clinic due to asymmetry of the face and one year history of memory disturbances. At 16 years of age she noticed hyperpigmented, sclerotic lesion on the right cheek. Lesions gradually extended to the trunk, legs and arms. The skin biopsy was consistent with morphea. MRI of the brain showed ipsilateral focal brain atrophy. Neuropsychological examination revealed Mild Cognitive Impairment. The diagnosis of PRS was made and treatment with corticosteroids was implemented. During the 6-years of follow up we have noticed progression of skin lesions and face hemiatrophy but no progression of brain atrophy.
This case shows that the course of skin lesions, neurological symptoms and MRI changes is variable in LS. Therefore follow-up observation with repeated brain MRI should be provided to all patients with LS.

4. ***MoCap method in the assesment of common symptoms presented in patients with Parkinson's Disease treated with deep brain stimulation (DBS) surgery***

Bartosz Kapustka[a], Ryszard Sordyl[a], Konrad Kubicki[b] , Magdalena Stawarz[c] , Tomasz Jamróz[a], Mariusz Hoffman[a], Stanisław Kwiek[a], Andrzej Polański[c], Konrad Wojciechowski[d]

kapustka.bartosz@gmail.com

[a] Medical University of Silesia, Katowice, Poland
[b] Wroclaw Medical University, Poland
[c] Silesian University of Technology, Poland
[d] Polish-Japanese Academy of Information Technology, Poland

Background: Patients with idiopathic Parkinson's disease(PD) commonly develop postural instability(PI), rest parkinsonian tremor(PT) and freezeing of gait(FOG). All are troublesome, affect the QoL and increase risk of falls. The most common scales used to assess severity of PI, PT and FOG are UPDRS and FOG-Q. Both got disadvantages like low precision and subjectivity. However a new objective measurment method– Motion Capture System (MoCap) seems to be crucial in the evaluation of the effects of various therapies on PD symtpoms intensivity. We aimed to determine: usability of MoCap System in the quantitative assessment of PI, PT and FOG and impact of Deep Brain Stimulation(DBS) in PD patients.
Methods: Trial included 12 patients treated with DBS. Motion analysis was performed in MoCap studio, where the impact of DBS on PI, PT and FOG was studied. Four sessions were recorded: S1–control, without treatment, S2-DBS, S3-medication, S4-DBS and medication.
Results: The presented method of PI, PT and FOG measurement is repeatable. We also find positive correlation between our method and used scales. DBS reduces the PT and PI in patients with severe PD.
Conclusions: Thus we got tool, that allows for quantitative assessment the impact of different treatment methods on severity of PD symptoms.

Neurophysiology

16.00 – 17.30

chaired by: Christian Henneberger (Univ. Bonn Medical School, Germany)

1. ***Astrocyte control of NMDA receptor signalling in the hippocampus***

Christian Henneberger

Univ. Bonn Medical School, Germany

Long-term potentiation of synaptic transmission (LTP) is believed to be the cellular mechanisms of learning. It is triggered by activation of N-methyl-D-aspartate receptors (NMDARs) at many glutamatergic synapses. Opening of NMDARs requires not only binding of glutamate but also of a co-agonist. Using a combination of two-photon excitation fluorescence microscopy and electrophysiology in hippocampal slices we provide evidence that intact astrocyte Ca2+ signalling is critical for the supply of the NMDAR co-agonist D-serine and in turn LTP. At the same time astrocytes react to induction of LTP with morphological changes. Online astrocyte volume fraction measurements and electron microscopy revealed a retraction of astrocyte processes from synapses. Since astrocytes mediate most of the glutamate uptake at these synapses this may favour glutamate escape from active synapses. Indeed, increased glutamate spill-over onto NMDARs at inactive synapses was observed after LTP induction. Therefore astrocytes are critical for NMDAR activation by providing the NMDAR co-agonist D-serine and dynamically modulate the spatial extent of glutamate signalling.

2. *Intrinsic frequency of sleep spindles in EEG in WAG/Rij rats with absence epilepsy*

Vadim Grubov[a], Alexander Hramov[a], Alexey Koronovskii[a], Evgenia Sitnikova[b]

vvgrubov@gmail.com

[a] Saratov State Technical University, Saratov, Russia
[b] Institute of Higher Nervous Activity and Neurophysiology of RAS, Moscow, Russia

Spike-wave discharges (SWD) are EEG manifestation of absence epilepsy. They appear in EEG spontaneously and their incidence increases with age. SWD and sleep spindles are known to share common thalamo-cortical mechanism. It was suggested that age-related increase of absence seizures might correlate with changes in intrinsic properties of sleep spindles. We found that in WAG/Rijrat model of absence epilepsy, the number and duration of SWDincreased between 7and 9 monthsof age.Time–frequency characteristics of sleep spindles in frontal EEG in WAG/Rijrats at the age of 7and 9 months. EEG investigation was performed with Morlet-based continuous wavelet transform and analysis "skeletons" of wavelet surfaces. It was found, first, that sleep spindlescontained dominant and subdominantfrequency components. Second, the dominant frequency of sleep spindle increased from start to end of oscillatory pattern in 7 months rats. The main frequency of SWD, in opposite, showed maximum at the beginning and decreased at the end. Third, in 9-months rats with severe epilepsy, dominant frequency did not change along sleep spindles or even decreased at the end (similar to that in SWD).
The study was supported by RFBR (13-04-00084and 14-02-31235) and Ministry of Education and Science of Russian Federation.

3. *Bad Touch: Somatosensory Processing Studies on a Mouse Model of Disease*

Konrad Juczewski[a b], Helen von Richthofen[a], Claudia Bagni[c d], Tansu Celikel[e], Gilberto Fisone[a], Patrik Krieger[f]

konrad.juczewski@gmail.com

[a]Department of Neuroscience, Karolinska Institutet, Stockholm, Sweden
[b] National Institute of Alcoholism and Alcohol Abuse, National Institutes of Health, Rockville, USA
[c] VIB Center for the Biology of Disease, Katholieke University Leuven, Leuven, Belgium
[d] Department of Biomedicine and Prevention, University of Rome Tor Vergata, Rome, Italy
[e] Department of Neurophysiology, Radboud University Nijmegen, Nijmegen, The Netherlands
[f] Department of Systems Neuroscience, Medical Faculty, Ruhr University Bochum, Bochum, Germany

Fragile X syndrome (FXS) is a common inherited form of intellectual disability caused by the absence or mutations of the fragile X mental retardation protein (FMRP) encoded by the FMR1 gene. In humans, one symptom of FXS is hypersensitivity to sensory stimuli, including touch. We used a mouse model of FXS (Fmr1 KO) to study sensory processing of tactile information conveyed via the whisker system. In the gap-crossing task, a whisker-dependent behavioral paradigm, Fmr1 KO mice showed aversion to touching with their whiskers while performing the task. In vivo electrophysiological recordings in somatosensory barrel cortex showed that the aversion to touch observed in Fmr1 KO mice was accompanied by a remarkable broadening of the receptive fields at the level of layer 2/3, in response to whisker stimulation. Furthermore, the encoding of tactile stimuli at different frequencies was severely affected. We propose that the increased excitability in the somatosensory barrel cortex upon whisker stimulation contributes to the lower propensity of Fmr1 KO mice to touch objects with their whiskers. This phenotype may reproduce the hypersensitivity to sensory stimuli occurring not only in FXS patients, but also in people suffering from depression, autism spectrum disorders, or attention-deficit-hyperactivity disorder.

4. *Population activity in mouse primary visual cortex during explorative behavior*

Steffen Kandler[a], Dun Mao[a, b], Bruce McNaughton[a, b], Vincent Bonin[a, c, d]

steffen.kandler@nerf.be

[a] Neuro-Electronics Research Flanders, Leuven, Belgium
[b] U Lethbridge, Canada
[c] VIB, Leuven, Belgium
[d] KU Leuven, Belgium

Active behavior requires the integration of multiple, ever-changing sensory inputs into a coherent internal representation. While primary sensory cortices process the information coming through thalamus from sensory organs, there is growing evidence that processing in sensory cortices is also modulated by brain state or behavior. Here, I will discuss how we aim to understand how task-related inputs are represented in mouse primary visual cortex (V1). I will describe how we image calcium transients of local neuron populations in V1 while the animal is performing

a head-fixed locomotion task, and how we relate neuronal activity to behavior and other task variables.

Aged 50 and still to be explored yet: The P3 component of event-related potentials

16.00 – 17.30

chaired by: Rolf Verleger (University of Lübeck, Germany)

1. *Bridging events and actions: P3b reflects activation of stimulus-response links*

Rolf Verleger

Dept. of Neurology and Inst. of Psychology II, University of Lübeck, Germany

Ever since the first reports about the P3 component, its meaning has been debated. The majority view has taken for granted that P3b depends on processing ("evaluation") of stimuli only rather than on selecting responses. To further explore this matter, we used the oddball-effect on P3b in choice-response tasks where rare or frequent stimuli (S1) were followed by ancillary stimuli (S2). Rare S1s evoked a large P3b. But this P3b became abolished when S1, though still relevant, did not define the response. In this line, by comparing response- to stimulus-locked averages, we tested whether P3b reflects the fragility of stimulus-response links in Parkinson's disease. Indeed, conspicuously, patients' P3b was overlapped by response-related negativity above the mesial motor cortex. Thus, conceiving of P3b as an indicator of integrated stimulus-response links will continue to provide good new possibilities for basic and applied research.

2. *P300 and episodic encoding – under which conditions do we observe a P300 "subsequent memory effect"?*

Siri-Maria Kamp[a], Regine Bader[b] & Axel Mecklinger[b]

[a] International Research Training Group "Adaptive Minds", Saarland University, Saarbrücken, Germany
[b] Experimental Neuropsychology Unit, Saarland University, Saarbrücken, Germany

The P300 is pronounced when events violate expectancies. Such events are also typically more likely to be recalled. Several studies have demonstrated that variance in the amplitude of the P300 is correlated with variance in subsequent recall, pointing to a mechanism by which distinctive events are episodically encoded. However, there are also many circumstances under which P300 amplitude is uncorrelated with performance on subsequent memory tests. To resolve this inconsistency, we examined the idea that the P300 "subsequent memory effect" occurs when item-specific details are encoded and utilized for subsequent retrieval. Another ERP component, the frontal slow wave, appears to index encoding of inter-item associations. A recent study (Kamp, Bader and Mecklinger, in preparation) supports this by demonstrating that the P300 "subsequent memory effect" occurs when word pairs are encoded as single units, but not when word pairs are encoded in a manner that promotes inter-item associative encoding. By contrast, the frontal slow wave effect is observed in both conditions.

3. *Relationship between P3 and individual differences in cognitive abilities*

Eligiusz Wronka

Psychophysiology Lab, Institute of Psychology, Jagiellonian University, Krakow, Poland

The P3 component of the ERP is thought to reflect activity of the fronto-parietal network that can be related to stimulus evaluation and/or response selection and preparation. Therefore, these two processes are highly relevant for effective recognition of important information and subsequent decision how to respond. This in turn implicated the link between brain activity involved in P3 generation and cognitive abilities. Results from previous ERP studies have suggested that P3 latency is inversely related to general intelligence. Some recent studies showed also that P3 amplitude can be positively correlated with IQ. Results from our experiments suggested that separately measured amplitudes of two P3 subcomponents (P3a and P3b) are bigger for subjects who had score higher on IQ tests. Consistently, intelligence-related differences in P3 amplitude were associated with various levels of cortical activities as revealed by source analysis, particularly within the frontal and the parietal cortex where neural generators of P3 component are probably located. These findings are consistent with results from neuroimaging studies showing link between fluid intelligence and fronto-parietal activity. We propose that the efficiency of the fronto-parietal network constitute basis for human cognitive abilities.

4. ***Putting P300 in context: Its role in the updating of sensory versus sensorimotor representations during cognitive task-set switching***

Francisco Barceló, Marcelina Chamielec, Alvaro Darriba

Laboratory of Neuropsychology, University of the Balearic Islands, Spain
Asociación de Neuropsicología Balear (ANEBA), Mallorca, Spain

Fifty years after the discovery of the brain P300 event-related potential (ERP), most evidence about its taxonomy and functional role has been obtained using homogeneous task-set (i.e., Oddball, Go/NoGo) paradigms. Today little is known about the purported relationship between the classic P3a and P3b sub-components and transient early- and late-latency positivities observed in task-set switching paradigms (cf., Barceló, 2003; Karayanidis et al., 2003). In a series of ERP studies, young and elderly healthy controls (N>175, aged 18-80 y.o.) were intermittently cued to switch or repeat their perceptual categorization of Gabor gratings varying in color and thickness (Switch task), or else they performed two visually identical control tasks (Go/NoGo and Oddball). Trial-by-trial neural dynamics of sensory vs sensorimotor adjustments during cue-locked task preparation and target-locked task implementation revealed both switch-specific (i.e., transient positivities around task transitions points) and domain-general mechanisms (indexed by cue- and target-locked P2, P3a and P3b). Topographic scalp analyses, however, revealed largely overlapping configuration of frontoparietal sources for temporarily and functionally distinct switch-specific and domain-general positivities. These findings are discussed in relation to the hypothesis of fast recursive activations across a common frontoparietal "multiple demand" system (Duncan, 2013) during the preparation and implementation of cognitive task-set switching.

5. ***Surfing a wave of attention: The P3 as a neuroboard for conscious access***

Tristan Bekinschtein

Department of Psychology, University of Cambridge, UK

Brain activity can be used as proxy of a volitional response or as a marker of a cognitive process. In electroencephalography in humans there is a slow potential commonly called P3 (or p300) that signals cognitive control or top-down attention of an event or situation. Here I would like to illustrate the limits of this neural signature of human consciousness with a series of experiments where attention, conscious access, wakefulness by sleep and sedation are used to modulate executive control, awareness and consciousness. Finally I would like to show the clinical utility (and its limitations) of the P3 as a prognostic and diagnostic tool for psychiatric patients and for disorders of consciousness.

Neurology

16.00 – 17.30

chaired by: Wojciech Turaj (Jagiellonian University Medical College, Krakow, Poland)

1. ***Illicit Drug Use in Hospital***

Harjot Kaur Grewal, Lianping Ti, Kanna Hayashi, Sabina Dobrer, Evan Wood, Thomas Kerr

harjot_90@hotmail.com

British Columbia Centre for Excellence in HIV/AIDS, St. Paul's Hospital, Canada
School of Population and Public Health, University of British Columbia, Canada
Department of Medicine, University of British Columbia, Canada

While persons with addiction are often hospitalized, hospitals typically employ abstinence-based policies specific to illicit drug use. Although illicit drug use is known to be common within hospitals, little is known about this problem. Therefore, we sought to investigate the prevalence of and factors associated with having ever used illicit drugs while hospitalized among people who use illicit drugs (PWUD) in Vancouver, Canada. Using data from two prospective cohort studies of PWUD between December 2012 and May 2013, demographic and behavioural factors associated with having ever used illicit drugs in hospital were identified. Among 1028 participants who had experienced ≥ 1 hospitalization, 43.9% reported having ever used drugs while hospitalized. Positively associated factors included daily cocaine injection and daily crack non-injection meanwhile negatively associated factors were older age and male gender. The most common reasons for drug use were "wanting to use" and "being in withdrawal". Drugs were most commonly used in patient washrooms. We conclude that abstinence-based approach to drug use in hospitals is ineffective at prohibiting drug consumption. High-risk drug use behaviours are often undertaken and pose risks for further harm and illness. Efforts to minimize the harms associated with using drugs in hospital are urgently needed.

2. ***Acute post – stroke/TIA depression and anxiety impair executive functioning***

Katarzyna Kowalska, Paweł Moskal, Elżbieta Klimiec, Agnieszka Słowik, Aleksandra Klimkowicz-Mrowiec,

katarzyna.olga.kowalska@gmail.com

Department of Neurology, University Hospital, Krakow, Poland

Mood disorders are common in patients with cerebrovascular diseases. They are associated with worse cognitive functioning and lower quality of life after the stroke or transient ischemic attack (TIA). The aim of this study was to evaluate association between acute post–stroke depression, anxiety and executive functioning. The consecutive patients admitted to the Stroke Unit, Department of Neurology, University Hospital, Krakow, with supratentorial stroke or TIA were included in the study. Depression and anxiety were assessed 7-10 days after admission with The Patient Health Questionnaire-9 (PHQ-9) and The State—Trait Anxiety Inventory (STAI). Executive functioning was evaluated with Frontal Assessment Battery (FAB). 233 out of 330 patients performed PHQ-9 and 212 out of 330 patients fulfilled STAI. Depression was diagnosed in 60,5% (n=141), high state anxiety occurred in 34% (n=72) and high trait anxiety in 24% (n=51). The higher level of depression or anxiety (state or trait) in stroke and TIA patients is associated with worse performance on FAB. In conclusion, acute post–stroke or TIA depression and anxiety impair executive functioning.

3. ***Risk factors of cerebral vasospasm after aneurysmal subarachnoid hemorrhage – how to predict the forthcoming silent killer***

Zofia Ślosarek, Bartosz Kapustka, Martyna Ostry, Paulina Kałuża, Dominika Pawlus, Michał Dworak, Małgorzata Kozikowska, Stanisław Kwiek

zofia_slosarek@interia.pl

Medical University of Silesia, Katowice, Poland

Background: Cerebral vasospasm(VA) after subarachnoid hemorrhage(SAH) is a major cause of death and disability. Recent data indicate a functional dissociation between VA and neurological outcome. It is known that major role in patogenesis of VA act degradation products of blood and Fisher Grade correlate with the risk of VA. We aimed to examine incidence of the diagnosis of VA as well as the relationship of different factors to the incidence of VA.
Material: Data from 173aSAH patients between 01.2008-12.2014 were reviewed. We evaluated clinical presentation, blood tests, management and outcome. To evaluate clinical presentation we used: Hunt and Hess, GCS and Fisher's grade.
Results: 36patients (average age=50,3) develop VA. 23%patients presented with a Fisher's Grade of I/II. According to H&H scale grades IV-V had 15%patients. 34 were in the anterior circulation, versus 2 in the posterior; the most common were ACo & MCA aneurysms(n=15). 52%had good or excellent outcome with GOS; 8died. We found statistically correlation between higher Fisher's grade, H&H score, gender and location of aneurysm and risk of VA.
Conclusions: Factors dependent of cerebral vasospasm may help better predict patient outcome following SAH. Induvidualized approach to patient with aSAH help to provide proper protection against cerebral vasospasm.

PLENARY LECTURE:
18.00 – 19.00

Learning to See: How Sensory Experience and Learning Change Neurons in the Visual Cortex

Mark Hübener

Max Planck Institute of Neurobiology, Martinsried, Germany

Neuronal response properties in the cerebral cortex are not static. They can change during development, after deprivation, and following learning. Likewise, even in the adult brain, the structure of neurons is not fixed but can be altered by modifications of sensory input and experience. We study such functional and structural plasticity in the visual cortex, using imaging approaches that allow following the fate of individual neurons over extended periods of time. In my lecture, I will show how such experiments help shedding light on the cellular mechanisms underlying specific types of plasticity.

April 19, 2015 (Sunday)

PLENARY LECTURE:
9.30 – 10.30

Brain-Machine-Interfaces (BMI) in Paralysis and behavioral disorders

Niels Birbaumer[a b c], G. Gallegos-Ayala[a], R. Sitaram[d], U. Chaudhary[a], S. Soekadar[a], A. Ramos-Murguialday[a e]

[a] Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen, Germany
[b] Ospedale San Camillo, IRCCS, Istituto di Ricovero e Cura a Carattere Scientifico, Venezia – Lido, Italy
[c] Institute for Diabetes Research and Metabolic Diseases of the Helmholtz Center Munich at the University of Tübingen, Germany and German Center for Diabetes Research (DZDe.V.), Neuherberg, Germany
[d] Department of Biomedical Engineering, University of Florida, Gainesville, FL, USA
[e] Health Technologies Department, TECNALIA, Mikeletegi Pasalekua 1, 20009 San Sebastian, Spain
University of Tübingen, Germany

Results from three applications of BMIs are described and their scientific, clinical and societal impact evaluated: (1) BMIs for brain-communication in the locked-in patients; (2) BMIs as a rehabilitation modality for severe chronic stroke; (3) BMI-metabolic fMRI-neurofeedback in neuropsychiatric disorders
(1) BMIs using EEG, implanted Electrocorticogram (ECoG) were used extensively for brain communication in patients with severe paralysis, mainly amyotrophic lateral sclerosis (ALS). Up to the locked-in (LI) stage different types of EEG-ECoG-BMIs were used successfully to select letters or answers with brain oscillations (mainly sensorimotor rhythm, SMR) or cognitive event-related potentials from a computer menue. However, attempts to use BMI in the completely locked-in-syndrome (CLIS) were largely unsuccessful despite intensive research efforts. The first successful attempt in a CLIS patient using near-infrared-spectroscopy (NIRS) BMI-systems will be described (Gallegos-Ayala et al 2014).
(2) A controlled outcome study of severe chronic stroke patients without residual hand mobility and without any available treatment modality left was recently published by this group (Ramos et al 2013) using a non-invasive extensive BMI-training with a neuroprosthetic device driven by sensorimotor brain oscillations (SMR) provides the first evidence of the clinical usefulness of BMI in this patient group. Reasons for this successful behavioral change and productive brain reorganization are presented and the necessity of future invasive BMI based on direct recordings from motor neurons comparable to those of Hochberg et al (2006, 2012) presented here by J. Donoghue in severe chronic stroke is emphasized.
(3) Neurofeedback of EEG oscillations was used as a behavioral training-approach with considerable success in attentional disorders and epilepsy. Recently real-time-functional magnetic resonance (rt-fMRI) neurofeedback was developed by the Tuebingen group and tested in several neuropsychiatric disorders such as psychopathy, addiction, schizophrenia, obsessive-compulsive disorder and obesity (see Birbaumer et al 2013 for a review). Rt-fMRI-neurofeedback allows self-regulation of circumscribed well-defined cortical and subcortical brain systems and their connectivity. A recent study with severe psychopathic criminals in a high security prison shows surprisingly good brain self -regulation skills after extended training.Some recent results in addiction are reported and the problem of brain-behavior associations related to BMI-training discussed.
Supported by Deutsche Forschungsgemeinschaft DFG (Koselleck BI 195/69-1), German Federal Ministry of Education and Research (BMBF) to the German Center for Diabetes Research (DZDe.V.,01GI0925), VW, Baden-Württemberg Stiftung, EU-FP7 and HORIZON 2020 (WAY, BRAINTRAIN, ERC to Rosenstiel & Birbaumer), CIN, FORTUNE (Faculty of Medicine, Univ. of Tuebingen).

Neuropsychiatry

10.45 – 12.15
chaired by: David Enbglom (Linköping University, Sweden)

1. ***Feeling sick: How inflammation controls dopaminergic circuits***

David Engblom

Linköping University, Sweden

Systemic inflammation causes malaise and general feelings of discomfort. This is annoying during mild infections and reduces the quality of life for people suffering from chronic inflammatory diseases. Recent findings also show that

inflammatory signalling sometimes contribute to the development of overt depression. We have investigated how systemic inflammation induces malaise and discomfort by using a behavioral test in which mice learn to avoid an environment where they have experienced inflammation (conditioned place aversion). Our findings show that the aversion induced by inflammation is not a consequence of fever or anorexia but mediated by a unique pathway. This pathway involves activation of the brain endothelium by circulating cytokines or bacterial fragments, leading to central nervous prostaglandin release and prostaglandin-mediated inhibition of the dopamine system. Further studies along this line has also identified the melanocortin system as an important mediator of aversion in response to inflammation as well as other stimuli. These findings elucidate an important aspect of why being sick feels bad and are also interesting in the context of depression.

2. ***Acute and chronic N-acetylcysteine on cue-induced nicotine-seeking behavior***

Federico Moro, Di Clemente A., Marzo C.M. and Cervo L.

federico.moro@marionegri.it

IRCCS – Mario Negri Institute for Pharmacological Research, Experimental Psychopharmacology, Department of Neuroscience, Milan, Italy

This study investigated whether, akin to cocaine and heroin, N-acetylcysteine (N-AC) pretreatment would inhibit cue-induced nicotine-seeking by restoring basal concentrations of extracellular glutamate (Glu) thereby increasing tonic activation of the presynaptic mGluR2/3. Naïve male Wistar rats were trained to associate discriminative stimuli (SDs) with intravenous nicotine or oral saccharin self-administration vs. no-reward in two-lever operant cages. Reinforced response was followed by cue signaling 20-second time-out (CSs). Re-exposure to nicotine or saccharin SD+/CS+, but not no-reward SD-/CS-, revived responding at the previously reinforced lever. Acute N-AC, 100 mg/kg i.p., reduced cue-induced nicotine-seeking behavior without modifying cue-induced saccharin-seeking behavior and did not affect the spontaneous locomotor activity of rats with an history of nicotine self-administration. Pre-treatment with the mGluR2/3 antagonist LY341495, 1 mg/kg i.p., prevented the effect of N-AC on nicotine-seeking. When N-AC was given chronically during forced abstinence or in combination with SD+/CS+, only in the latter condition N-AC reduced nicotine-seeking and induced lasting anti-relapse activity that was still present two weeks later. These results support and extend previous preclinical findings suggesting that N-AC might offer a therapeutic opportunity for acute cue-controlled nicotine-seeking and for promoting extinction of nicotine-cue conditioned responding.

3. ***The role of Arc/Arg3.1 in the regulation of alcohol-addiction related behavior***

Maria Nalberczak, Magdalena Ziółkowska, Jakub Kowalski, Szymon Łęski, Okuno Hyroyouko, Kasia Radwanska

m.nalberczak@nencki.gov.pl

Nencki Institute of Experimental Biology, Polish Academy of Sciences, Warsaw, Poland

Addiction is driven by neuropathology of the glutamatergic transmission in the brain reward system. Arc/Arg3.1 protein is one of the key regulators of glutamatergic transmission due to its function in the regulation of AMPA receptors endocytosis and expression. The role of Arc in the regulation of addiction-related behaviour is, however, poorly understood. Here, using long-term training in the automated cage, IntelliCage, we show that Arc KO mice are characterised by impaired extinction of alcohol seeking behaviour and decreased alcohol consumption. Our data suggest that Arc protein regulates not only cognitive processes related to development of addiction, such as persistence of reward seeking, but also alcohol preference after long-term alcohol training.

4. ***Identification and classification of cocaine-induced transcriptional variants and non-coding RNAs in the mouse striatum***

Magdalena Zygmunt[a], Sławomir Gołda[b], Marcin Piechota[b], Joanna Ficek[b], Jan Rodriguez Parkitna[a], Michał Korostyński[b]

zygmunt@if-pan.krakow.pl

[a] Laboratory of Transgenic Models, Department of Molecular Neuropharmacology, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland
[b] Department of Molecular Neuropharmacology, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

Activity-dependent gene expression in neurons enables changes necessary for long-term plasticity. The regulation of activity-dependent gene expression is complex, varies between types of neurons and in cases like the striatum among

same-type neurons that differ in connectivity. Furthermore, another layer of complexity arises from differential regulation of splicing or expression of non-coding RNAs. Here, we use next-generation sequencing to comprehensively map transcription in the striatum. Total RNA and small RNA sequencing was performed on samples derived from the striatum of mice killed 1h after treatment with 25 mg/kg cocaine. Transcript levels were quantified using the Cufflinks package and annotated based on Ensembl. Analysis indicated that in addition to increased expression of known activity-regulated genes, different types of cocaine inducible splicing variants and transcript biotypes were identified: alternative first exon (e.g. Clk4 and Cirbp), alternative last exon (e.g. Baiap2 and Fam115a), intron retention (e.g. Nebl and Polr2e) and small RNA (e.g. Mir1983 and Gm24049). In order to investigate the specificity of gene expression to different neuron subtypes we have used FACS to sort genetically labeled neurons. The main outcome of our study is a comprehensive assessment of transcriptional variation and non-coding RNA expression in the striatum in response to cocaine. This work was supported by NCN grant SONATA 2011/03/D/NZ3/01686.

Clinical Affective Neuroscience

10.45 – 12.15

chaired by: Claudia Schulz (University of Münster, Germany)

1. ***Emotional face learning in social anxiety disorder tracked by event-related potentials***

Claudia Schulz, Julian Hagemann, Thomas Straube

claudia.schulz@uni-muenster.de

University of Münster, Germany

Face perception and recognition are crucial abilities for everyday interactions. For people suffering from social anxiety disorder (SAD), a highly prevalent disorder, faces constitute an important, disorder-related category of stimuli. Patients show attentional and interpretational biases; however, it is not yet clear whether they also display changes in face memory due to potential changes in initial perception. Therefore, patients with SAD and healthy controls (HC) participated in an EEG learning study, in which they learned a larger number of individuals from emotional faces (happy, angry, neutral) and later recognized them from a neutral image. Behaviorally, we observed a main effect of emotion on accuracies and response times, but irrespective of participant group. During the learning phase, we observed effects of face emotion on P1, N170, P2, N250 and LPC, predominantly in SAD. However, in the test phase, an N250 familiarity effect proceeded to LPC, while a difference by group was no longer present. These data reveal enhanced processing of emotional faces in SAD during several stages of initial encoding. Interestingly, and in contrast to previous learning studies, these differences do not influence face memory, as they neither affect recognition performance, nor show up in ERPs associated with face recognition.

2. ***Too disgusting to forget – the effect of basic emotions on directed forgetting***

Artur Marchewka[a], Marek Wypych[a], Jarosław M. Michalowsk[b], Marcin Sińczuk[a], Małgorzata Wordecha[a], Anna Nowicka[c], Katarzyna Jednoróg[c]

a.marchewka@nencki.gov.pl

[a] Laboratory of Brain Imaging, Neurobiology Centre, Nencki Institute of Experimental Biology, Warsaw, Poland
[b] Faculty of Psychology, Warsaw University, Warsaw, Poland
[c] Laboratory of Psychophysiology, Department of Neurophysiology, Nencki Institute of Experimental Biology, Warsaw, Poland

Memory for emotional events is typically better than for comparable non-emotional incidents. We investigated whether memory in the directed-forgetting paradigm is influenced by basic negative emotions. 18 female students participated in the experiment divided into 2 phases. In the study phase with fMRI scanning, participants viewed 240 images from the Nencki Affective Picture System. 60 neutral pictures were followed by the instruction to-be-remembered (TBR) and 60 followed by the instruction to-be-forgotten (TBF). Additionally 120 negative images were shown (60 TBR/TBF) classified as evoking basic emotions: disgust, fear or sadness. In the test phase, all stimuli were re-presented mixed pseudorandomly with new pictures. Subjects had to categorize each picture as old (displayed in the study phase) or new. The recognition for TBR items was significantly higher than that for TBF items. For TBR items, all basic emotions had higher recognition than neutral stimuli. Disgust and fear emotions were remembered better than sadness. For TBF items, disgusting pictures were harder to forget than neutral stimuli. Intentional remembering led to activation in left medial temporal lobe including hippocampus and amygdala whereas intentional forgetting was associated with right middle/superior frontal activity. Additionally, we found an effect of basic emotions on amygdala and hippocampus activations.

3. Attentional engagement with social and non-social emotional stimuli in schizophrenia

Łukasz Okruszek[a], Adam Wichniak[b], Anna Schudy[a], Katarzyna Jednoróg[c], Artur Marchewka[c], Emilia Łojek[a]

lukasz.okruszek@psych.uw.edu.pl

[a] University of Warsaw, Poland
[b] Institute of Psychiatry and Neurology, Michał Jarkiewicz, Institute of Psychiatry and Neurology
[c] Nencki Institute of Experimental Biology, Warsaw, Poland

Background: The aim of the study was to examine neurophysiological and behavioral correlates of emotional reaction to social and non-social stimuli in healthy controls and in patients with schizophrenia.
Method: Twenty-six patients and twenty-one controls participated in the visual oddball task while EEG was recorded. Stimuli were selected from the Nencki Affective Picture System and were either aversive or neutral images presenting both social stimuli and non-social stimuli. Subjects also provided behavioral ratings for each picture.
Results: Similar attentional engagement (measured by Late Positive Potential at midline electrodes) was found to various types of stimuli, with strongest response to high-arousing social stimuli, followed by high-arousing and low-arousing non-social stimuli and lowest response to low-arousing social stimuli. This pattern of neurophysiological activity was congruent with behavioral ratings made by controls, but not by patients. Negative correlation between the negative symptoms of schizophrenia and LPP amplitude to neutral social stimuli but not to other types of stimuli was found at posterior electrodes.
Conclusion: Patients with schizophrenia, despite different behavioral ratings, in neurophysiological assessment respond to the social and non-social affective stimuli in a similar manner as healthy controls. Moreover, patients' brain activity to social stimuli was related to negative symptoms of schizophrenia

4*. Processing emotional faces in relation to cognitive load: An event-related potential study*

Berna Sari[a], Ernst H. W. Koster[a], Nazanin Derakshan[b], Gilles Pourtois[a]

ayseberna.sari@ugent.be

[a] Ghent University, Belgium
[b] University of Birkbeck, London, UK

Attentional bias towards threat is hallmark of negative affect. In this study, we sought to characterize the electrophysiological time-course of attentional biases, when they operate primarily on internal mental representations held in working memory (WM), as opposed to external emotional stimuli. To this end, we used an adapted delayed match-to-sample task (Sessa et al., 2010) enabling us to titrate, at the electrophysiological level, modulatory effects of (WM) load and emotion (neutral, fearful) during the retention interval. Results showed that sustained posterior contralateral negativity varied in amplitude with load, irrespective of emotion. More importantly, complementing analyses based on topographical evoked potential mapping revealed that load and emotion influenced the active maintenance of the first visual display at different latencies and through modulations in non-overlapping neural networks during a late phase of the retention interval. Increasing load decreased activity in a set of brain regions involved in attention control and WM before emotion influences the active maintenance of the first visual display. These ERP results suggest multiple but dissociable effects of load and emotion in WM. We discuss the implication of these new electrophysiological findings in light of recent neurobiological models accounting for interaction between cognition and emotion.

5. *Differentiating brain responses to phobic pictures in spider and social phobia individuals: a simultaneous EEG-fMRI study*

Jarosław Michałowski[a], Dawid Droździel[a], Jacek Matuszewski[a], Katarzyna Jednoróg[b], Artur Marchewka[c]

jmichalowski@psych.uw.edu.pl

[a] Faculty of Psychology, University of Warsaw, Poland
Department of Neurophysiology, The Nencki Institute of Experimental Biology, Warsaw, Poland
[c] Laboratory of Brain Imaging, The Nencki Institute of Experimental Biology, Warsaw, Poland

Phobic patients typically respond with enhanced vigilance and increased selective attention towards phobic-threat. However, there are fundamental differences in the processing of/coping with phobia-relevant events between specific and social phobias. In the present combined EEG-fMRI study we used a passive picture-viewing paradigm to investigate the brain response to phobia-relevant and neutral pictures in spider phobia (N=12), social phobia (N=12) and control individuals (N=12). Participants were exposed to 4 different blocks of continuously presented pictures: social intermixed with neutral, spider intermixed with neutral, general threat intermixed with neutral, neutral alone.

The study was performed using a 3T MRI scanner and a 64-electrode EEG cap. When compared to controls both phobia groups showed an overall increased P1 hypervigilance effect. Spider phobia individuals also demonstrated enhanced LPP amplitudes and significantly increased BOLD response in the subcortical fear system, insular and visual cortex during the exposure to spider pictures. The social phobia group lacked to show the enhanced LPP and subcortical fear system response but demonstrated higher activations in cingulate and superior and orbitofrontal areas during the exposure to social pictures. These findings suggest that social phobia and specific phobia individuals show diverse processing mechanisms when confronted with their feared stimuli.

Neurode(re)generation

14.30 – 16.00

chaired by: Antonella Consiglio (University of Barcelona, Spain)

1. *Modeling Parkinson's disease with patient-specific induced pluripotent stem (iPS) cells*

Antonella Consiglio

Institute for Biomedicine of the University of Barcelona (IBUB), Barcelona Science Park, Barcelona, Spain

A critical step in the development of effective therapeutics to treat Parkinson's disease (PD), the second most common age-related progressive neurodegenerative disease, is the identification of molecular pathogenic mechanisms underlying this chronically progressive neurodegenerative disease. However, while animal models have provided valuable information about the molecular basis of PD, the lack of faithful cellular and animal models that recapitulate human pathophysiology is delaying the development of new therapeutics. The reprogramming of somatic cells to induced pluripotent stem cells (iPSC) using delivery of defined combinations of transcription factors is a groundbreaking discovery that opens great opportunities for modeling human diseases, including PD, since iPSC can be generated from patients and differentiated into disease-relevant cell types, which would capture the patients' genetic complexity. Furthermore, human iPSC-derived neuronal models offer unprecedented access to early stages of the disease, allowing the investigation of the events that initiate the pathologic process in PD. Recent studies from our laboratory and others have demonstrated that iPSC technology can be used to observe disease-associated phenotypes relevant to PD neurodegeneration, in particular impaired axonal outgrowth and deficient autophagic vacuole clearance. iPSC disease modeling has provided first hand proof-of-principle evidence that neurons with a sporadic PD patient genome exhibited similar phenotypes compared to ones derived from patients with familial PD.
Currently we are taking advantage of this genuinely human PD model to undertake a comprehensive and multi-pronged approach in order to investigate: i) the pathogenic mechanisms that underlie the neurodegeneration phenotype identified in our model, with the aim of finding ways to delay, halt or rescue the neurodegeneration of PD patients; ii) further refinements in our iPSC-based PD model, including the generation of iPSC lines representing asymptomatic patients carrying pathogenic mutations, and the correction of known mutations by gene edition; and iii) whether DAn degeneration in PD is solely a cell-autonomous phenomenon, or whether it is influenced by an altered cross-talk between DAn and glial cells. Here, we will highlight the current PD iPSC-based models and discuss the potential future research directions of this field.

2. *GDNF prevents dopaminergic neurodegeneration in iPS cell-based models of familial and sporadic Parkinson's disease*

Roger Torrent[a], Adriana Sanchez Danes[a], Yvonne Richaud[b c], Javier Villadiego[d], Eduard Tolosa[e f], J. José Toledo Aral[d], Angel Raya[b c g], Antonella Consiglio[a h]

rtorrent@gmail.com

[a] Institute of Biomedicine of the University of Barcelona (IBUB), Barcelona Science Park, Barcelona, Spain
[b] Control of Stem Cell Potency Group, Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain
[c] Center for Networked Biomedical Research on Bioengineering, Biomaterials and Nanomedicine (CIBER-BBN)
[d] Laboratorio de Investigaciones Biomédicas, Departamento de Fisiología y Hospital Universitario Virgen del Rocío, Universidad de Sevilla, Sevilla, Spain
[e] Centre for Networked Biomedical Research on Neurodegenerative Diseases (CIBERNED)
[f] Movement Disorders Unit, Department of Neurology, Hospital Clínic of Barcelona, Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS), University of Barcelona (UB), Barcelona, Spain
[g] Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain
[h] Department of Molecular and Translational Medicine, University of Brescia and National Institute of Neuroscience, Brescia, Italy

Parkinson's disease (PD) is among the most frequent human neurodegenerative diseases characterized by a gradual degeneration of nigrostriatal dopamine-containing neurons (DAn). Here we investigated the therapeutic effect of the

neurotrophic factor GDNF in a human iPSC Parkinson's disease model, with the aim to protect dopaminergic neurons from the appearance of disease-associated phenotypes relevant to neurodegeneration, such as impaired axonal outgrowth and deficient autophagic vacuoles clearance. For this purpose we exposed sporadic and LRRK2mutG2019S patients iPSC-derived neural progenitor cells to a preventive treatment with GDNF for 6 weeks, starting at 3 weeks of DAn differentiation until reaching a total of 9 weeks. GDNF-treated PD derived DA neurons showed increased neurite number and length, compared with non-treated PD derived DA neurons. Moreover, GDNF exposure promoted neuronal survival, as judged by the decrease in the number of TH+/CASPASE3+ cells, consistent with a GFR1α/RET downstream activation of RAS/ERK1-2 and PI3K/Akt cell survival pathways, as well as reduced LC3 autophagosome vesicles presence. In conclusion, our data show that iPSC-derived neuronal cells are valuable models for measuring responses to neuroprotective strategies and they may help to identify potential new drugs and future treatments for PD.

3. *Advantages of in vivo genetic manipulations of the rodent brain innovative by site-directed in utero electroporation with a triple-electrode probe*

Andrzej W. Cwetsch[a], Joanna Szczurkowska[a], Marco dal Maschio[a], Diego Ghezzi[a], Gian Michele Ratto[b c], Laura Cancedda[a]

andrzej.cwetsch@iit.it

[a] Department of Neuroscience and Brain Technologies, Istituto Italiano di Tecnologia, Genova, Italy
[b] Institute Nanoscience, National Research Council, Pisa, Italy
[c] Scuola Normale Superiore, Pisa, Italy

One of the major challenges in current biology is the understanding of the function of different genes in health and disease. In utero electroporation is a powerful tool to manipulate in rodents neural-precursor cells of the parietal cortex and their progeny in vivo. In utero electroporation technique takes advantage of the fact that by addressing neural progenitors at different locations, one can genetically manipulate newborn neurons that will populate different brain areas. The standard method entails a quick and easy surgical procedure to inject DNA in the embryonic brain, followed by exposure to an electric field by a bipolar electrode. Here, we validate a new in utero electroporation design based on the use of three electrodes. By simply adjusting the relative positions and polarities of the three electrodes, hippocampus, cerebellum and motor, visual , as well as prefrontal cortices were targeted with extremely high consistency, in comparison to standard bipolar configuration. Finally, coupling of the tripolar in utero electroporation to other useful techniques such as RNA interference, tamoxifen-inducible Cre-ER(T) recombinase systems and optogenetics allows easy, consistent and temporally restricted modulation of in vivo gene expression.

4. *Sequential Development of Glutamatergic and GABAergic Synapses on Principal Neurons in the Rat Neocortex*

Shovan Naskar, Edoardo Balzani, Valter Tucci, Laura Cancedda

shovan.naskar@iit.it

Department of Neuroscience and Brain Technologies, Istituto Italiano di Tecnologia, Genova, Italy

Background: Synaptogenesis is a complex process wherein newborn excitatory and inhibitory neurons extend their axons in search of inputs from targets in the vicinity. This helps them integrate into neuronal microcircuits and establish a correct balance between excitation and inhibition. Disruptions in the maintenance of this balance result in a multitude of neurodevelopmental disorders. Morphofunctional studies in different areas of the rodent brain have revealed that GABAergic synapses develop before Glutamatergic synapses. In the developing neocortex, there are a handful of studies on the GABA-Glutamate sequence of synaptogenesis and they provide contrasting results.
Methods: Electrophysiology (whole-cell voltage clamp recordings), pharmacology and behavior studies in young rat pups (aged between postnatal days (P) 2 and 30).
Results: Glutamatergic miniature postsynaptic currents (mPSCs) appeared earlier than GABAergic mPSCs on pyramidal neurons in Layer 2/3 of the neocortex. Glutamatergic and GABAergic mPSC frequencies increased 'abruptly' at P9, which was possibly regulated by Serotonin. Systemic Serotonin reuptake inhibition by Selective Serotonin Reuptake Inhibitors (SSRIs) accelerated the development of Glutamatergic and GABAergic synapses. In Layer 5, both Glutamatergic and GABAergic synaptogenesis occurred earlier than in Layer 2/3 and increased gradually with age. Behavioral experiments performed in rat pups aged between P2 and P10 correlated well with our electrophysiological findings.
Conclusions: Glutamatergic synapses are formed prior to GABAergic synapses in the neocortex. In Layer 2/3, synaptogenesis increases abruptly between postnatal day 8 and 9, with Serotonin modulating this abrupt increase.

Language and Semantic Processing

14.30 – 16.00

chaired by: Marcin Szwed (Jagiellonian University, Krakow, Poland)

1. *The visual cortex is not exclusively visual, and plays a critical role in tactile Braille reading. fMRI, resting-state fMRI and TMS evidence from sighted Braille readers*

Marcin Szwed[a], Łukasz Bola[a]*, Katarzyna Siuda[a, b]*, Małgorzata Paplińska[c], Ewa Sumera[d], Katarzyna Jednoróg[e, f], Artur Marchewka[e], Magdalena Śliwińska[g] (*equally contributing authors)

mfszwed@gmail.com

[a] Department of Psychology, Jagiellonian University, Krakow, Poland
[b] Ecole des Neurosciences Paris-Ile-de-France, Paris, France
[c] Maria Grzegorzewska Academy of Special Education in Warsaw, Poland
[d] School for the Blind and Partially Sighted Children in Krakow, Poland
[e] Laboratory of Brain Imaging, Neurobiology Center, Nencki Institute of Experimental Biology, Warsaw, Poland
[f] Laboratory of Psychophysiology, Department of Neurophysiology, Nencki Institute of Experimental Biology, Warsaw, Poland
[g] Dept of Psychology, UCL London, London, UK

Are sensory cortical areas exclusively dedicated to one modality (e.g. vision?) Tactile reading in blind subjects activates the Visual Word Form Area (VWFA) – a ventral visual region known to develop expertise for visual reading. This brain region thus has the innate connectivity required to carry out a most complex task in a modality different than vision. Nevertheless, these results were obtained in congenitally blind subjects whose sensory experience is very different from our own. It remains to be determined whether the connectivity that underlies these results persists in sighted adults, or whether it has been pruned by visual experience. Here, we asked whether tactile reading can recruit the sighted's visual cortex. sighted subjects were enrolled in a 9-month tactile Braille reading course. After the course, subjects showed 1) enhanced activity for tactile reading in the visual ventral cortex, including the VWFA, which correlated with their Braille reading speed 2) enhanced resting-state-connectivity between visual and somatosensory cortices. Moreover, 3) TMS applied to the VWFA decreased accuracy of reading words in Braille in a lexical decision task. Our results thus show that the parts of ventral visual cortex are able to engage in tasks other-than-visual even while they are receiving visual input.

2. *Neural basis of phonological awareness in beginning readers with familial risk of dyslexia - results from shallow orthography*

Katarzyna Jednoróg[a], Agnieszka Dębska[a, b], Magdalena Łuniewska[a, b], Katarzyna Chyl[a], Anna Banaszkiewicz[a], Agata Żelechowska[a], Marek Wypych[c], Artur Marchewka[c]

k.jednorog@nencki.gov.pl

[a]Laboratory of Psychophysiology, Department of Neurophysiology, Nencki Institute of Experimental Biology, Warsaw, Poland
[b] Faculty of Psychology, Warsaw University, Poland
[c] Laboratory of Brain Imaging, Neurobiology Center, Nencki Institute of Experimental Biology, Warsaw, Poland

Phonological awareness (PA) is a crucial skill in reading acquisition, predicting its later success or causing reading problems when weakened. Two studies with relatively small samples examined the neural correlates of PA for spoken language in English-speaking typically developing children and in children with dyslexia or familial history of dyslexia (FHD+). Although in both cases the experimental groups showed hypoactivations compared to the controls, there was hardly any consistency between the studies with respect to the brain regions involved in the task and distinguishing between the groups. Here we examined the neural correlates of auditory word-rhyming in 102 Polish FHD+ and FHD- emerging readers in two groups – first grade and kindergarten (i.e. with and without reading instruction). FHD+ children in both groups showed hypoactivations in frontal and tempo-parietal areas. The differences included a broader network in kindergarteners, in line with neurodevelopmental trajectories. Importantly, the only common difference between FHD+ and FHD- children in the two age groups was decreased activity in the left dorsolateral prefrontal cortex (DLPFC). In previous studies, this same region was found to be hypoactivated in English-speaking children with dyslexia. We also found that its activity is negatively related to the familial risk reported by both parents.

3. ***Electrophysiological basis of production and comprehension of words and pictures: an ERP investigation in Basque-Spanish bilinguals***

Anna Beres[a], Itziar Laka[b]

anna.beres@gmail.com

[a] Bangor University, UK
[b] University of the Basque Country, Spain

Speech production is one of the most fundamental and unique human abilities. Language production studies involving event-related potentials (ERPs) are rare due to possible artefacts resulting from muscle movement. The present study aimed to establish the electrophysiological index of production and comprehension of words and pictures in Basque-Spanish bilinguals. In a classic priming paradigm, participants were presented with word-word and word-picture pairs and asked to decide whether they are related in meaning or not (comprehension blocks) or to name the target word or picture, before making the relatedness judgment (production blocks). Results show that the difference between comprehension and production in both words and pictures can be seen as early as ~70ms post stimulus presentation. This early access to some linguistic information could be a result of a top-town activity produced by the intention to speak. Later cognitive components, i.e. the N4/P6 complex (words) and the early N350 (pictures) also show a clear difference in the amplitude between comprehension and production, suggesting that accessing early linguistic representation in the brain is fundamentally different under those two conditions. Those results add to the growing body of literature regarding the time course of word retrieval and language production in the human brain.

4. ***Is the VWFA doing all the job? Dorsal stream deficit in dyslexia***

Marianna Boros[a], Marcin Szwed[b], Jean-Luc Anton[c], Catherine Pech[d], Jonathan Grainger[e], Johannes C. Ziegler[e]

marianna.boros@uj.edu.pl

[a] Jagellonian University, Krakow, Poland
[b] Instytut Psychologii, Uniwersytet Jagielloński, Krakow, Poland
[c] Centre d'IRM Fonctionnelle Cérébrale - Institut de Neurosciences de la Timone UMR 7289, Aix Marseille Université, CNRS, Marseille, France
[d] Centre de Références des Troubles d'apprentissages, CHU Timone, Marseille, France
[e] Laboratoire de Psychologie Cognitive, Brain and Language Research Institute, Aix-Marseille University and CNRS, Marseille, France

According to standard accounts of reading mechanisms, visual word recognition occurs in the ventral visual stream's Visual Word Form Area. Reading deficit in dyslexia would be a result of an underactivation in this region. This was confirmed by several studies, however, most of them were either carried out on adults and/or used reading tasks. Given that fluent reading is severely impaired in dyslexics, any underactivation might simply reflect a well-established reading deficit in impaired readers. Here, we designed a task that doesn't rely on reading per se, carried out in dyslexic children aged 8-12 years and age matched controls. We found that in addition to significant group differences in the VWFA, dyslexic children showed an underactivation of the middle occipital gyrus (MOG) relative to control group. The MOG lays in the dorsal visual stream, known for its engagement in spatial processing, and it was also proposed to be necessary for ordering the symbols in unfamiliar strings. Our results suggest that the VWFA deficit might be secondary to an impairment of visuospatial processing in the MOG. Thus we argue that MOG activity at the reading acquisition stage is critical for the development of effortless fast visual word recognition in the VWFA.

5. ***Automatic motor activavtion on the basis of spatial information: a TMS study***

Carsten Bundt, Lara Bardi, Elger L. Abrahamse, Marcel Brass, Wim Notebaert

carsten.bundt@ugent.be

Department of Experimental Psychology, Ghent University, Belgium

Various cognitive paradigms suggest an intimate link between perception and action. However, behavioral and neuroimaging methods that have been used to investigate this relation might not be ideally suited to directly demonstrate motor activation on the basis of perceptual information. Here, transcranial magnetic stimulation has been applied to directly probe the automatic activation of effectors in response to semantic, task-irrelevant stimuli (i.e., the words 'LEFT' and 'RIGHT'). Specifically, two sorts of trials were employed: on some trials, subjects were asked to respond to the color of target stimuli with the left or right first dorsal interossei (FDI). Crucially, on some trials, target-stimuli were spatial (non-) words and subjects were explicitly instructed not to respond to these stimuli. Electromyography (EMG) has been obtained from the left and right FDI. Results revealed that motor evoked potentials

were larger when the task-irrelevant stimulus (e.g. 'RIGHT') spatially corresponded with the effector (i.e. right FDI), and smaller when it did not (e.g. 'RIGHT' and left FDI). This finding suggests an automatic lateral motor activation on the basis of spatial words. Results are discussed in the context of the embodied cognition theory and spatial compatibility effects. Eventually, potential preconditions for the effect to occur are highlighted.

CLOSING LECTURE:
16.15 – 17.15

Signalling mechanisms of axonal growth, injury and regeneration

Bassem Hassan

VIB, KU Leuven, Belgium

Injury to the central nervous systems (CNS) is debilitating because injured CNS connections do not regenerate spontaneously. This is a conserved property of CNS neurons from flies to man. Although the factors underlying this inability are many, adult CNS neurons do have a basic intrinsic inability to re-grow their axons. An untested hypothesis stipulates that CNS axons do not regenerate because adult neurons lose the growth potential they had during development. Whether this is true and how developmental growth potential can be re-activated is unknown. Furthermore, if developmental growth potential can only be achieved via cellular re-programming, putative therapeutic applications would be quite challenging. We carried out an unbiased test of this hypothesis, whereby a genetic screen for genes capable of inducing regeneration is carried out. The screen resulted in the identification of a signaling pathway that can induce axonal regeneration after injury. Increasing the levels of the neuronal cell adhesion molecule Dscam is sufficient to induce axonal regeneration. Interestingly, enzymes that increase the translational efficiency of Dscam – namely the deubiquitinase Usp9x and the kinase DLK1 – can mimic this effect. This provides direct in vivo evidence that re-activation of developmental genes is indeed sufficient to induce axonal regeneration after CNS injury. Furthermore, it suggests that cellular re-programming may not be essential for this reactivation because targeting specific cytoplasmic enzymes or activating specific cell surface receptors may be of major help.

POSTER SESSION I

April 17, 2015 (Friday)
16.30 – 18.00

LEARNING AND MEMORY

1. An analysis of the relationship between anxiety and social rank

Marlena Bajer, Maria Krotewicz

marlena.bajer@interia.pl

University of Łódź, Poland

Social hierarchies tend to be quite stable over long period of time but insertion of new individuals can have important consequences for future behavioural interactions and fitness. Social rank limits social space for conspecifics, the individuals occupying high position in the social rank have more social opportunities compared to those low in the social hierarchy. Amygdala is engaged in the regulation of stress reaction resulted in complex emotion – behaviour interactions.The present study was undertaken to investigate a correlation between behavioural and neurochemical indices in rats observed in a social competition test. Arena was divided on three zones: feeder zone – included feeder; zone I – a zone surrounding the feeder zone; zone II – a most distant. During 3 minutes of the test thirty sucrose pellets were served. Number of eating pellets were summed up and behaviour of the paired rats was observed. The animals were sacrificed and the concentration of monoamines and its metabolites in amygdala was determined.There was also measured concentration of corticosterone in plasma. Analyses of correlation showed a positive correlation between serotonergic and dopaminergic activity and social behaviour of submissive animals in zone II. Dominant animals controled zone I as shown a positive correlation between corticosterone concentration and number of rearings in this zone.

2. Molecular mechanism of amnestic effect of ethanol

Kacper Łukasiewicz[a], Magdalena Ziółkowska[a], Michał Lipiński[b], Żaneta Matuszek[c], Magdalena Robacha[a], Anna Trąbczyńska[a], Katarzyna Radwańska[a]

k.lukasiewicz@nencki.gov.pl

[a] Department of Molecular and Cellular Neuroscience, Nencki Institute of Experimental Biology, Warsaw, Poland
[b] Instituto de Neurociencias de Alicante, Universidad Miguel Hernández - Consejo Superior de Investigaciones Científicas, Alicante, Spain
[c] College of Inter-Faculty Individual Studies in Mathematics and Natural Sciences, University of Warsaw, Poland

Ethanol is well known for its amnesic effects. The molecular processes which are involved in memory formation and are dysregulated by alcohol are, however, still unknown. Here we show that ethanol in dose-dependent manner prevents memory formation after Pavlovian conditioning in mice. The dose of 3, but not 2.5, g of alcohol per kg bw prevents memory formation and induces depolymerization of actin cytoskeleton in the hippocampus. Both of these processes are prevented by ascorbic acid (AA) treatment. One of the important proteins involved in the regulation of actin cytoskeleton and memory is alfa isoform of calcium and calmodulin-dependent kinase II (αCaMKII). Here we show that CaMKII-autophosphorylation deficient mutant mice (T286A) are more prone to amnestic effects of ethanol than WT mice. Ethanol decreased levels of polymerized actin (F-actin) in the hippocampus of T286A mice in a dose of 2.5 g/kg which is ineffective for WT animals. Alcohol effects are reversed by AA. Finally we show that actin stabilizing factor, jasplakinolide, partly rescues amnesic effects of alcohol. In conclusions our results suggest and that amnestic effects of ethanol are caused by actin depolymerization and that αCaMKII stabilizes actin cytoskeleton.

3. Effect of high fat simple sugar diet on performance in the radial maze test

Karolina Karwowska[a], Joanna Osoba[a], Zuzanna Setkowicz[a], Stefan Gaździński[b]

karolina.karwowska@uj.edu.pl

[a] Department of Neuroanatomy, Jagiellonian University, Krakow, Poland
[b] Military Institute of Aviation Medicine, Warsaw, Poland

Diet rich in fats and sugar is a major factor promoting obesity development. In addition to its metabolic consequences, recent evidence shows an association between high fat diet and cognitive functions. In this experiment, fifty male Wistar rats were fed for a year on a high fat simple sugar diet (40% fat, 40% sucrose) (HFSD). Control rats were fed standard laboratory chow. The animal body weight, blood levels of glucose and ketone bodies were recorded every two weeks. Learning and memory were tested with a radial 8-arm maze at 3-, 6-, 9- and 12-months of the experiment. As compared to controls, HFSD-treated rats committed less working memory errors in the radial maze, especially after 9-months of the experiment. Furthermore, the experimental group spent less time and walked a shorter distance to reach the reward. The study has demonstrated beneficial effects of HFSD on animal performance in the eight-arm radial maze task. Therefore, an unexpected conclusion can be inferred that consumption of high fat diet with high level of sucrose can improve learning and memory in rats. Neural correlates of these behavioral findings need, however, further histological verification. Supported by the Polish National Science Center, grant 2011/03/B/NZ4/03771.

4. Conditional deletion of limbic Npy1r impairs spatial memory acquisition and increases perineuronal nets formation in the dorsal hippocampus

Giuliano Ferrero, Mele P., Oberto A., Longo A., Carulli D., Eva C.

ferrero.giuliano@gmail.com

Neuroscience Institute Cavalieri Ottolenghi, University of Turin, Italy

Perineuronal nets (PNNs) are extracellular matrix structures enwrapping soma and proximal dendrites of CNS neurons, primarily involved in the restriction of experience-dependent synaptic plasticity. Our preliminary data show that the inducible knock-out of the Y1 receptors (Y1Rs) for Neuropeptide Y (NPY) in the excitatory neurons of the forebrain counteracts the anxiolytic effect exerted by maternal cares, and enhances the formation of PNNs in the dorsal hippocampus and prelimbic cortex. In this work, we used the same inducible KO model to assess the effects of Y1R deletion on the hippocampal-dependent acquisition of spatial reference memories, by subjecting mice to the Morris Water Maze test. KO mice showed longer escape latencies as compared to their wild-type littermates, and were unable to adopt goal-oriented strategies to reach the hidden platform. Immunofluorescence staining of PNNs with WFA lectin revealed that KO mice had a higher signal intensity in the CA1 region of the dorsal hippocampus, which is pivotal in the acquisition of spatial memories. These results suggest that the loss of Npy1r gene from forebrain excitatory neurons increases PNNs formation in the dorsal hippocampus, causing a restriction in synaptic plasticity that eventually impairs the acquisition of spatial reference memories.

5. The influence of the behavioural type on long-term body weight changes in young rats

Kacper Ptaszek, Edyta Jurkowlaniec

kacper.ptaszek@biol.ug.edu.pl

Department of Animal and Human Physiology, University of Gdansk, Poland

The novelty test (NT), one of behavioural assessments, allows to differentiate animals into more (high responders; HR) and less (low responders; LR) active in a new environment. However, rats' response to novelty seems to be connected not only with the locomotor activity but also with many other aspects, such as reaction to stress, susceptibility to disease, level of the neurotransmitters in the brain etc. The aim of the study was to verify whether the locomotor response may influence body weight changes. With the use of NT (Columbus activity meter), a group of 40 8-week rats was divided into LR and HR on the basis of the movements in the horizontal plane. The NT test began at 3.00 pm, when animals were put into the apparatus (plastic box), and took 120 minutes. The body weight changes were measured through a two-month period, once a week, at 9.00 am. The mean weight gain of the 5 least active (35.0±1.67) and the 5 most active (36.1±1.14) rats were not significantly different (Student's t: 0.552). Obtained results indicate that locomotor activity has no influence on body weight changes. Research was funded by Polish National Science Centre: D/NZ4/02499.

6. A masking effect of stress on social preference display in BALB/c mice

Maciej Winiarski, Alicja Puścian, Tomasz Nikołajew, Ewelina Knapska

maciej.winiarski@student.uw.edu.pl

Department of Neurophysiology, Nencki Institute of Experimental Biology, Warsaw, Poland

Impairments of social interactions are associated with many neurodevelopmental disorders, among which autism in considered to be the most life-disrupting disability. Research committed to proposing therapeutic approaches to that problem routinely exploits conspecific-related behavior tasks to assess sociability in a variety of autism mouse models on different genetic backgrounds. However, mentioned procedures are customarily highly stressful for tested subjects. They are usually carried out on isolated animals in distinctly unfamiliar environment and require their handling by an experimenter. These factors may exert confounding, anxiety-related effects on the obtained data and result in between-laboratory variability. To confirm that disquieting experimental factors may mask normal display of conspecific-related behaviors we investigated social approach of BALB/c mice - strain commonly considered as unsocial - in three-chambered apparatus, tool most commonly exploit for assessment of social behavior in rodents. Experiments were performed under highly stress-reducing conditions and results compared with data collected in routine manner. We show that BALB/c mice explicit evident social preference, although mentioned preference is undetectable in standard, distressing setup. Moreover, we observed stress-induced disturbance in exploration patterns of experimental environment, contributing to the social-preference masking. Based on that results we argue, that investigation of conspecific-related behavior in rodents should be performed under exceedingly stress-reducing and mild conditions.

7. Relationships between the degree of brain dysplasia and rat behavior in the open field test

Martyna Paleczna, Małgorzata Kaczyńska Paulina Nowak Seweryn Tałaj Krzysztof Janeczko

martyna.paleczna@gmail.com

Department of Neuroanatomy, Institute of Zoology, Jagiellonian University, Kraków, Poland

Prenatal exposure to gamma radiation interferes with neurogenesis and leads to irreversible structural impairments of the brain termed brain dysplasia. The production of neurons for particular brain regions occurs according to a strictly defined time schedule. Therefore, the developmental stage at which the irradiation is applied determines the extent of brain dysplasia which should finally correspond with specific functional disorders in adulthood. The present research was focused on relationships between the degree of brain dysplasia caused by gamma irradiation at different stages of prenatal neurogenesis and changes in animal behavior. To evoke the brain dysplasia of different degrees, pregnant Wistar rats were exposed to a 1Gy dose of gamma rays on gestational days 13, 15, 17 or 19. Their male offspring were subjected to an open field test and several parameters of motor activity were recorded. Despite the minimal brain weight and volume, and numerous irradiation-induced body abnormalities (missing toes, crooked tails or teeth malocclusions), the group of rats irradiated on E13 showed significant increases in motor activity, compared to other groups with brain dysplasia and controls. Further histological analyses are planned to reveal neural correlated of the inter-group differences. Supported by the Polish National Centre of Science, grant 011/01/B/NZ4/00586.

8. Role of the Lipocalin-2 in the structural plasticity of neurons

Marta Szychowska, Bozena Kuzniewska, Patryk Reniewicz, Leszek Kaczmarek, Katarzyna Kalita

m.szychowska@nencki.gov.pl

Laboratory of Neurobiology, Nencki Institute of Experimental Biology, Polish Academy of Sciences, Warsaw, Poland

The structural plasticity of neurons plays fundamental role in learning and memory as well as in major neuropsychiatric disorders. The modifications of neurons are indicated by changes of dendritic morphology as well as density and shape of dendritic spines that harbor excitatory synapses. Recent studies suggest that Lipocalin-2, a small, extracellular, iron-binding protein may be involved in modulation of neuronal morphology. The exogenous Lcn-2 was shown to decrease spine density and reduce number of mushroom spines. In this study we aimed to determine role of Lcn2 in structural plasticity of neurons. To check Lcn2 effects on development of dendritic tree we incubated rat hippocampal cultures with recombinant Lcn2. The Lcn2 treatment increased number of secondary dendrites and extended total dendrite length. Additionally, we have used live imaging of neurons to check the influence of Lcn-2 on dendritic spines morphology. The GFP-expressing hippocampal neurons were treated with Lcn-2 and visualized in a confocal microscope. The Lcn-2 administration caused elongation and thinning of “small” spines (spines with length-to-width ratio smaller then median). Altogether our results show that Lcn2 may exert effects on the dendritic spine shape of hippocampal neurons and influence the complexity of dendritic tree.

9. *Effects of acute and chronic administration of L-DOPA on cognitive judgement bias of rats in the ambiguous-cue interpretation paradigm*

Jakub Kręgiel, Joanna Golebiowska, Rafal Rygula

jakub.kregiel@gmail.com

Affective Cognitive Neuroscience Lab, Department of Behavioral Neuroscience and Drug Development, Institute of Pharmacology Polish Academy of Sciences, Krakow, Poland

Recent research has shown that pharmacological enhancement of dopaminergic function by acute administration of L-DOPA increases an optimism bias in humans. In the present study, we investigated whether L-DOPA have similar effects in rats. To accomplish this goal, the animals were trained in the ambiguous-cue interpretation paradigm, a test allowing measurements of cognitive judgement bias in animals. In this paradigm the rats must press one lever in response to one tone to receive a reward and to press another lever in answer to a different tone to avoid punishment. Cognitive judgement bias is than tested by measuring the pattern of animals' responses to a tone of intermediate frequency.
In the first experiment the animals received single injections of 3 different doses of L-DOPA. In the second experiment the animals received chronic injections of L-DOPA for a period of 2 weeks. We show for the first time, that pharmacological enhancement of dopaminergic function by administration of dopamine precursor L-DOPA, causes in rats, similar to humans, optimistic judgment bias. Our study proves translational validity of the ambiguous-cue interpretation paradigm. This work was supported by the National Science Centre (Research grant: Sonata bis dec-2012/07/E/NZ4/00196 to RR) and the statutory funds of the Institute of Pharmacology Polish Academy of Sciences

10. *Fully automated and ecologically relevant assessment of social interactions in prenatally induced mouse model of autism in two divergent genetic backgrounds*

Alicja Puścian[a], Szymon Łęski[a], Maciej Winiarski[a], Paweł Boguszewski[a], Grzegorz Kasprowicz[b c], Ewelina Knapska[a]

a.puscian@nencki.gov.pl

[a]Department of Neurophysiology, Nencki Institute of Experimental Biology, Warsaw, Poland
[b] Center for Theoretical Physics, Polish Academy of Sciences, Warsaw, Poland
[c] Warsaw University of Technology, Institute of Electronic Systems, Warsaw, Poland

Impairments of social interactions are the key feature of autism spectrum disorders. Although there exist behavioral assays for evaluation of conspecific-related behavior in mice, the available tasks do not allow for longitudinal observations of spontaneous interactions between littermates. Furthermore, the experiments are usually carried out on isolated animals and require their handling by experimenter. These factors may exert confounding, anxiety-related effects on the obtained data and result in large between-laboratory variability. In order to alleviate these problems, we designed Eco-HAB - a fully automated, stress-reducing tool for assessment of voluntary social interactions in group-housed mice. Using Eco-HAB, we assessed social approach of valproate-treated BALB/c and C57BL/6 mice (in utero exposure to this drug is one of the best established models of autistic phenotype). We determined that despite documented deficits of place learning (BALB/c) and repetitive behaviors (C57BL/6), none of those models displays impairments in social interactions. Moreover, we observed extensive enhancement in behaviors oriented towards olfactory stimuli of the conspecific-provenience. Obtained data is consistent with results collected with three-chambered apparatus test, performed in stress-reduced conditions. Therefore, we argue that when using mouse models of autism for developing therapeutic strategies, one should concentrate on particular behavioral impairments corresponding to individual symptoms in patients, rather than try to address a rarely appearing all-inclusive phenotype.

11. *Acute ethanol exposure disrupts actin polymerization in adult mouse brain slices*

Małgorzata Borczyk, Anna Suska, Katarzyna Radwańska

m.borczyk@nencki.gov.pl

Department of Molecular and Cellular Neuroscience, Nencki Institute of Experimental Biology, Warsaw, Poland

Acute ethanol exposure negatively affects both the adult and developing CNS. It has been shown that ethanol disrupts the actin cytoskeleton but the exact mechanisms of alcohol-induced changes in nerve cells remain unclear. The lack of well-established in vitro models of acute ethanol exposure on the adult brain continues to be an obstacle in investigating the details of its mode of action. Here, we prepared acute brain slices from adult animals and actin polymerization was evaluated in the CA1 region of the hippocampus after 30 min of ethanol (50 mM or 100 mM) incubation using phalloidin staining. Both doses of alcohol induced actin depolymerization in this model (effect size about 40%, $p<0.001$). This phenomenon was partially reversed with a common antioxidant ascorbic acid (effect size

about 20%, p<0.01). We have developed an in vitro model of acute ethanol exposure on adult mice brain. Our results indicate that actin depolymerization by ethanol can be, at least partially, attributed to free radicals as it can be reversed by ascorbic acid. Additionally, the established model can be used for further investigation of the molecular mechanisms of action of ethanol on the adult brain.

12. Brain dysplasia affects the learning ability in rats

Andrzej Kubiak, Małgorzata Kaczyńska, Natalia Bryniarska, Krzysztof Janeczko

andrzej.kubiak@student.uj.edu.pl

Department of Neuroanatomy, Institute of Zoology, Jagiellonian University, Krakow, Poland

An interruption of prenatal neurogenesis produces irreversible deficits in neuronal population and permanent changes in the brain structure termed dysplasia. The extent of the brain dysplasia depends on the intensity of damaging agents but also on the developmental stage at which the agent occurs. The brains with different degrees of dysplasia show also various susceptibility to epileptic seizures. Exploration of the relationships between dysplastic changes and epileptogenesis is one of the main goals of clinical neurology. A substantial progress in the research depends on the use of animal models with brain dysplasia evoked by ionizing radiation and tested using different seizuregenic agents. In this experiment, different degrees of brain dysplasia were produced in offspring of female rats by their exposure to gamma radiation on prenatal days 13, 15, 17 or 19. Sixty-day-old male offspring of these females were examined using an eight-arm maze test repeated three times in each of five consecutive days. The total walking distance and the time elapsing before the reward was gained were assessed in irradiated and control groups. The weakest performers were irradiated on the prenatal day 13. The best ones, irradiated on day 17, were even better than controls. Supported by NCN, grant 011/01/B/NZ4/00586.

13. Traits "optimism" and "pessimism" determine behaviour of rats in the forced swim test

Michal Rychlik[a b], Jakub Kregiel[b], Joanna Golebiowska[b], Rafal Rygula[b]

michalrychlik@gmail.com

[a] Jagiellonian University, Krakow, Poland
[b] Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

Optimism can be viewed as a cognitive-affective trait, which enables an organism to uphold motivation towards a positive outcome irrespectively of environmental circumstances. A decrease in despair-like behaviour (immobility) in the forced swim test (FST) is a long-established indicator of anti-depressant drug activity. Since rats differ with respect to enduring traits of 'optimism' and 'pessimism', in this study, using a recently developed ambiguous-cue interpretation (ACI) paradigm we took the unique opportunity to investigate whether level of 'optimism' as a trait is correlated with despair-like behaviour in rodents. In a series of ACI tests, we identified rats displaying 'pessimistic' and 'optimistic' traits. Subsequently, we investigated the trait differences in the motivation of these rats to escape uncomfortable situation using the FST. We report that "optimists" spent significantly less time immobile than "pessimists". The data are discussed in terms of neurobiological mechanisms of the observed phenomenon and their possible implications for antidepressant action of drugs. This work was supported by the National Science Centre (Research grant: OPUS-2014/13/B/NZ4/00214) and the statutory funds of the Institute of Pharmacology Polish Academy of Sciences.

NEUROPSYCHIATRY

14. Effect of short and long-term treatment with antipsychotics on orexigenic / anorexigenic neuropeptides expression and adult neurogenesis in the rat hypothalamus

Artur Pałasz, Ewa Rojczyk-Gołębiewska, Ryszard Wiaderkiewicz

apalasz@sum.edu.pl

Department of Histology, Medical University of Silesia, Katowice, Poland

Patients treated with neuroleptics suffer from significant weight gain. Hypothalamus contains circuits responsible for food intake regulation. Moreover, latest findings suggest, that adult neurogenesis occurs in hypothalamus, which could play a role in energy balance control. Considering that neuroleptics affect neuron formation in canonical neurogenic sites, we made a hypothesis, that they could modulate hypothalamic neurogenesis and change expression of orexigenic/anorexigenic neuropeptides and their receptors. Experiments were performed on adult rats injected

intraperitoneally for 1 or 28 days by neuroleptics: olanzapine, chlorpromazine and haloperidol. Hypothalami were isolated in order to perform PCR reaction and also whole brains were sliced for immunohistochemical assay. We proved that antipsychotics administered chronically increase the number of newly formed cells (Ki-67+) in the hypothalamus and modulate the number of neuroblasts (DCX+). Moreover, they have ability to upregulate preproorexin and orexin A expression and to increase the level of some anorexigenic factors (proopiomelanocortin, alpha-melanotropin), at the same time strongly downregulating nesfatin-1 signaling. Our results support the role of neuroleptics as hypothalamic neurogenesis modulators and contribute to understanding of mechanisms responsible for antipsychotics side effects. They also underline a complex nature of interactions between monoamine receptors, hypothalamic peptidergic pathways and adult neurogenesis which has potential clinical applications.

15. The effect of buspirone in the rodent slot machine task

Dominik Rafa, Agnieszka Potasiewicz, Agnieszka Nikiforuk and Piotr Popik

rafa@if-pan.krakow.pl

Department of Behavioral Neuroscience and Drug Development, Institute of Pharmacology, Polish Academy of Sciences, Kraków, Poland

Pathological gambling (PG) is a behavioral addiction resembling substance abuse disorder. It can be modeled in laboratory rats using slot machine task (rSMT). It has been confirmed that multiple similarities exist between PG and substance use disorders. Buspirone is an agonist of 5-HT1A receptors and an antagonist of D2, D3 and D4 dopaminergic receptors. The compound inhibits various manifestations of substance addictions, as it has been shown to reduce progressive-ratio responding for cocaine self-administration and attenuate amphetamine-induced enhancement of locomotor activity. We investigated whether buspirone could alter gambling behavior in rats. Animals were trained in rSMT by responding to a series of three flashing lights (analogous to the wheels of a slot machine). A winning trial was signaled when all three lights were illuminated. At the end of each trial, the rat chose between responding on the \'collect\' lever (that on the 'win' trials resulted in reward delivery, and on the 'loose' trials in a time penalty), or responding on the 'roll' lever that initiated the next trial. After reaching a stable baseline, the test was performed. Buspirone was administered at 1 and 3 mg/kg, P.O., 30 minutes before rSMT. We report that neither 1 nor 3 mg/kg of buspirone altered the pattern of responses in rSMT. Present data suggest that gambling behavior is not sensitive to this compound. Supported by the grant NR 72/H/E/13 from the Ministry of Health programme: "Support for scientific research into gambling and other non-substance addictions along with problem solving", co-financed from the Gambling Problem Solving Fund.

16. The effects of methylphenidate on impulsivity and attention in the 5-choice serial reaction time test in rats

Agnieszka Potasiewicz, Piotr Popik

potasiew@if-pan.krakow.pl

Department of Behavioral Neuroscience and Drug Development, Institute of Pharmacology, Polish Academy of Sciences Krakow, Poland

Deficits in attention and response impulse control are related to several psychiatric conditions, including attention deficit hyperactivity disorder (ADHD). The 5-choice serial reaction time test (5CSRTT) provides valid model to study these behavioral domains in animals. However, it is equivocal whether 5CSRTT paradigm may serve as a useful translational assay for screening drugs with therapeutic efficacy in ADHD. The aim of our study was to investigate the effects of methylphenidate (MPH), a psychostimulant with clinical efficacy in ADHD, on impulsivity and attention in rats. Rats were trained in 5CSRTT, until they had achieved stable performance. Animals were then injected with 0.3, 1 and 3 mg/kg of MPH, 30 min before testing. To increase the attentional demands of the task, a variable inter-trial-interval (vITI: 10, 7.5, 5 and 2.5 s) was introduced on drug testing day. Treatment with MPH (1 mg/kg) increased accuracy at ITI=7.5 s and reduced number of omissions (3 mg/kg) at ITI=2.5 s, but increased this measure at ITI=10 s. In addition, MPH increased premature responses at ITIs 7.5-10 s, but did not affect the latencies to collect the reward. The present study demonstrates the limited efficacy of MPH on 5CSRTT performance in cognitively unimpaired animals. Further studies are needed to evaluate the efficacy of this compound in 5CSRTT-deficit based models. This study was supported by the Statutory funds from the Institute of Pharmacology, Polish Academy of Sciences (Krakow, Poland).

17. *Early-life stress affects postnatal development of the medial prefrontal cortex and corpus callosum in rats*

Anna Solarz, Iwona Majcher-Maślanka, Krzysztof Wędzony, Agnieszka Chocyk

anka.solarz@gmail.com

Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

Clinical data suggest that early-life stress (ELS) increases the risk for mental disorders. It is postulated that ELS interferes with brain development and maturation and consequently induces psychopathology. The medial prefrontal cortex (mPFC) is strongly implicated in the pathophysiology of ELS-related mental disorders. Although long-term effects of ELS on mPFC development are poorly understood. In the present study we applied maternal separation (MS) in rats, to model ELS, and examined its impact on the numbers of cresyl violet+ neuronal and non-neuronal cells in the mPFC during development. Additionally, we measured corpus callosum (CC) area at the level of the forceps minor. Our study revealed that the number of neurons decreased during development both in MS and control rats. Moreover, MS juveniles and adolescents exhibited a tendency for an increase in the number of neurons (vs. control rats). Furthermore, we found a developmental increase in the number of non-neuronal cells specifically in control rats. Interestingly, MS juveniles and adolescents displayed more non-neuronal cells (vs. control rats) and the number of these cells was constant during lifespan. CC area showed developmental fluctuations, which were affected by MS during early-life period. Our results strongly suggest that ELS accelerate maturation of the mPFC and CC.

18. *Effect of acute corticosterone treatment on cFos expression in the medial prefrontal cortex of maternally-separated adolescent rats*

Iwona Majcher-Maślanka, Anna Solarz, Krzysztof Wędzony, Agnieszka Chocyk

majcher@if-pan.krakow.pl

Institute of Pharmacology Polish Academy of Sciences, Krakow, Poland

Adverse experiences in early life may lead to mental disorders. Early-life stress (ELS)-induced changes in medial prefrontal cortex (mPFC) function are implicated in the pathophysiology of such disorders. However, not all individuals subjected to ELS develop mental illness. Interactions between genotype and lifespan experiences which induce adaptive plasticity may explain such phenomenon. Our previous studies revealed that maternal separation (MS) in rats, a model of ELS, impaired structural plasticity and long-term potentiation processes within the mPFC of adolescents. In the present study we investigated how the MS together with subsequent acute corticosterone treatment (CORT, 10mg/kg) during adolescence, which mimicked high physiological stress, affected neuronal activity in the mPFC. As a marker of neuronal activity we used cFos protein expression visualized by immunohistochemical method. Our study showed that CORT treatment significantly increased the number of cFos-positive nuclei only in control rats. Both, neurons and glia cells in the mPFC were activated by CORT. Interestingly, in MS rats acute vehicle but not CORT injections enhanced cFos protein expression in the mPFC. The results strongly imply that MS induces adaptive plasticity which makes the mPFC more resistant to fluctuation in CORT levels. Such adaptation may modify the response to different stress intensities.

19. *Histone deacetylase inhibitor prevents fear memory deficits in neurodevelopmental model of schizophrenia*

Joachim Latusz, Aleksandra Radaszkiewicz, Ewelina Bator, Krzysztof Wędzony, Marzena Maćkowiak

latusz@if-pan.krakow.pl

Laboratory of Pharmacology and Brain Biostructure, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

Recent evidence indicates that epigenetic mechanisms are involved in the memory formation. Our previous study revealed the deficits in fear memory in the neurodevelopmental model of schizophrenia based on postnatal injections of CGP 37849 (CGP), a competitive antagonist of NMDA receptor . The impairment in memory retrieval was observed in adult CGP-treated rats in trace fear conditioning (TFC) task, which might be related with dysfunction of the medial prefrontal cortex (mPFC). Therefore, in the present study the role of histone H3 acetylation process in the fear memory deficits induced by CGP was investigated in the mPFC using Western blot analysis. Postnatal blockade of NMDA receptor induced a decrease in acetylation of histone H3 at lysine 9 (H3K9ac) and an increase in histone deacetylase 5 protein (HDAC5) level during memory retrieval in TFC. Moreover, the histone deacetylase inhibitor, sodium butyrate (1200 mg/kg) administered 2 h after memory acquisition prevented the deficit in fear memory induced by postnatal CGP administration in retrieval test. The above results indicate that memory deficits typical for schizophrenia evoked by postnatal blockade of NMDA receptor might be connected with the impairment in the acetylation process of histone H3 in the mPFC.

20. Prenatal stress increases the pro-apoptotic glucocorticoid action in the hippocampus

Anna Kurek, Jan Detka, Mateusz Kucharczyk, Joanna Ślusarczyk, Ewa Trojan, Bogusława Budziszewska

kurekanka@gmail.com

Department of Experimental Neuroendocrinolgy, Institute of Pharmacology, Polish Academy of Sciences, Cracow, Poland

Experimental data indicates, that long-lasting high levels of glucocorticoids (GCs) can contribute to neurodegenerative changes. Especially, increased GCs concentration during the perinatal period permanently increases the sensitivity of brain tissue, to adverse factors that act in adult animals. The aim of present study was to find out if prenatal stress potentiates the pro-apoptotic effects of corticosterone and/or glutamate in the hipoccampal cultures. The hippocampal organotypic cultures were prepared from the brains isolated from 6-7 day old offspring of control rats and animals subjected to immobilization stress from 14 to 22 day of pregnancy. Corticosterone (1 μM) and/or glutamate (10 μM) were added to culture medium for 24 h and next activity of caspase-3 and Bax and Bcl-2 gene expression were determined. It has been found that corticosterone and glutamate increased Bcl-2 expression much more strongly in hippocampus from prenatally stressed rats than in control tissue. Increased caspase-3 activity in prenatally stressed rats was observed in the hippocampus only after combined treatment with corticosterone and glutamate. These data indicated, that prenatal stress increased hippocampal sensitivity to the pro-apoptotic action of two major endogenous neurotoxic substances. Acknowledgements: This work was supported by the NCN, grant No. UMO-2012/05/N/NZ7/00678.

21. Modeling co-existence of depression and cocaine addiction in rats: the effects of imipramine on cocaine reward, extinction and seeking behavior in bulbectomized rats

Joanna Jastrzębska, Małgorzata Frankowska, Małgorzata Filip

czyzyk@if-pan.krakow.pl

Laboratory of Drug Addiction Pharmacology, Institute of Pharmacology Polish Academy of Sciences, Krakow, Poland

Introduction: Several clinical reports indicate a high comorbidity between depression and drug abuse. One of the leading hypotheses explaining this correlation called 'self-medication'. Depressed patients may use addictive substances to feel better and reverse anhedonia and/or unhappiness. The present study investigated the effects of the antidepressant drug imipramine in rats underwent olfactory bulbectomy (an animal model of depression) and cocaine self-administration procedures.
Methods: Male Wistar rats that underwent intravenous catheter implantation and the olfactory bulbs removal (OBX) and SHAM controls (without removal olfactory bulbs) were trained to self-administer cocaine (0.5 mg/kg/inf.; FR5). Extinction procedures were instituted and lasted for 10 days, during this phase the animals were given imipramine (20 mg/kg, ip) before each daily session. Reinstatement was induced by injection of cocaine (10 mg/kg, ip) or contextual cues (tone+light) previously paired with cocaine self-administration.
Results: Chronic administration of imipramine during extinction training reduced the active lever pressing in both phenotypes. Moreover, repeated treatment with imipramine attenuated the cocaine seeking behavior evoked by either cocaine priming dose or the drug-associated conditioned cue.
Conclusion: These results suggest that imipramine may be effective in patients suffering from cocaine dependence as well as in patients with co-morbid depression and drug addiction.

22. Glycolytic disturbances in an animal model of depression

Jan Detka, Anna Kurek, Mateusz Kucharczyk, Bogusława Budziszewska

detka@if-pan.krakow.pl

Department of Experimental Neuroendocrinology, Institute of Pharmacology, Polish Academy of Sciences, Cracow, Poland

Current data indicate frequent co-occurrence of depression and diabetes and suggests that impaired brain glucose metabolism may be involved in the pathogenesis of these diseases. Previously we found elevated glucose concentration in brain of prenatally stressed rats, especially in animals subjected as adults to acute stress or glucose administration. The aim of the present study was to determine if higher brain glucose level was evoked by changes in the process of glycolysis. Expression of key glycolytic enzymes was determined in the frontal cortex and the hippocampus in adult animals, whose mothers were subjected to immobilization stress from 14 to 22 day of pregnancy. These enzymes were determined under basal conditions and after exposure to acute stress or glucose administration. Both prenatal and acute stress significantly increased the amount of phosphofructokinase in the frontal cortex and hippocampus. Prenatal stress had no effect on the levels of pyruvate kinase, however it's amounts were lower in groups subjected to acute stress. Obtained results indicate, that elevated brain glucose concentration

was not evoked by inhibition of glycolysis and that disturbances, observed in this model of depression occurred mainly under the influence of unfavorable factors operating in later life. This work was supported by POIG.01.01.02-12-004/09.

23. Changes in the level of endocannabinoids after acute and repeated administration of tianeptine with simultaneous blockade of CB2 receptors in different rat brain structures

Karolina Kot, Irena Smaga, Tasnim Mohaissen, Dawid Gawliński, Małgorzata Filip

caroline130@op.pl

Department of Toxicology, Faculty of Pharmacy, Jagiellonian University, Medical College, Kraków, Poland

The role of the endocannabinoid system in the pathogenesis of depression and in the action of antidepressants has been highlighted. The aim of this study was to investigate the effect of the tianeptine (TIA, 10 mg/kg), on the level of endocannabinoids anandamide (AEA) and 2-arachidonoylglycerol (2-AG) with using simultaneous blockade of CB2 receptors by a selective antagonist AM630 (1 mg/kg) in different rat brain structures. The chronic CB1 receptor blockade restored the increased AEA levels to the basic levels in the hippocampus, without blockade of the effect on the striatal AEA levels. The increased 2-AG levels in the dorsal striatum after chronic TIA treatment were restored to the basic levels after simultaneous administration of AM630, without blockade of the effect on cortical 2-AG level. Our data suggest the engagement of the CB2 receptors in the effects of TIA on the AEA levels in the hippocampus. Acknowledgement: This study was supported by the research grant UMO-2012/05/B/NZ7/02589 from the National Science Centre, Kraków, Poland and statutory funds from the Jagiellonian University (K/ZDS/001425).

24. The effect of chronic fluoxetine administration on the profile of mitochondrial proteins – study in an animal model of depression

Katarzyna Głombik[a], Aneta Stachowicz[b], Rafał Olszanecki[b], Ewa Trojan[a], Joanna Ślusarczyk[a], Agnieszka Basta-Kaim[a]

glombik@if-pan.krakow.pl

[a] Department of Experimental Neuroendocrinology, Institute of Pharmacology Polish Academy of Sciences, Cracow, Poland
[b] Chair of Pharmacology, Jagiellonian University Medical College, Cracow, Poland

Recently mitochondrial dysfunction has been shown to be associated with the pathogenesis of depression. Therefore these organelles may become an potential interesting target for the antidepressant drugs treatment. Our purpose was to investigate the influence of prenatal stress and fluoxetine administration on the biogenesis and proteins pattern of brain mitochondria. Pregnant Sprague-Dawley rats were subjected to stress sessions from 14th day of pregnancy until delivery. At 3 months of age control and prenatally stressed rats, after behavioral verification, were injected with fluoxetine (10mg/kg i.p.) for 21 days. Rats were decapitated 24 hours after the last drug injection and biochemical study using molecular and proteomic techniques was carried out. We demonstrated that prenatal stress procedure decreased the gene and protein expression of PGC-1α (a regulator of mitochondrial biogenesis) and changed the pattern of mitochondrial proteins in frontal cortex. Futhermore, fluoxetine treatment resulted in 5 differentially expressed mitochondrial proteins in the frontal cortex of the prenatally stressed rats belonged to the groups of metabolic enzymes and oxidative stress factors. Presented results point to the importance of developing new pharmacological strategies based on mitochondrial action of antidepressant drugs. This work was supported by the statutory funds of PAS.

25. Characteristics of an animal model of locomotor sensitization to alcohol

Anna Trąbczyńska, Magdalena Robacha, Magdalena Ziółkowska, Katarzyna Radwańska

Nencki Institute of Experimental Biology, Polish Academy of Sciences, Warsaw, Poland

Alcoholism is a fatal and incurable disease. In order to propose a new and successful therapies of alcoholism the molecular and behavioral process involved in the development of addiction must be better understood. Thus development of new animal models reflecting different aspects of alcohol-induced behaviors is necessary. Here we aimed to establish and characterize an animal model of psychomotor sensitization to alcohol. This phenomenon is observed in humans and it is believed to play a role in early and recurring steps of alcohol dependence. C57BL/6J mice were treated daily with saline or 2 g/kg ethanol for 1,3,5 or 7 days in a novel or home cages and their locomotor activity were tested after 7 or 30 days of incubation. We revealed a significant (42%) increased in locomotor activity in the groups of mice injected 1 and 7 times with alcohol. The sensitization was very persistent as it was observed both after 7 and 30 days of incubation. Furthermore, mice injected with alcohol in a home cage and tested for incubation in a new context still showed increased locomotor activity. These data suggest that very short-term alcohol treatment involves long-lasting psychomotor sensitization.

26. Chronic zinc treatment reverses depressive-like changes induced by dietary zinc deficiency

Anna Rafało[a b], Urszula Doboszewska[a], Małgorzata Hołuj[c], Bartłomiej Pochwat[a], Gabriel Nowak[a], Bernadeta Szewczyk[a]

anna.rafalo@gmail.com

[a] Department of Neurobiology, Institute of Pharmacology, Polish Academy of Sciences, Kraków, Poland
[b] Faculty of Biology and Earth Sciences, Jagiellonian University, Kraków, Poland
[c] Department of Behavioral Neuroscience & Drug Development, Institute of Pharmacology, Polish Academy of Sciences, Kraków, Poland

Background: Data show that dietary zinc deficiency (ZnD) contribute to the development of depressive symptoms in humans and depressive - like behavior both in rats and mice. The aim of this study was to examined the effect of chronic zinc treatment on ZnD induced depressive-like behavior in rats.
Methods: Male Sprague-Dawley rats were fed a zinc adequate diet (ZnA, 50mg Zn/kg) or a zinc deficient diet (ZnD, 3mg Zn/kg) for 4 weeks. Then, zinc treatment (30 mg/kg, i.p. zinc hydroaspartate) in both ZnA and ZnD groups begun. Separate groups of ZnA and ZnD were used as an appropriate controls. Following 2 weeks of zinc treatment the behavior of the rats was examined in the forced swim test (FST), sucrose intake and social interaction tests.
Results: 6 weeks of ZnD induced in rats behavioral despair observed as increased immobility time in the FST, reduced intake of sucrose solution (anhedonia) and a reduction of social behavior. These behavioral changes were completely reversed by 2 weeks of zinc treatment.
Conclusions: The procedure of zinc deficiency in rats causes behavioral changes that share some similarities to the pathophysiology of depression. Two weeks of supplementation/treatment of zinc is sufficient to reverse the depressive-like symptoms caused by zinc deficiency.

27. The influence of caffeine on the activity of antidepressants

Aleksandra Szopa[a], Ewa Poleszak[a], Anna Serefko[a], Weronika Stasiuk[b], Katarzyna Świąder[a], Elżbieta Wyska[c], Piotr Wlaź[d]

aleksandra.szopa@umlub.pl

[a] Chair and Department of Applied Pharmacy, Medical University of Lublin, Poland
[b] Chair and Department of Human Physiology, Medical University of Lublin, Poland
[c] Department of Pharmacokinetics and Physical Pharmacy, Collegium Medicum, Jagiellonian University, Kraków, Poland
[d] Department of Animal Physiology, Institute of Biology and Biochemistry, Faculty of Biology and Biotechnology, Maria Curie-Skłodowska University, Lublin, Poland

Reports have shown an excessive intake of caffeine among the patients suffering from mental disorders, including depression. The objective of our study was to evaluate the effect of caffeine on the activity of the following antidepressant drugs: milnacipran (1.25 mg/kg), bupropion (10 mg/kg), tianeptine (15 mg/kg), and agomelatine (20 mg/kg). The forced swim test in mice was used as an evaluation method. Moreover, we assessed the influence of caffeine on the serum and brain levels of the antidepressants using high-performance liquid chromatography. The obtained results demonstrated that caffeine (5 mg/kg) potentiated the activity of all tested agents. Co-administration of caffeine and milnacipran, bupropion, or agomelatine did not affect the spontaneous locomotor activity in the animals. Joint administration of caffeine and tianeptine resulted in hyperlocomotion. Caffeine did not cause changes in murine serum and brain levels of bupropion, agomelatine, and tianeptine. As for milnacipran, an increase of its serum (but not brain) level was observed. The outcomes of our study indicated a synergistic interaction between caffeine and the antidepressants, which, for the combinations of caffeine with bupropion, agomelatine, or tianeptine has pharmacodynamic character. In the case of tianeptine, this effect may be influenced by the enhancement of the spontaneous locomotor activity.

28. The influence of traxoprodil on the activity of common antidepressants

Anna Serefko[a], Ewa Poleszak[a], Weronika Stasiuk[b], , Aleksandra Szopa[a], Sylwia Wośko[a], Elżbieta Wyska[c], Piotr Wlaź[d]

anna.serefko@umlub.pl

[a] Chair and Department of Applied Pharmacy, Medical University of Lublin, Poland
[b] Chair and Department of Human Physiology, Medical University of Lublin, Poland
[c] Department of Pharmacokinetics and Physical Pharmacy, Collegium Medicum, Jagiellonian University, Kraków, Poland
[d] Department of Animal Physiology, Institute of Biology and Biochemistry, Faculty of Biology and Biotechnology, Maria Curie-Skłodowska University, Lublin, Poland

Traxoprodil, a GluN2B subunit-selective NMDA receptor antagonist, appeared to be a safe and well tolerated agent capable of producing an antidepressant response in patients with treatment-refractory major depressive disorder. The aim of our study was to investigate the effect of the inactive dose of traxoprodil (10 mg/kg) on the activity of the commonly used antidepressants (i.e., imipramine, escitalopram, and reboxetine) using the forced swim test in mice. Spontaneous locomotor activity of animals was assessed to exclude the false positive/negative outcomes. Moreover, in order to evaluate the role of the serotoninergic system in the antidepressant potential of traxoprodil, we subjected the mice to serotoninergic lesion with p-chlorophenylalanine (p-CPA). The obtained results showed that traxoprodil increased the antidepressant effect of imipramine (15 mg/kg) and escitalopram (2 mg/kg), whereas did not enhance the activity of reboxetine (2.5 mg/kg). p-CPA (200 mg/kg) counteracted the action of traxoprodil only partially. Administration of the tested agents and their combinations did not change the overall spontaneous locomotor activity of the animals. Our findings indicated the partial involvement of the serotoninergic system in the activity of traxoprodil. Moreover, this NMDA receptor ligand synergistically potentiates the effect of antidepressants whose mechanism of action is linked with the serotoninergic neurotransmission.

29. Blockage of the alfa1-adrenergic receptor in the VTA does not induce place aversion, has no effects on the locomotor activity and depressive-like behaviours

Katarzyna Gralec[a b], Adam Klasa[c], Grzegorz Dobrzański[a], Wojciech Solecki[a c]

k.gralec@gmail.com

[a] Department of Molecular Neuropharmacology, Institute of Pharmacology of the Polish Academy of Sciences, Cracow, Poland
[b] Institute of Zoology, Jagiellonian University, Cracow, Poland
[c] Institute of Applied Psychology, Jagiellonian University, Cracow, Poland

Phasic activity of the dopamine (DA) neurons of the ventral tegmental area (VTA) is critical in the reinforcement learning as well as in the drug-seeking and drug craving. The phasic activity of DA neurons is modulated by the VTA inputs. Recent study showed that intra-VTA administration of the alfa1-adrenergic receptor antagonist prazosin reduces cocaine-evoked burst firing of VTA DA neurons which results in lowered DA levels in the nucleus accumbens shell (NAcS) and decreased cocaine-induced hyperlocomotion, pointing to the potential role of the VTA noradrenergic inputs in other behaviours. In the present study we tested the effects of intra-VTA administration of prazosin reward, basal locomotion as well as depressive-like behaviours. Using male Sprauge-Dawley rats (290-330 g) we conducted a battery of behavioural tests consisting of conditioned place preference paradigm, open field test and forced swim test during which we bilaterally microinjected 1 µg of prazosin into the VTA. Our studies showed that alfa1-adrenergic receptor blockage neither resulted in the development of place preference/aversion, nor does it affect basal locomotor activity. Similarly, we showed no effects of intra-VTA prazosin on depressive-like behaviours. Our data suggests that VTA noradrenergic inputs acting via alfa1-adrenergic receptors do not modulate reward, locomotion or depressive-like behaviours. Acknowledgment: HOMING PLUS/2013-7/14

30. In search for model of variable vulnerability to drug addiction

Ewa Niedzielska, Katarzyna Mikołajczyk, Lucyna Pomierny-Chamioło, Malgorzata Filip

ewa.niedzielska@uj.edu.pl

Faculty of Pharmacy, Collegium Medicum Jagiellonian University, Kraków, Poland

Addiction to psychostimulants like cocaine is a serious neuropsychiatric disease. As in humans, also in laboratory animals, addiction-prone phenotype with drug craving and relapses appear only in about 20% subjects following first drug abuse. The rest subjects can be considered as addiction-resistant phenotype.The aim of our study was to verify if the conditioned place preference (CPP) paradigm can serve as a model for determination of the variable vulnerability to drug addiction. We used male Wistar rats (240-280g) housed under standard laboratory conditions. Animals were exposed to either vehicle (n=20) or to the psychostimulant cocaine (15 mg/kg,i.p; n=64) during 10 days with CPP. As a result, 15 animals (i.e., 23.4% of all experimental animals) that performed unbiased version of CPP, spent more time in cocaine-paired chamber in test in comparison to pretest (p<0.0005 vs. control); those rats were classified as addiction vulnerable. In conclusion, our results suggest that unbiased conditioned place preference procedure can serve as an animal model for predictive analysis of vulnerability to psychostimulant addiction in rats. Moreover, it also gives the opportunity to study the phenotype of animals (so called addiction-resistant) which did not develop drug-associated environment-linked craving.

31. Arylsulfonamide derivatives of (aryloxy)ethyl-piperidines as 5-HT7 antagonists and their antidepressant and pro-cognitive properties

Vittorio Canale[d], Anna Partyka[a], Rafał Kurczab[b], Grzegorz Satała[b], Magdalena Jastrzębska-Więsek[a], Anna Wesołowska[a], Tomasz Kos[c], Piotr Popik[c], Andrzej J. Bojarski[b], Paweł Zajdel[b]

vittoriobcanale@gmail.coml

[a] Department of Clinical Pharmacy, Jagiellonian University Medical College, Krakow, Poland
[b] Department of Medicinal Chemistry, Institute of Pharmacology, Polish Academy of Sciences, Kraków, Poland
[c] Department of Behavioral Neuroscience and Drug Development, Institute of Pharmacology, Polish Academy of Sciences, Kraków, Poland;
[d] Department of Medicinal Chemistry, Jagiellonian University Medical College, Krakow, Poland

Correlation between distribution of 5-HT7Rs (e.g thalamus, suprachiasmatic nuclei, hippocampus) and their function in CNS, suggested their involvement in physiological functions including circadian rhythm, learning and memory as well as in different (patho)physiological processes such as depression or anxiety. It was further found that REM sleep, depression-like behavior and cognitive decline seem to be attenuated by 5-HT7R antagonists. Using Virtual Combinatorial Library method a new class of 5-HT7R antagonists, namely arylsulfonamide derivatives of aryloxy-ethyl-piperidines, was identified. Their antidepressant properties were evaluated in forced swim test (FST) a mice model of depression, while pro-cognitive properties were examined in novel object recognition task (NOR) in rats. Evaluated compounds demonstrated potent antidepressant properties in FST (1.25–5 mg/kg; i.p.), significantly reducing the immobility time by the range of 18–33% in similar way to SB-269970 (U-shaped dose-response curves). Furthermore, selected compounds reversed episodic memory decline, induced by phencyclidine (0.3–1 mg/kg; i.p.). A potent 5-HT7R antagonist (PZ-1404) demonstrated distinct antidepressant and pro-cognitive properties (2.5 mg/kg in FST; and 1 mg/kg in NOR). This warrants its further detailed studies related to mood disorders as well as learning and memory disorders. Supported by the NSN Grant No DEC-2012/05/B/NZ7/03076 and by the project ''Prokog,'' UDA POIG.01.03.01-12-063/09-00.

32. Imipramine causes neuroendocrine alterations in a rat chronic mild stress model

Weronika Duda[a], M. Kubera[a], K. Curzytek[a], T. Connor[b], E. Fagan[b], P. Gruca[a], M. Maes[c]

weronika_duda@interia.pl

[a] Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland
[b] School of Medicine, Trinity College Institute of Neoroscience, Dublin, Ireland
[c] Maes Clinic & TRIA, Piyavate Hospital, Bangkok, Thailand

Findings suggest that dysregulation within the hypothalamic-pituitary-adrenal axis is linked to depression. Also evidence indicates an association between depressive disorders and immune and neuroendocrine alterations. Neuroendocrinological abnormalities in depression patients are difficult to study. Therefore, animal models of chronic stress are very useful tools to investigate behavioral, immune and neuroendocrine changes in depression. A rat model of chronic mild stress (CMS) provides a relatively realistic animal model of the decreased response to reward (anhedonia) that characterizes depression. The aim of the present study was explore the antidepressant effects of imipramine on neuroendocrinological parameters involved in the CMS model of depression in male Wistar rats. Chronic mild stress, applied for three weeks, caused a significant decrease of the consumption of 1% sucrose solution. In animal treated with saline, the effect was maintained through the whole experiment. Imipramine had no significant on sucrose consumption in non-stressed animals. However, the drug caused a gradual increase in the sucrose intake in stressed animals, resulting in a complete reversal of the effect of the stress by the end of the six-week treatment period. The important observation in the present study was that sucrose intake reduction induced by CMS was related to specific alterations in immune and neuroendocrine parameters in male Wistar rats and they were reversed with chronic imipramine administarion. These results indicate that the effects of the imipramine on immune and neuroendocine parameters may contribute to its antidepressant properties.
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33. *Influence of ADN-2013 (2-(3-(4-(1-(phenylsulfonyl)-1H-indol-4-yl)piperazin-1-yl)propoxy)benzamide), a novel candidate for treatment of schizophrenia on food intake in fasted rats*

Anna Wasik[a], Anna Partyka[a], Magdalena Jastrzębska-Więsek[a], Marcin Kołaczkowski[b], Anna Wesołowska[a]

annawasik87@gmail.com

[a] Department of Clinical Pharmacy, Faculty of Pharmacy, Jagiellonian University Medical College, Kraków, Poland
[b] Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Jagiellonian University Medical College, Kraków, Poland

Schizophrenia is a severe mental disorder affecting about 1% of global population. Current available treatment does not cause necessary recovery in 30-50% of patients and induces many side effects like extrapyramidal symptoms, cardio-vascular problems and/or metabolic dysfunction leading to weight gain and obesity. ADN-2013 is a novel benzamide derivate with high affinity to D2, 5-HT2A, 5-HT1A and 5-HT6 receptors (Ki=3.2 nM, Ki= 18.0 nM, Ki= 3.9 nM, Ki=0.3 nM, respectively) which demonstrates antipsychotic-like activity in vivo (data not shown). Its receptor functional profile, especially partial agonist activity to 5-HT1A and antagonist one to 5-HT6 receptor, appears to tie in with affect on food intake regulation. To evaluate the potential anorectic action of tested compounds the influence of food intake in fasted rats were conducted. As active comparator SB-742457, a selective potent 5-HT6 receptor antagonist was used. Acute administration of ADN-2013 at doses of 10 and 30 mg/kg and SB-742457 at a dose of 10 mg induced significant decrease in food intake (by 20%, 37% and 20% in comparison to control, respectively). ADN-2013 seems to be a good candidate for a novel antipsychotic drug with an additional anorectic properties which might root from its antagonistic activity toward 5-HT6 receptor. Further evaluations using another experimental tools and species (e.g. mice) are required.

*34. Chronic oral caffeine treatment induces similar modifications of aggressive behaviour in workers of the red wood ant (***Formica polyctena***) paired with opponents from two different ant species (***Formica fusca** *and* **Formica rufibarbis***)*

Paweł Jarosław Mazurkiewicz[a b c], Damian Palus[a d], Karolina Ciepiaszuk[a b e], Beata Symonowicz[a], Anna Mirecka[a f], Marcin Studnicki[g], Róża Węglińska[a d], Anna Szczuka[a] & Ewa Joanna Godzińska[a]

p.mazurkiewicz@student.uw.edu.pl

[a] Laboratory of Ethology, Department of Neurophysiology, Nencki Institute of Experimental Biology PAS, Warsaw, Poland
[b] College of Inter-Faculty Individual Studies in Mathematics and Natural Sciences, The University of Warsaw
[c] Department of Animal Physiology, Faculty of Biology, University of Warsaw, Poland
[d] Faculty of Biology, University of Warsaw, Poland
[e] Medical University of Warsaw, Poland
[f] Institute of Ecology and Bioethics, Cardinal Stefan Wyszyński University, Warsaw, Poland
[g] Department of Experimental Design and Bioinformatics, Warsaw University of Life Sciences (WULS – SGGW), Poland

Caffeine, a common central nervous system stimulant, is known to influence physiology and behavior of both invertebrates and vertebrates. In rodents and humans caffeine exerts both stimulatory and inhibitory effects on specific patterns of aggressive behaviour. We investigated the effects of chronic oral caffeine treatment on aggressive behaviour of workers of the red wood ant Formica polyctena during dyadic aggression tests involving confrontations with two allospecific ants: Formica fusca (Experiment 1) and Formica rufibarbis (Experiment 2). Workers of F. polyctena were fed with various doses of caffeine diluted in aqueous sugar solution during three weeks (Experiment 1) or two weeks (Experiment 2) prior to the tests. In both experiments caffeine treatment enhanced various patterns of overt aggressive behaviour shown by the tested workers of F. polyctena, but reduced ritualized aggressive behaviour (open-mandible threatening). However, whereas in the Experiment 1 such a pattern of significant effects of caffeine treatment was observed only when the data were subjected to GLM analysis, in the case of the Experiment 2 it was revealed by both GLM analysis and non-parametric statistics. Our study provides thus a good illustration of the importance of the choice of statistical tests for the conclusions drawn from neuroethological experiments.

35. Impact of psychostimulant designer drugs on neurotransmission in rat brain

Alexandra Jurczak, Krystyna Gołembiowska

alexandra.jurczak@gmail.com

Institute of Pharmacology, Polish Academy of Sciences, Kraków, Poland

Designer drugs, also known as „legal highs", are synthetic compounds developed to provide similar effects to illicit

drugs of abuse, which are not subjected to legal control. Synthetic drugs are classified roughly, based on their chemical formula, into phenethylamines, tryptamines, and piperazines. Although designer drugs still have the reputation of being safe, several experimental studies in rats and humans indicated risks including life-threatening serotonin syndrome, hyperthermia, neurotoxicity, and abuse potential. The least investigated and most dangerous synthetic components found in the designer mixtures are phenylalkylamines: para-methoxyamphetamine (PMA), paramethoxymethamphetamine (PMMA) and synthetic cathinone: mephedrone. Our study is aimed on examining the effects of the above-mentioned on extracellular levels of dopamine, serotonin and their metabolites using microdialysis in freely moving rats. Dialysates are assayed using HPLC, following i.p. administration of each drug at doses of 5 and 10 mg/kg. PMA, PMMA and mephedrone given intrastriatally, have strong inhibitory effects on re-uptake of serotonin and to lesser extent dopamine, causing their extracellular increase and decrease in their metabolites. Our results suggest that designer drugs have strong impact on the central nervous system causing profound alterations in neurotransmission, but the exact mechanism by which they act still needs to be clarified.

36. Changes in the level of endocannabinoids after acute and repeated administration of imipramine with simultaneous blockade of CB2 receptors in different rat brain structures

Tasnim Mohaissen, Irena Smaga, Karolina Kot, Małgorzata Filip

tasnim15@onet.eu

Laboratory of Pharmacology and Brain Biostructure, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

The role of the endocannabinoid system in the pathogenesis of depression and in the action of antidepressants has been highlighted. The aim of this study was to investigate the effect of the imipramine (IMI, 15 mg/kg), on the level of endocannabinoids anandamide (AEA) and 2-arachidonoylglycerol (2-AG) with using simultaneous blockade of CB2 receptors by a selective antagonist AM630 (1 mg/kg) in rat brain structures. Administered acutely AM630 reversed the effect of acute administration of IMI on the AEA levels in the hippocampus (increased) and on the 2-AG levels in the cerebellum (decreased), without blockade of the effect on the cortical 2-AG level. The chronic CB2 receptor blockade restored the increased AEA levels to the basic levels in the hippocampus, but not in the dorsal striatum. The increased 2-AG levels in the dorsal striatum or decreased 2-AG levels in the cerebellum after chronic IMI treatment were restored to the basic levels after simultaneous administration of AM630, without blockade in the cortical 2-AG level. Our data suggest the engagement of the CB2 receptors in the effects of IMI. This study was supported by the research grant UMO-2012/05/B/NZ7/02589 from the National Science Centre and statutory funds from the Jagiellonian University (K/ZDS/001425).

37. Role of β-adrenergic, but not α1-adrenergic or glucocorticoid receptors in the expression of conditioned place aversion induced by morphine withdrawal

Natalia Kuś[a c], Katarzyna Gralec[a b], Adam Klasa[c], Jolanta Nowak[c], Łucja Kudła[c], Łucja Marut[c], Wojciech Solecki[a c]

natalia.k.kus@gmail.com

[a] Department of Molecular Neuropharmacology, Institute of Pharmacology, Polish Academy of Sciences, Kraków, Poland
[b] Institute of Zoology, Jagiellonian University, Kraków, Poland
[c] Department of Neurobiology and Neuropsychology, Institute of Applied Psychology, Jagiellonian University, Kraków, Poland

Aversive physiological and motivational symptoms accompanying drug withdrawal are considered as one of main reasons of relapse. Therefore, it is important to investigate mechanisms underlying withdrawal in order to find a way to modulate its aversive aspects. Noradrenergic system plays an important role in the expression of somatic signs of the withdrawal, whereas glucocorticoids and glucocorticoid receptors (GR) facilitate several responses to drugs of abuse. The purpose of our study was to examine the role of α1- and β-adrenoceptors, as well as GR, in the formation of physiological and motivational symptoms of morphine withdrawal. Using mice after chronic morphine treatment, we showed that pretreatment with β-adrenergic antagonist, propranolol (at dose 5mg/kg, but not at 1mg/kg), 30 minutes prior to naloxone-precipitated withdrawal, decreases dysphoria assessed in the conditioned place aversion (CPA) paradigm. In contrast, propranolol had no effects on the magnitude of the physical signs of withdrawal. Furthermore, α1-adrenergic antagonist – prazosin (0.05, 0.1, 0.25 and 0.5mg/kg) and GR antagonist – mifepristone (10,20,40 and 60mg/kg) had no effects on physical nor motivational signs of withdrawal. Together, our results demonstrate the important role of β-adrenergic, but not α1-adrenergic nor glucocorticoid receptors in the expression of the motivational aspects of morphine withdrawal. Acknowledgements: HOMING PLUS/2013-7/14/styp2

VISUAL PROCESSING

38. Involuntary attentional orienting in the absence of awareness speeds up early visual processing

Antonio Schettino[a], Valentina Rossi[b], Gilles Pourtois[b], Matthias M. Müller[a]

antonio.schettino@uni-leipzig.de

[a] University of Leipzig, Germany
[b] Ghent University, Belgium

Attention can be involuntarily allocated to salient peripheral cues in the visual field, thereby improving sensory discriminability of targets subsequently appearing at the cued location. Event-related potential (ERP) studies have consistently reported amplitude modulations of early components (80-200 ms post-stimulus onset) for validly as opposed to invalidly cued targets, reflecting sensory gain control mechanisms. Latencies, however, are typically unaffected. Thus, the long-held assumption (based on behavioral observations) that attention speeds up stimulus processing – a phenomenon termed prior entry – is, at present, scarcely supported by brain data.To investigate whether involuntary attention speeds up visual processing, we conducted two ERP experiments employing a temporal order judgment procedure with non-reportable exogenous cues. The novel use of invisible cues ensured the elimination of any confounds related to the implicit use of stimulus features that are common to both the cue and the target. Valid unaware cues modulated the latency of the visual N1pc component -- an electrophysiological marker of initial attentional orienting --, indicating increased processing speed in extrastriate visual cortex. These effects were replicated regardless of whether participants were actively looking for the cue (Experiment 1) or were not informed of its presence (Experiment 2), indicating purely automatic, stimulus-driven orienting mechanisms.

39. Origin of the fundamental and harmonic components of SSVEP

Alicja Brzozowska, Maciej Łabęcki, Rafał Kuś, Piotr Suffczyński

alicjabrzozowska@student.uw.edu.pl

Faculty of Physics, University of Warsaw, Poland

Steady State Visual Evoked Potentials are steady-state oscillatory potentials elicited in the EEG by flicker stimulation. Frequency of these responses corresponds to the stimulus frequency and its harmonics. In this study we investigated the nature and origin of harmonics, which are not very well understood. It is conceivable that harmonics are caused by nonlinearity of the visual system itself, since an output of the nonlinear system may contain harmonics and sub-harmonics of the sinusoidal input signal. In order to discern between these two hypotheses, we analyzed responses to square and sine stimulation waveforms. The analysis showed that both types of stimuli evoked harmonics in the response, ruling out the hypothesis that the appearance of harmonics is solely caused by the square shape of the stimulation pattern.

40. Free viewing vs. watching with a view to planning functional grasps of tools: an eye-tracking study

Agnieszka Nowik, Magdalena Reuter, Maciej Raś, Gregory Króliczak

akiwon@amu.edu.pl

Action and Cognition Laboratory, Institute of Psychology, Adam Mickiewicz University in Poznan, Poland

Tools are a special category of objects: their visual structures (affordances) and the perceived functional identities are thought to automatically "potentiate" relevant actions, including proper eye movements, even in the absence of overt tasks. We tested this idea directly by asking subjects - who already participated in three experiments using the same sets of stimuli and tool-related tasks – to freely view or watch them with a view to planning functional grasps of these objects. SMI RED eye-tracker enabling remote and contact-free study of eye movements was used. The stimuli were high-resolution photos of workshop, kitchen and garden tools presented at three different angles (0, 135, and 225 degrees) in their foreshortened perspectives, which emulate 3D viewing. The number of saccades did not differ between tasks. Yet, as shown by a significant interaction between task and object part (i.e., affording grip vs. enabling action), when planning functional grasps participants' attention was drawn for much longer to parts affording appropriate grips, whereas in free viewing fixations were distributed equally across parts. These results clearly show that even the visual exploration of tools is sensitive to specific tasks, and other factors must contribute to automatic action potentiation in the presence of tools.

41. Localizing cortical sources of ERPs related to vergence eye movement preparation

Monika Wojtczak[a, b], Anna Przekoracka-Krawczyk[a, b], Rob van der Lubbe[c, d],

monikaa.wojtczak@gmail.com

[a] Laboratory of Vision Science and Optometry, Faculty of Physics, Adam Mickiewicz University of Poznań, Poland
[b] Laboratory of Neuro and Vision Science, NanoBioMedical Centre, Adam Mickiewicz University, Poznań, Poland
[c] Cognitive Psychology and Ergonomics, University of Twente, Enschede, the Netherlands
[d] Department of Cognitive Psychology, University of Finance and Management, Warsaw, Poland

Recent studies indicate that different cortical structures are involved in vergence eye movements as compared to pure saccades. However, the specific involvement of these areas is less well understood. The aim of the current study was to examine the activity of cortical sources related to the preparation of pure saccades (PS), combined convergences (CC) and combined divergences (CD). Six LEDs were positioned at eye level on two isovergent circles at two distances: near (20 cm) and far (1 m). The eccentricity of the lateral LEDs was 10o for both distances. The subject was instructed to look at the target LED as quickly and accurately as possible.The EEG was recorded from 64 active electrodes.Source analyses with BESA revealed that four pairs of regional sources are likely to be involved with eye movement preparation (R.V.=1,17%). The sources were located in: (1) the occipital lobe (extrastriate cortex), (2) the temporal lobe (the superior temporal gyrus), (3) the frontal lobe (the frontal eye fields), and (4) the middle frontal gyrus. In all conditions activation of occipital extrastriate cortex was observed (peak about -80 ms before saccade onset), which may reflect the decoding of the direction of the stimulus. Vergences (especially CC) were additional related to strong activation in temporal (-160 ms and -60 ms before saccade onset) and frontal lobes what may show engagement of these areas in depth perception.

42. Efficacy of Transcranial Direct Current Stimulation over the Posterior Parietal Cortex on Fixation Disparity in Subjects with Symptomatic Heterophoria

Anna Przekoracka-Krawczyk, Paulina Warszewska, Krzysztof Piotr Michalak

ania_pk@amu.edu.pl

Laboratory of Vision Science and Optometry, Faculty of Physics, Adam Mickiewicz University, Poznań, Poland
Neuro and Vision Science Laboratory, NanoBioMedical Centre, Adam Mickiewicz University, Poznań, Poland

Fixation disparity (FD) is a condition when small misalignment (some minutes of arc) of the eyes appears when viewing with both eyes. This deficit is found usually in subjects with decompensated latent strabismus - called symptomatic heterophoria (SPH). Science SPH is an common visual binocular disorder, neuronal mechanism of this condition is poorly understood. In the present study we tried to explore impact of the Posterior Parietal Cortex (PPC) on occurrence of FD by means of transcranial direct current stimulation (tDCS). Ten individuals without any FD (normal vision) participated in the Exp.1 to test the effect of anodal and cathodal tDCS stimulation of the right PPC on the level of FD. In the Exp.2 the same stimulation was used on 10 subjects with SPH. FD was measured with polarized Wesson card. We found that parietal tDCS could not evoke FD in individuals with normal vision (Exp.1). While, anodal and cathodal stimulation influenced binocular stabilization and FD in SPH group when compared to sham (placebo) stimulation. The results suggest that PPC may be involved in processing of visual information leading to the stabilization of binocularity and FD.

43. Posturography: Estimating the path of 'Center of Body Mass' shows the features of aging process of postural control

Krzysztof Piotr Michalak[a], Anna Przekoracka-Krawczyk[a], Peter Vieregge[b]

michalkr@amu.edu.pl

[a] Lab. of Vision Science and Optometry, Adam Mickiewicz University of Poznań, Poland
[b] Klinik fuer Neurologie, Klinikum Lippe, Lemgo, Germany

Posturography consists in the registration of path of 'Center of Pressure' (COP) of the body during quiet standing. Unfortunately, the statistical parameters COP signal possess, as a rule, weak statistical significance because they represent mainly the large-amplitude slow drift of 'Center of Body Mass'(COM) rather than proper postural reflexes. The estimation of COM path from COP makes it possible to separate the COP signal into the COM sway and remaining COP-COM (PM) signal which represents the corrections of muscle-nervous system keeping COM close to the feet center. The posturographic signals of 384 patients were registered in 4 Eyes/Head conditions: Eyes Open/Closed vs Head Normal/BentBack. The patients were divided into 4 groups: 'Old with Gait Disturbance', 'Healthy Old', 'Healthy Middle Aged' and 'Healthy Young'. The results for PM signal show that the amplitude increases significantly with age. In the group of healthy patients, the increase with age is observed especially for 'Eyes Closed' condition and to lower degree for 'Head Bent Back'. The patients with Gait Disturbance exhibit the strongly significant increase in Eyes

Open/Head Bent Back condition when compared to healthy age-fitted group. The number of COP and COM crossings increases with age suggesting the postural reflexes to be too strong and causing the body imbalance.

44. Brain diffusion tractography and the network science

Adam Rybiński

adam.rybinski@outlook.com

Jagiellonian University, Krakow, Poland

Network science can help us understand complex systems. I present the method for extracting connectivity information out of the brain diffusion images. The goal is to acquire mathematical description of the structural connectivity in the brain. Method involves performing tractography on the raw brain diffusion data. Next, taking the regions of interest, computer calculates how many white matter tracts connect specified brain areas. As a result, we get connectivity matrix that can be further used to perform network science analysis, using the concepts and algorithms from the mathematical field of graph theory. This approach can aid research in understanding differences between our brains and diagnosing diseases. My method uses Nipy: open-source Python neuroimaging tools. This helps share and exchange ideas between scientists, to further improve the method, for the better understanding of connections in our brains.

LANGUAGE & SEMANTIC PROCESSING

45. Educational neuroscience – when more difficult is better for learning

Anna Beres[a], Nick Davis[b], Maria Dimitropolou[c], Manuel Carreiras[c]

anna.beres@gmail.com

[a] Bangor University, UK
[b] Swansea University, Wales, UK
[c] BCBL - Basque Center on Cognition, Brain and Language, Spain

Translanguaging is a method of bilingual learning involving simultaneous switch between languages and between comprehension and production. In a series of ERP experiments, we aimed to provide the first neuroscientific evidence of the potential benefits of such learning. In study 1&2, participants learned new information using just one of their languages (monolingual block) or two (translanguaging block). We have found a striking and long-lasting, main effect of translanguaging on the N400, known to index semantic integration effort, suggesting that information learned through translanguaging was easier to access from semantic memory than that same information acquired in a monolingual way. We then aimed to establish the separate role of code-switching and comprehension-to-production switching in translanguaging. Results of the code-switching study (3) showed that language change significantly increased the N400, compared to language constancy, suggesting deeper semantic access when switching languages. Results of the comprehension-to-production switch study (4) showed no difference between comprehension and production, suggesting that having to speak has no measurable immediate impact on semantic integration.Translanguaging therefore is a complex process that cannot be reduced to a simple combination of code-switching and comprehension-to-production switching. It is a simultaneous use of both strategies that is essential for more efficient learning.

46. Sighted visual cortex can be critically involved in tactile Braille reading – TMS evidence

Łukasz Bola[b, c], Katarzyna Siuda[c], Małgorzata Paplińska[d], Ewa Sumera[e], Katarzyna Jednoróg[f], Artur Marchewka[b], Magdalena Śliwińska[a], Marcin Szwed[g]

bolalukasz@gmail.com

[a] Department of Experimental Psychology, UCL, London, UK
[b] Laboratory of Brain Imaging, Neurobiology Center, Nencki Institute of Experimental Biology, Warsaw, Poland
[c] Psychophysiology Laboratory, Jagiellonian University, Krakow, Poland
[d] Academy of Special Education in Warsaw, Poland
[e] Institute for the Blind and Partially Sighted Children in Krakow, Poland
[f] Laboratory of Psychophysiology, Department of Neurophysiology, Nencki Institute of Experimental Biology, Warsaw, Poland
[g] Department of Psychology, Jagiellonian University, Krakow, Poland

According to the standard model, the brain processes sensory input in separate systems: visual cortex, auditory cortex, and so forth. Against this view, growing number of studies show that many brain regions are in fact meta-modal. Recently we observed that reading Braille by sighted subjects results in enhanced activity of the Visual Word Form Area (VWFA) – a part of the visual cortex essential for visual reading. Here, we used a transcranial magnetic stimulation (TMS) to test whether this region is causally involved in tactilereading. Nine sighted subjects were taught Braille (mean reading speed=9.44 words-per-minute). They performed a tactile lexical decision task in Braille, while TMS was applied to the VWFA and two control sites - Lateral Occipital Area and vertex. In line with visual reading studies, TMS to the VWFA decreased the accuracy of reading Braille words but not pseudowords. We found no TMS effect for control sites. Our results show that the visual cortex can be critically involved in tactile reading even when vision is unimpaired. This indicates that some parts of the visual cortex are in fact multimodal regions that process data relevant for a specific task, independent of the sensory modality.

47. Good looks help: Universal visual features are necessary for efficient reading

Joanna Sowa[a], Łukasz Bola[a], Katarzyna Siuda[a], Małgorzata Paplińska[b] , Ewa Sumera[c], Marcin Szwed[a]

joannasowa91@gmail.com

[a] Institute of Psychology, Jagiellonian University, Kraków, Poland
[b] Academy of Special Education in Warsaw, Poland
[c] Institute for the Blind and Partially Sighted Children in Krakow, Poland

The "cultural evolution" hypothesis proposes that efficient reading is possible because all reading scripts were matched to natural capabilities of the visual cortex i.e. they rely on set of line-junctions and their combinations. Here we test a critical prediction of the "cultural evolution" hypothesis: reading atypical (e.g. made out of dots) scripts should be much less efficient than reading "normal" alphabets. We used a lexical decision task as a test of reading performance. First we tested to what extent words generated from moving dots are harder to read than natural ones (N=15). Next, to generalize beyond artificially created stimuli, we tested the speed and efficiency of Braille reading by eyesight –a skill common in sighted Braille teachers (N=29). As control, we tested learners of a natural visual script, Cyrillic,at three levels of expertise (N=29). Our results show both moving-dot and visual Braille alphabet reading is slow, prone to errors and highly serial, even in subjects with years of reading experience (Braille teachers). This is in clear contrast to a natural alphabet, where only three months of Cyrillic learning are sufficient to achieve relative proficiency. This suggests that certain visual features of the reading script might be necessary for efficient reading.

48. What is the role of the primary auditory cortex in the congenitally deaf?

Maciek Szul[a], Łukasz Bola[a], Maria Zimmermann[b], Artur Marchewka[c], Katarzyna Jednoróg[c], Piotr Mostowski[d], Paweł Rutkowski[d], Marcin Szwed[a]

maciek.szul@uj.edu.pl

[a] Institute of Psychology, Jagiellonian University, Krakow, Poland
[b] MSMP, Warsaw University, Poland
[c] Laboratory of Brain Imaging, Nęcki Institute of Experimental Biology, Warsaw, Poland
[d] Section for Sign Linguistics, Warsaw University, Poland

Congenital deafness along with sign language acquisition is an opportunity to study cortical reorganisation on a large scale. Behavioural changes caused by deafness involve mainly an enhancement of peripheral visual processing under attentional load. Evidence provided by animal models locates those enhancements only in secondary auditory structures. The role of primary auditory cortex (A1) in human deafness with sign language usage is still not clear. Large-scale cortical reorganizations can reflect in the resting-state activity of the brain. Task-free resting-state fMRI paradigm was used to perform analysis of A1 functional connectivity patterns, in congenitally deaf (n=15) and hearing subjects (n=14). A novel approach, based on individual mapping of white matter auditory radiation with DTI-MRI, was used to locate A1. Left A1 showed increased connectivity with cerebellum (VI, VII lobules bilaterally), left medial orbitofrontal cortex and posterior cingulate gyrus. Right A1 showed increased connectivity with the same region of left orbitofrontal cortex and with left middle frontal gyrus. It seems, in line with evidence from animal models, that A1 does not participate in computation of basic visual information. Our results indicate that, analogous to primary visual cortex in the blind, A1 could be instrumental in other high-level functions, typically mediated by prefrontal cortex.

49. What role does N400 component play in processing of interlingual homographs?

Joanna Durlik, Patrycja Kałamała, Jakub Szewczyk, Zofia Wodniecka

jdurlik@yahoo.pl

Jagiellonian University, Krakow, Poland

Interlingual homographs (IHs) are words of common orthography but different meanings across languages, e.g. windy for Polish and English. Previous evidence shows that when bilingual speakers read IHs, they initially activate conceptual representations in both languages, even if only one is relevant in a given context. Macizo et al. (2010) designed a task verifying whether this co-activation leads to interference, and how this interference is resolved. Their paradigm involved presenting IHs in second language context (L2), followed by L2 words denoting first language IHs\' meanings (e.g. windy, followed by elevators). They found that words requiring re-access to previously irrelevant meanings of the IHs (elevators) lead to longer RTs and lower accuracy when preceded by IHs, and concluded that these meanings were inhibited. We set out to replicate the paradigm using ERPs, to test the nature of proposed inhibition mechanism. We predicted that if irrelevant IHs meanings are indeed inhibited, upon their re-access we should observe a pronounced amplitude of the N400, a component indexing difficulty of accessing conceptual representations. Surprisingly, we obtained N400s of the same amplitude when these words were preceded by the IHs, and by an exclusively English word. We discuss mechanisms alternative to the purported inhibition effect.

50. FN400 potentials are topographically and functionally distinct from N400 when procedures clearly separate recognition memory from semantic priming

Paweł Stróżak[a], Delora Abedzadeh[b], Tim Curran[b]

p.strozak@gmail.com

[a] The John Paul II Catholic University of Lublin, Poland
[b] University of Colorado Boulder, USA

There is a growing debate as to whether frontally distributed FN400 potentials reflect familiarity-based recognition or are functionally identical to centro-parietal N400 reflecting semantic processing. We conducted two experiments in which event-related potentials (ERPs) associated with semantic priming and recognition were recorded, either when priming was embedded within a recognition test (Experiment 1), or when these two phases were separated (Experiment 2). In Experiment 1, we observed 300-500 ms differences between primed and unprimed old words as well as differences between old and new primed words, but these two effects did not differ topographically and both showed midline central maximum. In Experiment 2, the N400 for priming was recorded exclusively during encoding and again showed midline central distribution. The ERP component of recognition was only found for unrelated words (not primed previously during encoding), and also showed midline central maximum, but, in addition, was present in left frontal region. This pattern of results indicate that FN400 and N400 potentials share similar neural generators; but when priming and recognition are not confounded, these potentials do not entirely overlap in terms of topographical distribution and presumably reflect functionally distinct processes.

51. Reduced vergence ranges and binocular instability under associated condition in dyslexic adults

Alicja Brenk-Krakowska, Milena Szady, Ryszard Naskręcki

ali_bk@amu.edu.pl

Adam Mickiewicz University of Poznań, Lab. of Vision Science and Optometry, Poland

Developmental dyslexia affects about 10% of population and is considered to be a long-life disorder. Studies show that some visual factors may be correlated with dyslexia, particularly those which are activated while reading. One area of interest is fixation disparity (FD) and its stability. As studies show, children with dyslexia experience binocular instability, however still little is known of vergence control in adult dyslexics. 50 university students took part in our study: 25 dyslexics and 25 normally reading adults. The associated phoria was measured with modified Mallett test both at far and at near. Sensory and motor stability of response during FD measurement was also examined. In addition, fusional vergence ranges at near using Risley prisms were measured. It was observed that dyslexics fixating at near reach higher absolute magnitude of near associated phoria. Moreover, they experience motor instability during FD measurements both at far and at near, with instability of FD being even more symptomatic at near, reaching also sensory instability. Moreover, near fusional vergence ranges, particularly the convergence ones, are reduced. The study results indicated that in conditions similar to those while reading, binocular instability takes place also in adult dyslexics, which is observed mainly in motor response.

52. Familial risk of developmental dyslexia: behavioral and structural brain differences, associated with socioeconomic status

Anna Banaszkiewicz[a], Katarzyna Chyl[a], Agnieszka Dębska[a,b], Magdalena Łuniewska[a,b], Agata Żelechowska[a], Artur Marchewka[c], Katarzyna Jednoróg[a]

banaszkiewicz.a@gmail.com

[a] Laboratory of Psychophysiology, Department of Neurophysiology, Nencki Institute of Experimental Biology, Warsaw, Poland
[b] Faculty of Psychology, Warsaw University, Poland
[c] Laboratory of Brain Imaging, Neurobiology Center, Nencki Institute of Experimental Biology, Warsaw, Poland

Previous voxel based morphometry (VBM) studies in developmental dyslexia reported gray matter volume (GMV) reductions compared to controls in several brain structures. Moreover, cognitive performance and GMV differences were affected by environmental factors such as socio-economic status (SES). We investigated behavioral and GMV differences in 68 beginning readers at risk for dyslexia (FHD+) and 46 controls (FHD-). Behaviorally, FHD+ group performed lower in digit span and phonological awareness tasks. Furthermore, almost all of the linguistic tests positively correlated with SES and these associations were weaker in FHD- than the FHD+ group. At the anatomical level FHD+ group showed GMV reduction in the left fusiform, lingual gyrus and left precuneus as well as an increase of GMV in the right temporal regions. SES correlated with GMV in several frontal and occipital regions bilaterally, however these correlations were driven mostly by the FHD+ group. Our findings suggest that structural brain changes in dyslexia are present at the beginning of reading acquisition and are mediated by SES. Thus they are unlikely to be a result of reading failure, but rather earlier genetic and environmental factors. Furthermore, stimulating environment may have a positive impact on the cognitive performance and brain development in FHD+ children.

53. Auditory event-related potentials and level of language comprehension in children with Specific Language Learning Impairment

Anna Dacewicz[a], Kamila Nowak[a,b], Anna Bombińska[a], Elżbieta Szeląg[a,b]

a.dacewicz@nencki.gov.pl

[a] Laboratory of Neuropsychology, Nencki Institute of Experimental Biology, Warsaw, Poland
[b] University of Social Sciences and Humanities, Warsaw, Poland

The aim of the study was to examine the relationship between language comprehension and event-related potentials (ERPs) elicited by syllables in children with Specific Language Learning Impairment (SLI, ICD10: F80). SLI refers to deficit in which normal patterns of language acquisition are disturbed from the early stages of development. However, they are not directly attributable to neurological or environmental factors. In ERP study, series of standard syllable /TO/ were interspersed by syllables /DO/ and /PO/ (deviants) presented in a multi-feature oddball paradigm. Language comprehension was assessed with behavioral tests i.e. Token Test - 36. We examined 22 children with SLI, 15 boys and 7 girls aged from 5,1 to 8,3 years. Results revealed that standard syllable elicited P1, N2 and N4 waveforms, as typically observed at this age in children with normal language development. The novel outcome was that both P1 and N4 amplitudes were significantly correlated with the level of language comprehension. This finding may suggest that difficulties in auditory language comprehension in SLI children may be related to brain response to linguistic stimuli. Supported by: INNOTECH-K1/IN1/30/159041/NCBR/12

54. Lexical access in native and non-native language: An ERP study

Katarzyna Jankowiak[a b], Katarzyna Jankowiak[a b], Ryszard Naskręcki[c], Karolina Rataj[a]

kjankowiak@wa.amu.edu.pl

[a] Faculty of English, Adam Mickiewicz University in Poznań, Poland
[b] NanoBioMedical Centre, Adam Mickiewicz University in Poznań, Poland
[c] Laboratory of Vision Science and Optometry, Faculty of Physics, Adam Mickiewicz University in Poznań, Poland

A reduced and delayed N400 effect has been observed in response to semantically anomalous sentences in L2 as compared to L1 speakers (Newman et al., 2012). The present study was aimed at examining whether this effect would be corroborated in the minimal context condition (word dyads) in native speakers of Polish (L1), who were highly proficient in English (L2). To this aim, the participants performed a semantic judgement task to semantically meaningful and meaningless verb-noun dyads in both languages. Unlike in the study by Newman et al., expectancy was controlled so that the target words were not expected in both meaningful and meaningless word pairs. The ERP

analyses revealed a main effect of language (p = .005), with significantly reduced N400 amplitudes to L2 compared to L1. Furthermore, anomalous expressions elicited more negative amplitudes than literal utterances (p = .009) in both languages. These result are in line with Newman et al., suggesting a less automatic lexical expectancy, and less efficient lexical access in L2 compared to L1, even when bilinguals are at high level of proficiency in their non-native language. Furthermore, more negative N400 waveforms to anomalous than literal utterances indicate the sensitivity of the N400 to semantically unexpected lexical items in both languages.

55. The neural circuitry for speech and print in beginning readers – comparison between deep and shallow orthography in a multi-site fMRI study

Bartosz Kossowski[a b], Katarzyna Chyl[c], Artur Marchewka[b], Kenneth Pugh[d], Katarzyna Jednoróg[c]

b.kossowski@nencki.gov.pl

[a] Institute of Radioelectronics, Warsaw University of Technology, Warsaw, Poland
[b] Laboratory of Brain Imaging, Neurobiology Center, Nencki Institute of Experimental Biology, Warsaw, Poland
[c] Laboratory of Psychophysiology, Department of Neurophysiology, Nencki Institute of Experimental Biology, Warsaw, Poland
[d] Haskins Laboratories, New Haven, Connecticut, United States

Shallow orthographies with high symbol–sound consistency (e.g. Polish) are acquired more easily than complex and opaque orthographies with a high proportion of inconsistent and irregular spellings (e.g. English). To date, few cross-linguistic studies of literacy acquisition have employed well-matched designs and samples, and none have yet included integrated neurobiological and behavioral measures. We present the results of an fMRI study performed on 2 samples of Polish and English speaking 7-year-old children, matched for age and gender. Children watched 4 kinds of stimuli: print - visually presented printed words; visual control - the same words but written with Wingdings font; speech - auditorily presented words and auditory control - the same words but noise-vocoded. Print>visual control contrast in the English children revealed increased activity in the left fusiform gyrus, whereas in Polish sample no significant activations were found. However, the direct group comparison did not reveal any significant differences between them. For the speech>auditory control, both groups activated bilateral superior temporal gyri, though Polish sample showed higher activity in the right one. It seems that speech and print circuits differ somewhat in each language reflecting the different challenges that these writing systems place on learning orthography, phonology, morphology, and semantics.

56. Task related differences in the late positive complex evoked by novel metaphors

Karolina Rataj[a], Anna Przekoracka[b,c], Rob van der Lubbe[d,e]

krataj@wa.amu.edu.pl

[a] Faculty of English, Adam Mickiewicz University, Poznań, Poland
[b] Krawczyk Faculty of Physics, Adam Mickiewicz University, Poznań, Poland
[c] NanoBioMedical Centre, Adam Mickiewicz University, Poznań, Poland
[d] Faculty of Behavior, Management, and Social Sciences, University of Twente, the Netherlands
[e] Department of Cognitive Psychology, University of Finance and Management, Warsaw, Poland

While an increased N400 for novel metaphoric utterances has been frequently reported, inconsistent results have been observed for the late positive complex (LPC). Arzouan et al. (2007) showed a reduced LPC to metaphoric utterances, whereas De Grauwe et al. (2010) noticed an increased LPC. In the current study, we further explored the LPC in two experiments with the same set of novel metaphoric, literal and anomalous sentences. In Experiment 1, participants performed a semantic decision task, and in Experiment 2 they read the sentences. As predicted, for the N400, increased negativity was observed in response to novel metaphoric and anomalous as compared to literal sentences in both experiments. The analysis of the LPC revealed the main effect of sentence type only when semantic judgment was involved (Experiment 1). Novel metaphors evoked less positivity than anomalous and literal utterances over posterior sites, which corroborates the findings of Arzouan et al. (2007). Most interestingly, increased frontal positivity was observed for novel metaphoric as compared to literal and anomalous utterances. Since response-locked analyses revealed the main effect of utterance type over frontal, but not parietal sites, we interpret this increased frontal LPC as an indicator of task difficulty.

57. Neural correlates of brand extension – An ERP study

Agnieszka Fudali-Czyż, Andrzej Cudo, Marta Jaśkiewicz, Natalia Kopiś, Marta Ratomska, Przemysław Tużnik

a-czyz@wp.pl

The John Paul II Catholic University of Lublin, Poland

Brand extension is the use of well-known brand names to sell a new product. It is considered that the success of brand extension is determined by the coherence of the product category with the brand name (Boush, Loken, 1991). A drawback of previous ERP (event-related potential) studies of the processing of brand extension (Ma et al., 2007, 2008; Wang et al., 2012) is the difficulty of distinguishing the effects of: 1) perceptual similarity between a brand and a product stimulus and 2) brand extension evaluation. In our ERP study we tried to distinguish these two effects. Trials (n=160) consisted of fixation point, beverage brand name and product name – from one of the two categories: a) beverages (coherent-trials), b) clothes (incoherent-trials). In half of trials subjects (N=20) had to just concentrate on pairs of stimuli and in half of trials they answered whether a brand extension is suitable or not. In the 'no-answer' condition comparison of coherent and incoherent trials revealed the difference in amplitude of N1. The same comparison in the 'answer' condition showed the difference in amplitude of N400. In conclusion, only in conscious brand extension evaluation the semantic coherence of product-brand pair seems to be important.

MOTOR ACTIVITY & MOVEMENT

58. Assessing cognitive interference on motor control

Erwan Guillery, Mouraux, A., Thonnard, J.-L., Legrain, V.

erwan.guillery@uclouvain.be

Institute of NeuroScience, Brussels, Belgium

Simultaneous execution of cognitive and sensorimotor tasks is critical in daily life. Here, we explored the recruitment of cognitive resources when performing a precision grip in 37 healthy participants (18 women/19 men), split in three equally sized age groups (18-30, 30-60 and 60-75 years). Participants performed a motor task in isolation (M), or in combination with a simple (M+CS) or difficult (M+DS) cognitive task. The motor task consisted in gripping, lifting and holding an instrumented apparatus with the dominant hand. In M+CS and M+DS, a list of letters was shown at trial onset. At trial offset, one letter was shown, and participants reported the following letter of the list. In M+CS, letters were a sequence of the alphabet. In M+DS, letters were in random order. Hence, only M+DS required maintaining information in working memory. Temporal and dynamic parameters of grip and lift forces were compared across conditions. In the dual tasks, there was a significant alteration of movement initiation and a significant increase of grip force, which was more pronounced in M+DS. There was no interaction with age and sex. Our results suggest that motor-cognitive dual tasks may constitute an ecologically-meaninful tool to evaluate motor function.

59. Robot-assisted line bisection in virtual reality

Lieve Filbrich[a], Orban de Xivry J.J.[b], Verfaille C.[a], Lefèvre, P. [a], Legrain V.[a]

lieve.filbrich@uclouvain.be

[a] Institute of Neuroscience, Université catholique de Louvain, Belgium
[b] Katholieke Universiteit Leuven, Belgium

This study investigated the ability to search for and reach to visual stimuli in the space surrounding bodily limbs. We adapted the classic line bisection task in a virtual reality environment for the use with patients with upper-limb sensory-motor deficits. Here, we report the results from a pre-clinical testing with healthy volunteers. Lines were projected horizontally on a semi-reflective mirror. For some of them, participants had the illusion that they were projected directly in the space surrounding one of the hands positioned passively in the device. Participants were asked to bisect the lines at their estimated midpoint by means of a robotic handle. Other factors were the hand used as active, the position of the passive hand (inside or outside of workspace), the possibility to see the hands and the location of the lines. Results showed that participants neglected the most lateral part of the lines, but only when lines were projected distantly from the body and when participants could see their hands. This study allowed us to evaluate the mechanical and cognitive constraints of reaching-to-point movements in our robot-assisted line bisection task, with the aim to control these parameters when evaluating cognitive deficits in patients with sensory-motor impairments.

60. To what extent does motor imagery affect sequential motor skill learning?

Jagna Sobierajewicz[a b], Sylwia Szarkiewicz[c], Anna Przekoracka-Krawczyk[c], Wojciech Jaśkowski[d], Willem Verwey[e], Rob van der Lubbe[a e]

jagnasobierajewicz@gmail.com

[a] University of Finance and Management, Warsaw, Poland
[b] Vision and Neuroscience Laboratory, NanoBioMedical Centre, Adam Mickiewicz University, Poznan, Poland
[c] Laboratory of Vision Science and Optometry, Faculty of Physics, Adam Mickiewicz University, Poznan, Poland
[d] Poznan University of Technology, Poznan, Poland
[e] University of Twente, Enschede, The Netherlands

Previous studies revealed that motor imagery shares common mechanisms with motor execution. In the present study we examined whether motor imagery induces motor sequential skill learning and also the extent to which motor imagery may substitute motor execution. The effects of motor imagery on motor skill learning may become visible on a behavioral level. A Go/NoGo discrete sequence production task with four stimulus and response locations was used. The sequence consisted of five stimuli that the participants were asked to memorize; they had to execute the corresponding movement sequence after a Go signal, or to imagine carrying out the movement sequence after a NoGo signal. The task was performed with different sequences of which the proportion of executed and imagined sequences was varied: 0/100, 25/75, 50/50, 75/25, and 100/0. The experiment was divided over three days: two days of training, and one final test day, in which all sequences had to be executed. To asses learning effects, response times and percentage of correct responses were calculated for each proportion of sequences from the test phase. An increase in PC and decrease in RTs over days revealed that the more participants practiced the less time they needed to produce the correct movement sequence. However, a comparison of RTs and PC for the different proportions of executed and imagined sequences revealed no significant differences on the final test day. These findings suggest a similar influence of motor imagery on motor skill learning as compared with motor execution.

61. Sensorimotor rhythms in motor tasks of various complexity. Effects in experts and amateurs

Emilia Zabielska-Mendyk, Piotr Francuz, Marta Jaśkiewicz, Paweł Augustynowicz

zabielska.emilia@op.pl

John Paul II Catholic University of Lublin, Poland

Movement execution causes desynchronization in sensorimotor rhytms, registered with EEG method on electrodes placed at the central site of the skull. The purpose of present study was to verify how movement complexity and motor expertise influence the alpha rhythm desynchronization during movement execution. In addition, the influence of these variables on beta rhythm was also investigated. 21 right-handed participants took part in the study, 10 of who were professional musicans playing piano for average of 16 years and 11 of them were amateurs with no motor training. Subjects task was to perform left and right hand finger tapping movements of various complexity during EEG recording. Results show that alpha rhythm desynchronization depends on movement complexity and the pattern differs in group of experts and amateurs. The similar pattern of results can be observed for beta band. There was also interaction of movement complexity and low and high alpha rhytm factor and a tendency towards an interaction of motor expertise and low and high beta rhytm factor.

62. Effect of selected types of neurofeedback trainings on SMR-BCI control skills

Dariusz Zapała[a], Piotr Francuz[a], Piotr Wierzgała[b], Ewelina Polak[a], Natalia Kopiś[a], Paweł Augustynowicz[a,b]

d.zapala@gmail.com

[a] The John Paul II Catholic University of Lublin, Poland
[b] Maria Curie Skłodowska University, Lublin, Poland

A brain computer interface (BCI) is communications system that enables humans to interact with their surroundings, without the involvement of peripheral nerves and muscles, by using control signals generated from e.g. EEG activity. One of the biggest challenges in BCI research is to understand and solve the problem of ''BCI Illiteracy''or \"BCI aphasia\", which is that BCI control does not work for a large portion of users (10 - 30%). Also the brain activity patterns produced by the user (e.g., ERD/ERS) are too often incorrectly recognized by the BCI. Unfortunately, the BCI community has focused the majority of its research efforts on signal processing, mostly neglecting the human in the loop. In this study, we argue that the users training process is one of the most critical component of the BCI that that may explain the limited efficiency of current systems. In our experiment we investigated the effects of psychological factors, like attentional and motivational processes on the sensorimotor rhythms-based BCI performance. The analysis of results pointed out a significant differences between experimental groups with different types of

BCI/neurofeedback training (motivational/attentional/motivational and attentional). Some of these findings can help users learn the BCI skill more efficiently.

63. Facilitated processing of communicative (vs. tool use) gestures as revealed by fMRI adaptation and behavioral tests

Agnieszka Kubiak, ,Bartosz Michałowski, Grzegorz Króliczak

kubiak.agn@amu.edu.pl

Cognition Laboratory, Institute of Psychology, Adam Mickiewicz University in Poznań, Poland

Both neuropsychological and neuroimaging evidence converge on the notion that pantomimed tool use (transitive) action recognition and performance put greater demands on a representational system which is shared with "communicative" (intransitive) gestures. To determine whether or not subdivisions of the networks involved do show different sensitivities to their processing, we used an fMRI adaptation paradigm in which only repeated stimuli reveal areas selectively responsive to their specific features with significant signal decreases. Eleven right-handed participants, tested in an event-related design, watched 2.75-s back-to-back movies presenting either repeated or disparate gestures belonging to the same or different category. Significant repetition suppression effects were observed only for repeated intransitive gestures, including bilaterally the anterior lateral occipital cortices, the left antero-dorsal precuneus, and the parieto-occipital fissure. The following experiment for same-different discrimination of the identical set of back-to-back movies showed significantly faster response times for intransitive gestures, regardless of the context in which they were processed. Although these outcomes are still consistent with an idea that a common representational network is invoked less for the more familiar communicative gestures, they also revealed areas selective for higher-order information conveyed merely by this gesture category.

64. Non-physical abstract actions are also caused by brain activity: evidence from EEG

Maciej Ras

ras@amu.edu.pl

Action and Cognition Laboratory, Institute of Psychology, Adam Mickiewicz University, Poznań, Poland

Although current neuroscience research provide substantial understanding of neurophysiological causes of action, most of this knowledge is limited to physical actions. Consequently, non-physical actions executed exclusively 'in the head' have not yet been examined in the perspective of EEG potentials that precede them. To fill this gap, EEG data were collected while 19 participants performed the following tasks: (1) finger taping, (2) imagined finger tapping, (3) mathematical calculations. Participants decided on their own when to execute the action. Negative waves were observed not only prior to the execution of actual or imagined movement, but also before the execution of math calculations. The potential observed in the latter condition do not differ significantly from the first two in respect to the place of its appearance (Cz electrode) or the shape of the wave. These results indicate that abstract actions, which are not linked to any motoric properties, are also preceded by a specific brain event. In the context of Libet's experiment, which showed that the onset of readiness potential precedes not only the movement execution, but also the conscious intention to move, these outcomes provide further support for the hypothesis of epiphenomenal character of consciousness in causing different types of actions.

65. Object exploration with a view to grasping: an fMRI study

Mattia Marangon, Gregory Króliczak

Action and Cognition Laboratory, Institute of Psychology, Adam Mickiewicz University in Poznań, Poland

Adoption of an appropriate hand posture and finger preshaping for grasping actions seems trivial when visually guided but poses great challenges when performed based on remembered (visual) information. But what if there is no representation of object in the brain and it needs to be created from scratch on the basis of haptic information alone? We used functional magnetic resonance imaging (fMRI) to directly address this issue. In an event-related design, 10 right-handers using their dominant hands explored complex and irregular vs. simple circular 3D shapes with the intention to later grasp them. Exploration of all shapes engaged typical temporo-fronto-parietal circuits linked to goal-directed manual actions. Contrasting exploration of complex vs. simple objects with a view to grasping them revealed unilateral right-sided signal modulations extending from the superior parietal gyrus, via anterior intraparietal sulcus, and through anterior supramarginal gyrus. The inverse contrast revealed modulations both in the default mode network, and less inhibition in subdivisions of mid inferior frontal, posterior supramarginal, angular, and throughout the inferior temporal gyri. These results provide evidence for differential involvement of the temporo-fronto-parietal circuits for object manipulation when they are engaged with a view to performing future grasping actions.

66. Kinematics of motor sequence performance in the presence of implicit and explicit structure

Oleg Solopchuk, Andrea Alamia, Etienne Olivier, Jean-Jacques Orban de Xivry, Alexandre Zenon

osolopchuk@gmail.com

Université catholique de Louvain, Belgium

Motor sequences can be learnt with or without conscious awareness. Here we investigated how conscious awareness of the sequence structure affects the kinematic characteristics of movements. Two groups of subjects performed either an explicit (simple sequence structure, N=19) or implicit (complex sequence structure, N=12) sequence learning task using KINARM (BKIN Technologies). We found that in both groups, movement parameters were significantly impacted by the sequence structure. In addition, in the explicit group, we observed a clear anticipation of the movements, which allowed movement velocity, and consequently, energy cost, to be spared. In contrast, the pattern of changes observed in the "implicit group" was different, with no anticipation, and affected only a subset of the items within the sequence. This difference between groups could be explained by the fact that movement parameters were influenced by 2 different mechanisms. While the pattern and dynamics of movement parameters in the "explicit group" seemed to be caused by the grouping of successive items into sub-groups, or chunks, the results obtained for the "implicit group" suggest rather the involvement of associative learning mechanisms, whereby statistical regularities are used to predict upcoming targets.

67. Development of EEG pattern classifier committee for imaginary finger movements

Konstantin Sonkin[a], Lev Stankevich[a], Zhanna Nagornova[b], Natalia Shemyakina[b], Julia Khomenko[c]

sonkink@gmail.com

[a] Saint-Petersburg State Polytechnical University, Russia
[b] Sechenov Institute of Evolutionary Physiology and Biochemistry of the Russian Academy of Sciences
[c] N. P. Bechtereva Institute of the Human Brain, Russian Academy of Sciences

Brain-computer interfaces (BCIs) represent a vast field of potential applications and research. One promising, inexpensive and non-invasive approach is an EEG-based BCI related to imagery movement fulfillment. Main objectives of this study are the implementation of new methods for registration, analysis and classification of EEG-patterns of imaginary movements of fingers and wrist of right hand, and the evaluation of the efficiency of the developed qualifiers as a part of BCI. New model of motor imaginary execution in adjusted rhythm was developed to reduce the time of one trial execution and to synchronize the trials. Scalable committee of qualifiers was developed on the basis of the artificial neural networks (ANN) and the support vector machine (SVM). As a result of the studies with participation of healthy subjects the most efficiently and stably classified imaginary movements were revealed for each subject according to approach of individual classifier adjustment. The committee of ANNs on the basis of two feature spaces demonstrated higher recognition accuracy of pairs of imaginary movements both for the single-trial classification (mean – 70%, max – 98% for some pairs of movements) and for the classification of synchronously accumulated trials (mean – 72%, max – 93%) in comparison with the classification accuracy of SVM.

68. Proprioceptive evoked potentials – does gender matter?

Sigita Melynyte[a], Sidse M. Arnfred[b], Inga Griskova-Bulanova[a]

sigita.melynyte@gmail.com

[a] Department of Neurobiology and Biophysics, Faculty of Natural Science, Vilnius University, Vilnius, Lithuania
[b] Psychiatric Center Ballerup, Copenhagen, Denmark

Proprioception is the sence of (a) passive and active movements of the body, (b) relative position of body in space and (c) strength of muscular effort employed in movement. A sudden change of weight of a handheld load can induce proprioceptive evoked potentials (PEP). PEP has been investigated in schizophrenia showing a particular type of impairment being related to anomalies of self-experience. Although recent studies revealed gender differences in expression of psychosis in schizophrenia patients, so far gender effect has not been considered in PEP studies. The aim of our study was to investigate PEP differences between men and women. Twenty eight healthy subjects (12 females) were included in the study. PEPs were recorded with 64 channel EEG while applying stimuli to left and right hands. The main result is an increase of frontal P2 amplitude (a component related to stimulus ability to catch attention) in women, independently of hand stimulated. Gender differences should be considered when performing PEP studies.

AUDITORY PROCESSING

69. The better way to entrain: which sound and what task to use?

Aleksandras Voicikas, Ieva Niciute, Osvaldas Ruksenas, Inga Griskova-Bulanova

avoicikas@gmail.com

Vilnius University, Lithuania

Auditory steady-state response (ASSR) is an electrophysiological response recorded to periodically present auditory stimuli: the frequency of the ASSR is close to the frequency of stimulation and reflects the ability of neural networks to synchronize. Recently, ASSR was proposed to serve as a biomarker of schizophrenia. However, the optimal type of stimulation and task during the stimulation is not estimated yet. We compare three types of auditory stimuli, presented to 19 male subjects and leading to entrainment: chirp, flutter amplitude modulated sounds and clicks. Additionally, we evaluate effect of 3 different tasks: counting of presented stimuli, reading and sitting with closed eyes. 62 channels EEG is recorded and wavelet-extracted intertrial phase locking factor (PLF) is computed as the main measure of entrainment. As expected, the strongest entrainment is seen in response to click stimuli; PLF was larger in counting than during reading and it was largest in eyes closed condition as compared to other two conditions. However, topographical properties of the responses are different.

70. Auditory steady-state response in schizophrenia: eyes open or eyes closed?

Inga Griskova-Bulanova[a, b], Valentinas Maciulis[a], Kastytis Dapsys[a, b]

i.griskova@gmail.com

[a] Department of Electrophysiological Treatment and Investigation Methods Republican, Vilnius Psychiatric Hospital, Lithuania
[b] Department of Neurobiology and Biophysics, Vilnius University, Lithuania

Auditory steady-state response (ASSR) - a response to periodic stimulation (mostly at gamma frequencies) - has been proposed to serve one of the biological markers of schizophrenia, being consistently impaired in the disorder (O'Donnell et al., 2013). Commonly, ASSRs are recorded during open eyes conditions, with tasks varying from simple eyes fixation to active attention paid to stimulation. We have shown that ASSRs are modulated by eyes closure in schizophrenia patients: both amplitude and phase-locking index increase when patients stay with closed eyes (Griskova-Bulanova et al., 2013). This is not evident in healthy subjects (Griskova-Bulanova et al., 2011). Observations from several samples suggest that the degree of increase in ASSR measures during closed eyes condition is different between treatment-responsive and treatment-resistant patients. Previously reported positive relationship between positive symptoms/hallucinations and ASSRs (Spencer et al., 2008, 2009) is not evident for ASSRs from closed eyes condition. ASSR assessment during several experimental conditions thus could contribute to the increased specificity and sensitivity of the method serving as the biological marker.

71. ASSRs as a potential tool for measuring consciousness level

Urszula Górska[a, b], Marek Binder[a]

urszula.gorska@uj.edu.pl

[a]Psychophysiology Laboratory, Institute of Psychology, Jagiellonian University, Cracow, Poland
[b]Department of Neurophysiology, Donders Institute for Brain Cognition and Behaviour, Nijmegen, The Netherlands

Objective: The principal aim of the following study was to test the sensitivity of the ASSRs (auditory steady-state responses) to the level of cortical arousal comparing deep sleep and awake conditions. The subsequent step of the research was motivated by the lack of reliable clinical method to differentiate between patients with disorders ofconsciousness (DOC) after severe brain injuries in various states of consciousness.
Methods: 15 healthy controls and 12 DOC patients were presented a series of 1 kHz sine-wave auditory stimuli modulated by the set of amplitude modulation (AM) frequencies (4Hz, 8Hz, 20Hz, 40Hz, 80Hz) while measuring their brain activity with EEG. The analysis compared frequency peaks amplitudes with F-test and relative constancy of the difference of phases using phase coherence (PC) calculations.
Results: The comparison between sleep and awake group revealed significantly lower values both for F-test and PC measures in sleeping condition, but only for lower from presented ASSR modulations. DOC patients group displayed various differences in whole range of stimuli however it seems to remain in compliance with behavioral diagnosis of CRS-R Scale ratings. Taken together, this results suggest that selected ASSR frequencies could be a promising marker of the actual level of cortical arousal and DOC patient's condition.

72. The Effects of Ecological Auditory Cueing on Rhythmic Walking Interaction: EEG study

Justyna Maculewicz[a], Agnieszka Nowik[c], Stefania Serafin[a], Lise Busk Kofoed[b], Gregory Króliczak[c]

jma@create.aau.dk

[a] Multi-sensory Interaction Laboratory, Architecture Design and Media Technology Department, Aalborg University Copenhagen, Denmark
[b] Architecture Design and Media Technology Department, Aalborg University Copenhagen, Denmark
[c] Action and Cognition Laboratory, Institute of Psychology, Social Science Department, Adam Mickiewicz University in Poznan, Poland

This electroencephalographic (EEG) study was conducted to test neural activity for interactive rhythmic walking in place with three different tempi (80, 105 and 130 BPM) in the presence of four auditory cues: two ecological (gravel, wood) and two non-ecological (aggregate, solid). By analysing power spectrum density in alpha, beta and gamma oscillations wave bands we tested brain activations correlated with attention, motoric behaviour, social and semantic information enclosed in the ecological or non-ecological auditory signals. The 9.1 Hz activity on FCz electrode chosen to test for the socialinteraction effect induced by ecological sounds revealed a significant mixed material*tempo interaction in favour of the natural materials within 105 and 130 BPM tempo categories. The analysis of gamma activity on Cz electrode associated with attention showed significant differences for the tempo and material categories. The difference between materials was significant within category of 130 BPM (the highest gamma activation for solid non-ecological sound). The alpha activity on CP4 and CP6 electrode (Inferior Parietal Lobule), linked to sensory processing, sensorimotor integration, attention and motion processing revealed a decrease of activity for natural sounds and increase for unnatural sounds. These outcomes have implications forrhythmic gait rehabilitation and ecological signal processing.

73. Differences in EEG fractal dimension between men and women – an auditory oddball study

Jan Szczypiński, Jakub Wojciechowski, Jan Nikadon, Bibianna Bałaj, Joanna Dreszer-Drogorób

jan.szczypinski@gmail.com

Faculty of Humanities Institute of Philosophy, Nicolaus Copernicus University, Torun, Poland
Centre for Modern Interdisciplinary Technologies Nicolaus Copernicus University in Torun, Poland

Fractal dimension (FD) is a measure of how complex or how complicated the figure is. Fractal curves often occurs naturally – coastlines or trees. What is more interesting lungs, blood vessels and even the brain can be described asfractal curves. FD can be a tool to examine complexity on which neuronal regions works. Quantifying FD using Higuchi's algorithm on EEG signal is well know, non-linear method applied in recent studies (Raghavendra, et al., 2009, Fernández, et al., 2013). There is prior evidence of FD sex depending differences from resting-state EEG study (Ahmadi, et al., 2013). We wanted to examine whether there is difference of EEG signal complexity depending on sex of subjects during auditoryoddball task. 41 right-handed subjects (19 females, 22 males) participated in the study. They were asked to perform auditoryoddball paradigm and respond only to target sound. EEG signal was recording using 64 channel station. We found significant differences of FD on frontal electrodes between men and women when they were hearing target and deviant stimuli, but not standard stimulus. Concluding, women have more complex signal in frontal, contrlateral areas comparing to men.
This study was part of NeuroPerKog. Symfonia I: UMO-2013/08/W/HS6/00333

PERSONALITY & INDIVIDUAL DIFFERENCES

74. Big Five personality traits and its association with the frequency of alpha waves during resting-state

Joanna Gorgol[a], Jonatan Dalasiński[a], Joanna Dreszer-Drogorób[b c], Piotr Weber[c]

joanna.gorgol@gmail.com

[a] Nicolaus Copernicus University in Torun, Poland
[b] Centre for Modern Interdisciplinary Technologies in Torun, Poland and Department of Cognitive Science and Epistemology, Faculty of Humanities, Nicolaus Copernicus University in Torun, Poland
[c] Faculty of Physics, Astronomy and Informatics, Nicolaus Copernicus University in Torun, Poland

The aim of this study was to verify the hypothesis that the Big Five personality traits (openness, conscientiousness,

extraversion, agreeableness, and neuroticism) are reflected in the frequency of alpha wave of particular regions in the brain. The study involved 43 right-handed, healthy subjects (23 males). Big Five personality traits were measured using a Revised NEO Personality Inventory. Subjects were asked to relax with their eyes closed while EEG signal was recorded from 64 electrodes. EEG data were converted in Matlab.
The results of this studies show that in groups of subjects divided by sex there is a relationship between selected personality traits and frequency of alpha waves.So, we can conclude, Big Five personality traits are reflected in the spontaneous brain activity.

75. People with higher neuroticism have more complex neuronal activity

Marek Waligóra[a b], Jakub Wojciechowski[b], Jan Szczypiński[b], Jan Nikadon[b], Bibianna Bałaj[b], Monika Lewandowska[b], Joanna Dreszer-Drogorób[b]

waligora.marek@gmail.com

[a] Institute of Philosophy, The Pontifical University of John Paul II, Kraków, Poland
[b] Centre for Modern Interdisciplinary Technologies Nicolaus Copernicus University in Torun, Poland

The aim of the presented study was to investigate relationship between five personality traits and brain activity. Personality was measured using NEO-PI-R, which allows to define personality traits such as extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. Higuchi's fractal dimension algorithm is non-linear method that enables analysis of fractal characteristics in complexdata signal (eg. EEG recording). To get an insight into these aspects we examined 40 participants and recorded their brainactivity using 64 channeled EEG with active, auditory oddball paradigm. Fractal dimension analysis of participant's bioelectrical data showed positive correlation with personality types. We found association between fractal dimension of EEG signals and neuroticism. EEG signals recorded from frontal areas in subjects with higher anxiety (subtype of neuroticism) exhibit increased fractal dimension in response to specific stimuli. In addition EEG signals derived from parietal and left temporal areas also demonstrate significant positive correlation. This study was part of NeuroPerKog. Symfonia I: UMO-2013/08/W/HS6/00333

76. Fluid intelligence and complexity of the EEG signal in active, auditory task

Jakub Wojciechowski, Jan Szczypiński, Jan Nikadon, Bibianna Bałaj, Monika Lewandowska, Joanna Dreszer-Drogorób

wiercirurki@gmail.com

Centre for Modern Interdisciplinary Technologies Nicolaus Copernicus University in Torun, Poland

There is growing amount of studies using non-linear signal analysis from various research fields, but very few concentrate on most complex organ we know – the brain. Fractal geometry is used frequently as indicator of complexity of either objects or ongoing signals. The most robust method for estimating fractal dimension of ongoing signal is Higuchi's algorithm. Higuchi's fractal dimension (HFD) is a method of measuring complexity of bioelectrical function of the neural networks. In our previous study we have showed that fluid intelligence has negative correlation with HFD of EEG from resting-state. In presented study we have focused on relations between HFD of EEG recorded during active auditory task and fluid intelligence measured with Raven's Advanced Progressive Matrices (RAPM). We have investigated 41 right-handed young, healthy people (19 women, 22 men) using 64-channel EEG system. Results show that fluid intelligence and HFD score differentiate people during active task and that gender plays an important role in lateralization and orientation of the effect.

77. When less is enough. The influence of need for closure on neural correlates of evidence accumulation

Tomasz Oleksy[a], Mikołaj Szulczewski[b]

tomasz.oleksy@psych.uw.edu.pl

[a] University of Warsaw, Poland
[b] University of Finance and Management, Warsaw, Poland

Successful adaptive behavior depends on processing and resolving uncertainty. One of individual differences thatinfluence dealing with uncertainty is need for cognitive closure (NFC). NFC is described as a general cognitive style including preference for order, predictability and reduced processing of information search. People with high NFC try to quickly formulate hypotheses about the situation (the phenomenon of cognitive 'capture'), and then exhibit resistance to the evidence of the need for their revision (the phenomenon of \'freezing\'). Many research used event-related potentials (ERPs) to search on how brain processes incongruent information. However, there was no research linking ERP conflict-monitoring systems with individual differences and evidence accumulation during value-based decision making. In our research, we show how different aspects of NFC (preference for order, preference for

predictability, decisiveness, discomfort with ambiguity, and closed-mindedness) explain N400 and Feedback-related Negativity amplitudes in reaction to congruent/incongruent and relevant/irrelevant information during evidence accumulation.

POSTER SESSION II

April 18, 2015 (Saturday)
14.30 – 15.45

BASIC NEUROSCIENCE

1. Protons modulate GABAA receptor gating by affecting both desensitization and flipping transitions

Magdalena Kisiel[b], Magdalena Jatczak[a], Jerzy W. Mozrzymas[b]

kisiel.magda@gmail.com

[a] Laboratory of Cellular Neurobiology, Department of Animal Molecular Physiology, Wrocław University, Poland
[b] Laboratory of Neuroscience, Department of Biophysics, Wrocław Medical University, Poland

GABAA receptors are crucial for inhibitory functions in the mammalian brain and alterations of pH are known to affect GABAARs. Moreover, it has been demonstrated that alpha1F64 residue is involved in the receptor preactivation/flipping (Szczot et al., 2014) and also in pH sensitivity (Huang et al., 2004). Therefore, we decided to check whether flipping is affected by pH. Using patch clamp with ultrafast perfusion system we examined the impact of extracellular pH changes on macroscopic currents mediated by wild type alpha1beta2gamma2 receptors and by alpha1F64 mutants (to C or L). An increase in pH (6.0 to 8.0) caused a significant decrease in current amplitude for all types of receptors and agonists (GABA, P4S) with acceleration of desensitization kinetics (especially for currents evoked by GABA in WT). Surprisingly, pH differently affected deactivation kinetics in non-mutated and mutated receptors. Model simulations indicated that the mechanism of GABAAR modulation by protons includes changes in flipping and in the "classical" channel gating - desensitization. Single-channel recordings for WT receptors indicated no effect of protons on opening/closing transitions indicating lack of influence on channel efficacy. We conclude that pH modulation of GABAAR gating transitions involves both flipping and microscopic desensitization. Support NCN: DEC-2013/11/B/NZ3/00983, Ministry: Pbmn135.

2. Mutation of glutamate 155 residue in the β2 subunit of the α1β2γ2 GABAA receptor alters both binding and gating and is likely to be involved in preactivation/flipping mechanism

Magdalena E. Jatczak[a b], Magdalena Kisiel[b], Marta M. Czyżewska[b], Marek Brodzki[a b], Jerzy W. Mozrzymas[b]

magdalena.jatczak@gmail.com

[a] Laboratory of Cellular Neurobiology, Department of Animal Molecular Physiology, Wrocław University, Poland
[b] Laboratory of Neuroscience, Department of Biophysics, Wrocław Medical University, Poland

The GABAA receptor is the primary mediator of inhibitory transmission in the brain. A residue β2E155, located in GABA-binding site, is a key residue for direct interactions with the neurotransmitter (Cromer et al., 2002). Movements of amino acids in this GABA-binding site region is involved in coupling GABA binding to channel gating and β2E155 seems to be initial trigger for ion channel opening (Newell et al., 2004). We investigated the impact of cysteine substitution of β2E155 on macroscopic currents mediated by α1β2γ2 and α1β2 receptors using patch clamp technique with ultrafast perfusion system. Mutations of this residue right-shifted the dose–response curves for GABA evoked currents. Moreover, especially for receptors with γ2 subunit, mutation β2E155C also caused a slowing of macroscopic desensitization and a disclosure of spontaneous opening. Non-stationary variance analysis indicated reduced maximal open probability with no change in single channel conductance in α1β2E155Cγ2 receptors compared to wild type receptors. This observations suggest that both binding and gating transitions might be affected by a mutation. Preliminary analysis and model simulations suggest that the most likely mechanism of gating modulation is alteration of preactivation/flipping transitions which precede channel opening. Supported by NCN grant DEC-2013/11/B/NZ3/00983 and ministry grant Pbmn135.

3. Alpha1-gamma2 and alpha1-beta2-gamma2 GABA(A) receptors show distinct pharmacological characteristics

Marek Brodzki[a b], Marta M. Czyżewska[a], Radosław Rutkowski[a], Magdalena Kisiel[a], Magdalena Jatczak[a b], Jerzy W. Mozrzymas[a b]

marek.brodzki@uni.wroc.pl

[a] Laboratory of Neuroscience, Department of Biophysics, Wrocław Medical University, Poland
[b] Laboratory of Cellular Neurobiology, Department of Animal Molecular Physiology, University of Wrocław, Poland

GABAAR is a major inhibitory ionotropic receptor in the adult mammalian CNS. This receptor is greatly diversified and most frequent subunit composition of GABAARs in the brain is alpha1-beta2-gamma2. Several other GABAAR types exist but the physiological significance of this diversity is not clear. It has been reported that alpha1-gamma2 receptors can be highly expressed in the recombinant model (Verdoorn et al., 1990) but their kinetic and pharmacological profile has not been fully characterized. Using patch-clamp technique with ultrafast solution exchange we show that they have similar kinetic properties to those observed for alpha1-beta2-gamma2 receptors but a distinct pharmacological profile. Alpha1-gamma2 receptors are more potently inhibited by zinc ions and, in contrast to alpha1-beta2-gamma2 receptors, responses to saturating [GABA] are enhanced by benzodiazepines. Protons were found to differently affect the deactivation time courses of responses mediated by these receptors but the mechanism of activation by pentobarbital was similar. In conclusion, we show for the first time that alpha1-gamma2 and alpha1-beta2-gamma2 receptors show substantially different pharmacological profile. Supported by NCN grant DEC-2013/11/B/NZ3/00983.

4. Does extremely low electromagnetic field affect action of voltage-dependent sodium channel modifier?

Milena Jankowska, Maria Stankiewicz, Joanna Wyszkowska

jankowska.mil@gmail.com

Department of Biophysics, Faculty of Biology and Environmental Protection ,Nicolaus Copernicus University in Toruń, Poland

Extremely low-frequency (50 Hz) electromagnetic field (ELF-EMF) is a phenomenon which we deal with every day. It is produced by electronic devices and electric power transmission lines. Results of ELF-EMF action are as follows: the discrete changes in membrane potential, the increase of calcium channel activity as well as intracellular concentration of Ca2+ and changes in distribution of charges in receptors and ion channels. LqhαIT toxin from scorpion Leiurus quinquestriatus venom is a small peptide, which binds to insect voltage-dependent sodium channels and inhibits their fast inactivation. In our research we formulated the hypothesis that ELF-EMF changes efficiency of LqhαIT toxin on nervous system of insect. We present the experiments, in which we have verified an action of 0,7 mT ELF-EMF and LqhαIT (5*10-8 M) on isolated nerve cord of cockroach – Periplaneta americana. Tests have been conducted using extracellular electrodes, which allowed to record total bioelectric activity from one connective and cercal nerve. We have also performed in-vivo¬ tests, in which we have estimated the impact of 0,7 mT and 7 mT ELF-EMF on degree of insects paralysis caused by LqhαIT (10-8 M and 10-7 M). ELF-EMF exposure induced important changes in LqhαIT activity.

5. Neurosoft for analysis of different cell types in histological Nissl-staned brain tissue

Agata Kołodziejczyk, Magdalena Ładniak and Adam Piórkowski

Institute of Environmental Sciences, Jagiellonian University, Poland
Faculty of Geology, Geophysics and Environmental Protection, AGH-University of Science and Technology, Poland

Cell number, density and volume of white and gray matter in brain structures are not constant values. Cellular alterations in brain areas might coincide with neurological and psychiatric pathologies as well as with changes in brain functionality during selection experiments, pharmacological treatment or aging. Several softwares were created to facilitate quantitative analysis of brain tissues, however results obtained from these softwares require multiple manual settings making the computing process complex and time-consuming. This study attempts to establish half automated software for fast, ergonomic and an accurate analysis of cellular density, cell number and cellular surface in morphologically different brain areas: cerebral cortex, pond and cerebellum. Images of brain sections of bank voles stained with standard cresyl-violet technique (Nissl staining), were analyzed in designed software. Results were compared with other commercially available tools regarding number of steps to be done by user and number of parameters possible to measure.

6. Antiepileptogenesis and Group I metabotropic glutamate receptors

Valerio D'Amore, Gilles van Luijtelaar

damorevalerio@gmail.com

Donders Centre for Cognition, Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen, The Netherlands

Ethosuximide (ETX) has become the drug of choice in the treatment of patients with absence seizures taking into account both its efficacy, tolerability and antiepileptogenic properties in man and in genetic absence models. However, 47% of subjects treated with ETX failed in therapy. The availability of subtype selective and potential to control only the disease mediating receptors offers a new opportunity for drug discovery and development. Indeed, VU0360172, a positive allosteric modulator (PAM) of mGluR5 decreased seizures dose dependently in the WAG/Rij absence model. The aim of the study was to investigated if anti-epileptogenic effect induced by ETX via the drinking water alters the sensitivity of mGluR5. Antiepileptogenesis was successfully induced and this was accompanied by a large decrease in the sensitivity of this PAM in a pharmacological challenge. Western blot of this receptor in cortex and thalamus in chronically ETX treated WAG/Rij rats did show large differences between cortex and thalamus, but not between the ETX and control animals. It is concluded that this PAM lost its potential as an anti-absence drug after antiepileptogenesis with ETX and that ETX interacts with the efficacy of the mGluR5 receptor system. However, the working mechanism of this interactions remains to be elucidated.

NEUROGENETICS

7. Analysis of genotype/phenotype correlation for genetic variants of SNCA, PRKN genes and alpha-synuclein, and Parkin concentrations in Parkinson's disease

Anna Oczkowska[a], J. Florczak-Wyspiańska[b], W. Kozubski[b], J. Dorszewska[a]

annapol2@autograf.pl

[a] Laboratory of Neurobiology, Department of Neurology, Poznan University of Medical Sciences, Poland
[b] Chair and Department of Neurology, Poznan University of Medical Sciences, Poland

Introduction: Currently, it is believed that in the Parkinson's Disease (PD) pathogenesis may be involved both SNCA, PRKN mutations and improper levels of their protein product – alpha-synucleine (ASN) and Parkin.
Aims: The aim of the study was to analyze the SNCA and PRKN mutations and ASN and Parkin plasma concentration in PD patients and controls.
Methods: For 90 PD patients and 113 controls performed SNCA and PRKN genotyping using PCR, HRM/RT-PCR and sequencing. Plasma ASN and Parkin concentrations were evaluated using ELISA.
Results: In Polish population, PRKN variants occur few times more often in PD patients than controls. Controls tend to show higher level of plasma Parkin whereas PD patients tend to generate higher level of plasma ASN. In the PD patients increased plasma level of ASN was associated by the decreased of Parkin plasma level. Moreover, in PD patients without point mutations in PRKN Parkin and ASN plasma levels increase until 2nd stage of disease in Hoehn and Yahr scale and during first 10 years of disease
Conclusions: Analysis of the variations of PARK gene as well as plasma levels of ASN and Parkin may consist an additional diagnostic and prognostic factor for PD.

8. Association of GSTM1 and GSTT1 null alleles with susceptibility to multiple sclerosis

Sandra Hanysova[a], Cierny, D.[a], Michalik, J.[b], Kurca, E.[b], Lehotsky, J.[a b]

hanysova@jfmed.uniba.sk

[a] Department of Medical Biochemistry, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, Slovakia
[b] Department of Neurology, University Hospital and Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, Slovakia

Background: Oxidative stress as a result of excessive production of reactive oxygen species (ROS) is an important factor contributing to etiopathogenesis of neurodegenerative disorders. The enzymes of molecular antioxidant defense (glutathione-S-transferases, GSTs), when act properly, are responsible for ROS detoxification. The aim of our study was to detect association between frequency of null alleles of selected antioxidant genes (GSTM1 and GSTT1) in cases of multiple sclerosis (MS) patients and healthy control subjects.
Methods: We analysed two groups of people – 258 patients suffering from multiple sclerosis (MS Centrum, UH and JFM CU Martin) and 194 healthy control subjects. The allelic status of each sample was detected by methods of molecular biology – multiplex polymerase chain reaction and separation of fragments by electrophoresis.

Results: We did not observe any statistically significant differences in frequency of GSTM1 and GSTT1 null alleles between MS patients and healthy control subjects.
Conclusions: Our results do not indicate for the relevant association of null allele´s genotype frequencies with MS. It is suggested to enlarge the groups of examined people and determine another potentially important gene polymorphisms.

9. Association between NEIL1 and PARP1 single-nucleotide polymorphisms, and the risk of recurrent depression disorder

Piotr Czarny[a], Dominik Kwiatkowski[a] , Monika Talarowska[b], Agata Orzechowska[b], Anna Bielecka-Kowalska[c], Janusz Szemraj[d], Piotr Gałecki[b], Tomasz Śliwiński[a]

pczarny@biol.uni.lodz.pl

[a] Department of Molecular Genetics, University of Łódź, Poland
[b] Department of Adult Psychiatry, Medical University of Łódź, Poland
[c] Non-public Medical Center "Akoria", Łódź, Poland
[d] Department of Medical Biochemistry, Medical University of Łódź, Poland

Increasing number of reports indicates that inflammation and oxidative stress are present in depression disorder (DD, including recurrent DD [rDD]). An increased oxidative stress may damage biomolecules, including DNA. In agreement with this, in patients with depression elevated levels of 8-oxoguanine, oxidative modification of other bases and strand breaks were found. Moreover, our previous study showed less efficient repair of oxidative DNA damage in mononuclear cells of patients, when compared with the cells isolated from controls. These facts encouraged us to genotype single nucleotide polymorphisms (SNPs) of genes encoding NEIL1 and PARP1. These proteins are involved in base excision repair (BER), a pathway responsible for elimination of oxidative DNA damage. We selected two polymorphisms: c.*589G>C – NEIL1 (rs4462560) and c.2285T>C – PARP1. 395 DNA samples (188 cases and 207 controls) was genotyped using TaqMan probes. We found that the G/G genotype and allele G of the c.*589G>C increased the risk of rDD occurrence, whereas the allele C of the same SNP decreased this risk. As for the c.2285T>C, only the genotype C/C significantly increased the risk of depression. We showed for the first time that SNPs of genes involved in DNA repair, particularly BER pathway, may modulate the risk of depression occurrence.

10. Association between DNA damage and polymorphism of base excision repair genes in Alzheimer's disease

Dominik Kwiatkowski[a], Piotr Czarny[a], Piotr Galecki[b], Agnieszka Bachurska[b], Monika Talarowska[b], Agata Orzechowska[b], Anna Korycińska[a], Anna Bielecka-Kowalska[c], Agnieszka Śliwińska[d], Ireneusz Majsterek[e], Janusz Szemraj[f], Tomasz Sliwinski[a]

d.kwiat@biol.uni.lodz.pl

[a] Department of Molecular Genetics, University of Lodz, Poland
[b] Department of Adult Psychiatry, Medical University of Lodz, Poland
[c] Non-public Medical Center "Akoria", Poland
[d] Department of Internal Disease, Diabetology and Clinical Pharmacology, Medical University of Lodz, Poland
[e] Department of Clinical Chemistry and Biochemistry, Medical University of Lodz, Poland
[f] Department of Medical Biochemistry, Medical University of Lodz, Poland

Background: Reduced DNA repair efficiency may be the cause of neurodegenerative disease such as Alzheimer\'s disease (AD). The aim of this study was to investigate the effect of base excision repair genes polymorphisms on level of DNA damage in AD.
Materials and Methods: To determine DNA damage level we used comet assay. The analysis of polymorphisms was performed using the TaqMan SNP Genotyping Assay. The research material was peripheral blood mononuclear cells obtained from 120 patients with diagnosed AD. The control group was 110 healthy volunteers matched with age and gender.
Results: Our research suggest positive association between AD and the presence of G/A genotype variant of XRCC1-rs25487 polymorphism (OR-3.762, CI-1.793-7.891) and the T/C variant of PARP gene rs1136410 polymorphism (OR-4.159, CI-1.978-8.745). In the case of patients with the presence of examined variants we showed greater than threefold increase in the DNA damage level compared to control.
Conclusion: The presence of the G/A genotype variant polymorphism of XRCC1 rs25487 and in the T/C variant of rs1136410-PARP gene polymorphism increases the level of DNA damage and may contribute to the development of AD.
This study was supported with funding from the scientific research grant from the Polish National Science Centre (no.DEC-2012/05/B/NZ7/03032).

11. *Association of RS703842 gene polymorphism in CYP27B1 gene with susceptibility to Multiple Sclerosis*

Peter Dubovan[a], Čierny, D.[a], Michalik, J.[b], Kurča, E[b], Lehotský, J.[a]

peterdubovan@centrum.sk

[a] Department of Medical Biochemistry, Jessenius faculty of medicine in Martin, Comenius University in Bratislava, Slovakia
[b] Department of Neurology, University hospital in Martin and Jessenius faculty of medicine in Martin, Comenius University in Bratislava, Slovakia

Background: Vitamin D regulates immune response and may improve clinical course of MS. One of the cholecalciferol activation steps is its hydroxylation to the bioactive form. Rs703842 gene polymorphism is potentially affecting the final step of this activation by altering the function of CYP27B1 gene. The aim of our preliminary study was to uncover potential role of this gene polymorphism of CYP27B1 gene in MS susceptibility.
Materials and methods: We genotyped 267 Slovak patients with MS and 62 healthy controls. DNA samples were isolated from peripheral leucocytes. DNA was amplified by PCR reaction and Rs703842 genotypes were identified by restriction analysis.
Results: We found 28,46 % incidence of allele C in MS patients compared to 34,68 % in controls. The incidence of homozygotes CC was 8,24 % in MS patients and 17,74 % in healthy individuals.
Conclusion: In our preliminary study, we find CC genotype to be significantly less prevalent in the groups of MS patients compared to controls with p = 0,0249. To confirm these findings, the role of Rs703842 gene polymorphism in MS susceptibility will be further studied in larger cohort of individuals.
This work was supported by grants VEGA 1/0213/12, 2012/30-UKMA-7 Biological and molecular markers of MS.

12. *Analysis of the polymorphic variants of genes involved in miRNA pathway and its association with pathogenesis of primary open angle galucoma*

Milena Molasy[a], Anna Walczak[a], Karolina Przybyśowska-Sygut[a], Katarzyna Szymanek[b], Jerzy Szaflik[b], Jacek Szaflik[b], Ireneusz Majsterek[a]

milenamolasy@gmail.com

[a] Department of Clinical Chemistry and Biochemistry, Faculty of Medicine, Medical University of Lodz, Poland
[b] Medical University of Warsaw, Department of Ophthalmology, SPKSO Ophthalmic Hospital, Warsaw, Poland

Introduction. Primary open - angle glaucoma (POAG) is an ocular, neurodegenerative disease, usually characterized by increased intraocular pressure. Matrix metalloproteinases are involved in extracellular matrix remodeling resulting in disrupted outflow of aqueous humor from the eye. Available data indicates that in the neurodegeneration could be involved microRNA processing machinery by affecting the level of miRNA and the level of matrix metalloproteinases.
Methods Single nucleotide polymorphisms (SNPs) of miRNA pathway genes: TARBP2, RAN, XPO5 were identified by TaqMan SNP Genotyping Assay. miRNA was isolated from blood samples of 250 patients and 250 age matched controls.
Results The statistical analysis revealed that certain SNPs of miRNA might be associated with risk of POAG. The genotype GG (rs784567) in gene encoding TARBP2 protein (p= 0.001451) and the genotype TT (rs14035) in RAN gene (p=0.040424) occur more often in people not affected by POAG. However genotype CT (rs14035) in RAN gene probably increases the risk of disease (p=0.019235). SNP (rs11077) in XPO5 presumably does not affect to the risk of developing POAG.
Conclusion Obtained results may contribute to quicker PAOG diagnosis and enable classification people to high-risk group.
The work was supported by the grant of National Science Center Poland no. 2012/05/B/NZ7/02502.

13. *ApoE genetic variants among patients with Alzheimer's disease and their closest relatives in the population of Greater Poland*

Marta Kowalska[a], Michał Prendecki[a], J. Florczak-Wyspiańska[b], U. Łagan-Jędrzejczyk[a], Wojciech Kozubski[b], Jolanta Dorszewska[a] ;

martak_89@o2.pl

[a] Laboratory of Neurobiology, Department of Neurology, Poznan University of Medical Sciences, Poland
[b] Chair and Department of Neurology; Poznan University of Medical Sciences, Poznań, Poland

Alzheimer's disease (AD) is a progressive neurodegenerative disorder that leads to production of β-amyloid (Aβ). The

best known genetic risk factor for late-onset Alzheimer's disease is the inheritance of the ε4 allele of the apolipoprotein E (apoE), although the exact mechanism is still not clear. The aim of the study was to correlate the relationship between APOE allele and AD risk among the population of Greater Poland. The study on APOE was performed on 42 patients with AD, 43 unrelated controls (UK) and 15 controls related to AD patients (RK). APOE allele was determined by RT-PCR mismatch-primer technique. The analysis of APOE status showed ε-3/ε-3 genotype to be almost 2 times more common in control group (UK: 72,1%; RK: 73,3%) than in AD patients (42,9%). The ε-3/ε-4 variant was more abundant in AD group (42.9%) as compared to controls (UK:23,3%; RK: 20%). Variant ε-4/ε-4 occurred in two AD patients and only in one unrelated control subject. The study performed on citizens of Greater Poland has confirmed that ε4 allele of APOE is a risk factor of AD. The both control groups carry the protective variants.

14. PRKN, SPR and 5-HTTLPR variants and depression symptoms in Parkinson's Disease

Michał Fidera[a], A. Oczkowska[a], J. Florczak-Wyspiańska[b], W. Kozubski[b], J. Dorszewska[a]

[a] Laboratory of Neurobiology, Department of Neurology, Poznan University of Medical Sciences, Poland
[b] Chair and Department of Neurology, Poznan University of Medical Sciences, Poland

Introduction: The most common non-motor symptom of Parkinson's disease (PD) is depression. It is believed, that in depression pathophysiology in PD may be involved both genetic factors (like 5-HTTLPR, SPR, PRKN) and serotonin (5-HT) metabolism disorders.
Aims: The aim of the study was to correlate 5-HTTLPR, PRKN and SPR variants, depression symptoms and 5-HT levels in PD patients.
Methods: The studies included 20 PD patients and 25 controls. Genotyping was performed using PCR, HRM and sequencing while 5-HT levels were determined using HPLC/EC technique.
Results: Genotype S/S 5-HTTLPR was more frequent in PD patients (35 %) compared to controls (20%) as opposed to genotype L/S (35%-PD, 56%-controls) while genotype L/L frequency was similar in both groups. Reduced 5-HT levels, probably associated with depression symptoms manifestation, was the most frequently (33%) observed in patients with genotype S/S and less frequently in patients with remaining genotype (28%-L/S, 17%-L/L). Simultaneously symptoms of depression were found in 14% of PD patients, 69% of them had changes in analyzed PARK genes [46%-PRKN, 15%-SPR (Spearman R 0.371; p <0.001), and 8% coexisted PRKN and SPR variants].
Conclusions: 5-HTTLPR, PRKN and SPR variants seem to be linked with 5-HT levels and depression symptoms in PD patients.

15. Expression and level of selected apoptotic proteins and mutations in Trp53 gene in PS/APP mice

Izabela Postrach, Agata Różycka[b], Aleksander Strugała[c], Anna Oczkowska[d], Jolanta Florczak- Wyspiańska[e], Mateusz Dezor[d], Paweł P. Jagodziński[b], Wojciech Kozubski[e], Jolanta Dorszewska[d]

i.postrach@gmail.com

[a] Poznan University of Medical Sciences, Poland
[b] Department of Biochemistry and Molecular Biology, Poznan University of Medical Sciences
[c] Department of Molecular and Systems Biology, Institute of Bioorganic Chemistry, Polish Academy of Sciences
[d] Laboratory of Neurology, Department of Neurology, Poznan University of Medical Sciences
[e] Chair and Department of Neurology, Poznan University of Medical Sciences

The aim of the study was the analysis of Trp53 gene mutations and expression, and p53, OGG1, TNF-alpha, Bax, and Bcl-2 protein levels in Alzheimer's disease model PS/APP and control mice. The studies were performed on double transgenic PS/APP and young adults and aged-match control mice. Brains of the animals were isolated and divided into three structures: cerebral gray matter (GM), subcortical white matter (WM) and cerebellum (C).
The analysis of genes mutations was performed by using DNA sequencing. Expression of genes was carried out with use of RT-PCR and the level of proteins was performed by Western blotting. Our studies showed that the frequency of mutations was almost quadrupled higher in PS/APP mice (44%), compared to controls (14%). It was shown that the expression of Trp53 gene increased only in GM and C of PS/APP mice ($p<0.05$) as compared to aged-match controls. Moreover, in GM and WM of PS/APP mice without Trp53 mutations were occurred tendency to increase p53 protein levels together with elevated Trp53 gene expression. It seems that mutations of Trp53 gene may lead to changes expression especially of this gene and levels of p53 proteins in PS/APP mice.

16. PERK inhibitors as a new pharmacological strategies for treatment of Alzheimer's disease

Wioletta Rozpędek[a], Ireneusz Majsterek[a], Łukasz Markiewicz[a], Dariusz Pytel[b c], J. Alan Diehl[b c]

viola0106@wp.pl

[a] Department of Clinical Chemistry and Biochemistry, Medical University of Lodz, Poland
[b] Department of Cancer Biology, AFCRI, Perelman School of Medicine, University of Pennsylvania, PA, USA
[c] Department of Biochemistry and Molecular Biology, Hollings Cancer Center, Medical University of South Carolina, Charleston, SC, USA

Alzheimer's disease is the progressive, age – related neurodegenerative disorder which is closely association with deposition of amyloid beta plaques and neurofibrillary tangles in nervous tissue in brain. Recent investigations suggest that mentioned disturbances are linked with Endoplasmic Reticulum stress and the Unfolded Protein Response. The main target is to decrease a misfolded protein accumulation by translation inhibition mediated by PERK kinase via phosphorylation of factor eIF2α. We selected by TR-FRET test from approximately 80.000 two compounds – potent inhibitor of PERK which were marked by numbers 2 and 8. We utilized wild type mouse embryonic fibroblasts and as a control PERK knockout cells. Next, cells were treated with thapsigargin and selected at a concentration of 50 μM . PERK activity was measured by evaluating eIF2α phosphorylation using the anti-phospho-eIF2 α specific antibody Western Blot. As a result compound 8 was more active in the cells and significant inhibition of PERK was obtained at 0.3 μM and higher concentrations. In conclusion presented experiment can contribute to better understanding of the role of PERK in neurodegenerative disease such Alzheimer's disease and discovery of PERK inhibitor. Obtained outcomes can also provide the new ways of treatment or enhance the effectiveness of standard drugs.

17. The effects of vibrasal sensory modulation on absence seizures

Sertan Arkan, Ayse Karson, Nurbay Ates

sertanarkan@gmail.com

Department of Phyisology, Kocaeli University, Turkey

Introduction: WAG/Rij is an inbred genetic rat model that exhibits absence seizures. Recent electrophysiological experiments showed hyperexcitable locus in the somatosensory cortex (SPo1) of these animals. The excitatory signals originating from this locus affect the thalamic relay and reticular thalamic nucleus, and contribute to the synchronized oscillations in cortico-thalamo-cortical pathway, which are implicated for the generation of absence seizures. We investigated deprivation of somatosensorial input to cortex in order to investigate the sensorial modulation of absence seizures.
Methods: The vibrissa of eight adult female WAG/Rij rats were trimmed and EEG electrodes were placed on their cortex. We recorded the EEG signals for 90 minutes to test the effects of the whisker modulation on spike-wave discharges (SWDs).
Results: Despite a reduction in the total duration of SWDs and an increase in the mean duration of absence seizures in the experimental group, these differences were not statistically significant.
Conclusions: This study focused on the acute effects of somatosensorial modulation on absence seziures. We did not find any effect on the generation and duration of absence seizures. Further studies can focus on the investigation of the chronic effects of somatosensorial modulation.

NEUROIMMUNOLOGY

18. Systemic inflammation at developmental stages affects the response of NPY-immunopositive cells to seizures evoked in adulthood

Paulina Cieślik, Iga Wasilewska, Emilia Kosonowska, Zuzanna Setkowicz

pa.cieslik@gmail.com

Department of Neuroanatomy, Institute of Zoology, Jagiellonian University, Krakow, Poland

Systemic inflammation may enhance epileptogenesis but it may also reduce the severity of epileptic seizures. Increases in neuropeptide Y (NPY) levels, displaying neuroprotective influences, occur in in the hippocampal formation or neocortex in various animal seizure models. The present study focuses on changes in NPY+ cell populations following seizures in brains of adult rats experiencing systemic inflammation at different stages of their postnatal development. To evoke systemic inflammation, lipopolysacchride (LPS) was injectedintraperitoneally to six- or thirty-day-old Wistar rats. At postnatal day 60, status epilepticus (SE) was induced with pilocarpine. The seizures

induced in LPS-untreated, control rats, led to significant increases in NPY+ cell populations within the neocortex and hippocampal formation. On the contrary, no such effect was detected in the group previously injected with LPS alone. The obtained results suggest that systemic inflammation evoked at the developmental period could prevent the increase in NPY+ cell population occurring in response to seizures. This might be the result of long-term changes in the nervous tissue reactivity (preconditioning), possibly mediated by various bioactive agents since LPS alone showed no influence NPY+ cells.
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19. Lack of CD8+ T or NKT cells remove immunosuppressive effect of antidepressant drugs on contact hypersensitivity reaction

Katarzyna Curzytek[a] , Monika Majewska-Szczepanik[b], Marian Szczepanik[b], Weronika Duda[a], Barbara Korzeniak[a], Marta Kubera[a]

curzytek@if-pan.krakow.pl

[a] Department of Experimental Neuroendocrinology, Institute of Pharmacology, Polish Academy of Sciences, Kraków, Poland
[b] Department of Medical Biology, Jagiellonian University Medical College, Kraków, Poland

Contact hypersensitivity (CHS) reaction induced by a topical application of hapten is a T cell-mediated antigen-specific type of skin inflammation. It has been shown that antidepressants inhibit CHS reaction, although this mechanism remain unknown. The aim of present study was to establish the effect of two-week antidepressants administration on the CHS reaction induced by picryl chloride (PCL) in B10.PL mice and in knock-out mice: TCRd-/-, B2m-/- and CD1d-/- mice. The antidepressants significantly suppressed the CHS reaction in B10.PL mice, about 50%. This effect was even stronger in TCRd-/- mice (72%). Desipramine and fluoxetine did not inhibit CHS reaction in B2m-/- and CD1d-/- mice. Moreover PCL increased metabolic activity of splenocytes, estimated by MTT test, in all four strains of mice whereas the antidepressants decreased this activity of splenocytes in B10.PL, TCRd-/- and CD1d-/- mice. The results of the present study show that antiderpressants suppress CHS reaction through the inhibitory effect on NKT and CD8+ T cells but not TCR delta cells. This study was supported by statutory funds. Katarzyna Curzytek is a holder of scholarship from the KNOW sponsored by Ministry of Science and Higher Education, Republic of Poland.

20. Impact of prenatal stress on the IGF-1 and IGF-1receptor mRNA expression in the olfactory bulbs of adult rats offspring

Ewa Trojan, Slusarczyk J., Glombik K., Sowa J., Basta-Kaim A

trojan@if-pan.krakow.pl

Departament of Experimental Neuroendocrinology, Institute of Pharmacology PAS, Cracow, Poland

Stressful events occurring early life have an influence on the development of the central nervous system. Insulin-like growth factor-1 (IGF-1) is a potent regulator of cell growth, survival and differentiation, which exerts neurotrophic, neurogenic and neuroprotective actions. Thus, it is possible that disturbances in the function of the IGF-1 system may be responsible for disturbances observed over the course of depression. The aim of the study was to examine whether prenatal stress can lead to changes in the IGF-1 and IGF-1receptor (IGF-1R) gene expression in the olfactory bulbs of adult rats offspring. Pregnant Sprague-Dawley rats were subjected to stress sessions from 14th day of pregnancy until the delivery. At 3 months of age, rats were first tested for behavioral changes (1% sucrose preference test) and 24 h later sacrificed. mRNA expression of IGF-1 and IGF-1R by RT-PCR assay were determined. Our study confirmed that adult offspring rats after prenatal stress procedure exhibit behavioral disturbances. Biochemical study shown that mRNA expression of IGF-1 and IGF-1R was significantly lower in the animal subjected to prenatal stress. It may be suggested that evoked by prenatal stress long-lasting behavioral alterations may result from IGF-1 system disturbances.
This work was supported by the statutory funds.

21. LPS-induced inflammation in young rats cause an increase in Bcl-2 protein expression level after epileptic seizures suffered in adulthood

Emilia Kosonowska, Kiełbiński M., Karwowska K., Setkowicz Z.

emilia.kosonowska@gmail.com

Department of Neuroanatomy, Institute of Zoology, Jagiellonian University, Kraków, Poland

Systemic inflammation is followed by apoptosis of brain cells mainly in the hippocampus therefore it is considered as a common risk factor for epileptogenesis. However, some scientists claim that early-age inflammation acting as a preconditioning factor may have neuroprotective effects in case of epilepsy. Bcl-2 has antiapoptotic properties and cause protection against hippocampal seizure damage. The present study focuses on the long term effect of systemic

inflammation induced on different postnatal developmental stages on hippocampal Bcl-2 expression in case of epileptic seizures induced in adulthood. Six- or 30-day-old Wistar rats were injected intraperitoneally with LPS. When became two-month-old, rats which survived inflammation were injected with pilocarpine to evoke status epilepticus and sacrificed 3 days after. Hippocampi were dissected and western blot analysis was performed to assess Bcl-2 expression level. Obtained results showed that status epilepticus induced in adult rats evoked statistically significant reduction of Bcl-2 hippocampal expression. However, LPS injection on postnatal day 30 could prevent such seizure-induced decrease. Detected changes appear to confirm a theory that LPS injection in young rats could act as a preconditioning in case of epileptic seizures suffered in adult life. However further investigations are needed to verify neuroprotective effects of Bcl-2. Supported by NCN-GRANT:UMO-2012/05/B/NZ4/02406.

22. Tianeptine modulates lipopolysaccharide-induced activation of microglial cells

Joanna Ślusarczyk, Trojan E, Głombik K, Sowa J, Basta-Kaim A

slusarczyk_j@op.pl

Institute of Pharmacology Polish Academy of Sciences, Cracow, Poland

Tianeptine is an atypical antidepressant drug with proven efficacy, but still not fully understood mechanism of action. Recently it has been suggested that tianeptine may modulate inflammatory processes, however there is a lack of data about its influence on microglia cells which are the main source of cytokines in the brain. The aim of this study was to investigate whether tianeptine may inhibit lipopolysacchride-evoked activation of microglia cells. Primary microglia cell cultures were prepared from the cortices of 1-2 days old rats. Cells were pre-treated for 30 min with different concentrations of tianeptine (0,1- 50 μM) and stimulated with LPS (100 ng/ml). Next, the expression pro-inflammatory cytokines was evaluated. Our results show that tianeptine alone had no effect on the production of cytokines. Stimulation of LPS led to increase in the TNF-α, IL-1β, IL-18 and IL-6 expression. Interestingly pre-treatment with tianeptine inhibited overproduction of all tested pro-inflammatory cytokines in the concentration range of 1-10 uM. These data demonstrate that tianeptine inhibits activation of microglia. It can be postulated that therapeutic, beneficial effect of tianeptine may be at least partially mediated by its action on microglia cells. This research was supported by statutory funds of the Institute of Pharmacology.

23. Changes in expression level of genes coding for enzymes involved in modification of polysaccharide components of perineuronal nets in the mouse cortex after photothrombotic stroke

Anna Greda, Dorota Nowicka

a.greda@nencki.gov.pl

Nencki Institute of Experimental Biology, Polish Academy of Sciences, Warsaw, Poland

Perineuronal nets are complex structures of the nervous system extracellular matrix enwrapping the subset of neurons. They stabilize existing synapses and restrict neuronal plasticity. Changes in PNNs expression were observed in perilesional area after photothrombosis and can be considered an attempt to create conditions favorable for synaptic remodeling (Karetko-Sysa, 2011). We suggest that they may result from the activity of endogenous glycolytic enzymes. We have analyzed the expression of 26 genes coding for enzymes that have capacity to modify PNNs polysaccharide components in cortical region of the perilesional area of mouse brain at 1h, 24h and 7 days after photothrombotic stroke. Quantitative RT-qPCR analysis revealed the increase in hyaluronidase 1 expression level at 24h and 7 days after photothrombosis but no change in expression level of hyaluronidase 2. Furthermore, photothrombosis induced modification in expression level of chondroitin sulfotransferases. While the increase in expression of chondroitin-4-O-sulfotranserase at 24h after stroke was observed, the increase in expression of chondroitin-6-O-sulfotranserase at 7 days after photothrombosis occurred. Our results identify certain enzyme involved in modification of PNNs components. Moreover, the study suggests changes in the 4-sulfation/6-sulfation pattern of chondroitin sulphate proteoglycans, which may be involved in the regulation of post-stroke cortical plasticity.

24. Assessment of the photothrombotic stroke localisation in the cat primary visual cortex

Joanna Borowska[a] , Maria Sadowska[a] , Jan Jabłonka[b], Andrzej Foik[c], Ewa Kublik[c], Anaida Ghazaryan[c], Wioletta Waleszczyk[c], Marcelina Szczerba[d]

joanna.borowska@student.uw.edu.pl

[a] College of Inter-Faculty Individual Studies in Mathematics and Natural Sciences,University of Warsaw, Poland
[b] Laboratory of Animal Physiology, Faculty of Biology, University of Warsaw, Poland
[c] Nencki Institute of Experimental Biology, Warsaw, Poland
[d] Faculty of Biology, University of Warsaw, Poland

The post-stroke cortical plasticity is essential for restoration of the human visual capabilities after stroke. Considering its well known organisation, cat visual system is a good model for spontaneous and supported brain reorganisation after ischemia. We used photothrombosis as the model of ischemic stroke (PtS). We reviled the performance of unilateral photothrombotic stroke induced on experimental cat by the Bengal Rose irradiated by optic bundle placed directly on the dura surface over the visual cortex on a border of the cortical areas 17 and 18. The unilateral stroke was performed in the dorsal zone of the left marginal gyrus. We used the cytochrome oxidase staining to visualize the areas of lower mitochondrial cytochrome oxidase activity in the illuminated area of the left hemisphere in comparison to the contralateral intact cortex areas. The lesion covers all the width of the marginal gyrus and partially of the sulcus area with the medial part of the dorsal posterior ectosylvian gyrus and does not spread on adjacent gyri or further blood vessels and clearly reaches the white matter. The study develops the methodology of PtS stroke induction in cats visual cortex for future studies of postroke visual cortex recovery.
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25. Subdiaphragmatic vagotomy and crowding stress affects central IL-1β response to acute restraint

Paulina Rachwalska[a], Anna Gądek-Michalska[a] , Joanna Tadeusz[a], Andrzej Bugajski[b]

rachwal@if-pan.krakow.pl

[a] Department of Physiology, Institute of Pharmacology, Polish Academy of Sciences, Cracow, Poland
[b] Department of Pathophysiology, Jagiellonian University Medical College, Cracow, Poland

During stress IL-1β level is modulated in brain structures and peripheral systems. Vagal afferents conduct information to the brain from periphery, influencing the hypothalamic-pituitary-adrenal axis. The study evaluated whether the vagus nerve is involved in stress-induced alterations of IL-1β level in hypothalamus, frontal cortex and hippocampus.
Subdiaphragmatic vagotomy or sham surgery was performed 10 days before experimental procedure. Adult male Wistar rats were exposed to 10 min restraint and decapitated immediatelly after restraint or 1, 2 and 3 hours later. Another group was subjected to crowding stress for 3 days before exposition to restraint. Western blot analyses were performed to determine the level of IL-1β in brain structures. Acute restraint decreased IL-1β level in frontal cortex, more substantially in vagotomized rats. Similary, in hippocampus restraint decreased IL-1β content, but in 1 hour after stress there was a transient increase of IL-1β level. Regardless of vagotomy hypothalamic IL-1β level increased in response to acute restraint. In priorly stressed rats, IL-1β level increased in frontal cortex and decreased in hypothalamus in response to acute restraint. Results indicate important mediation of IL-1β in stress-induced reactions and suggest that central IL-1β response to stress may be under the influence of the vagus nerve.

26. HMGB1 protein – novel prognostic biomarker in subarachnoid hemorrhage

Norbert Wąsik, Hinna Shahid

norbertwasik@gmail.com

Poznan University of Medical Sciences, Poland

Background: Subarachnoid hemorrhage is a life threatening and disabling condition. First 72 hours of brain injury are crucial for tissue oxygenation, which predicts patient survival. A proinflammatory mediator, HMGB1 protein, was found to be strongly involved in pathogenesis of cerebral ischemia. This study aims to assess prognostic value of HMGB1 in comparison to traditional biomarkers.
Methods: Ten patients with subarachnoid hemorrhage and acute hydrocephalus underwent endovascular coiling and ventriculostomy. HMGB1 level was measured in cerebrospinal fluid (csf) samples collected on 1st, 5th, and 10th day. HMGB1 level in first sample was correlated with treatment outcome assessed in Glasgow outcome scale (GOS) at 3 months. Obtained results were compared to plasma inflammatory markers, clinical grading scales and imaging grading scales.
Results: HMGB1 level in csf of subarachnoid hemorrhage patients, in contrast to control group, is significantly elevated ($p<0,001$). Good (GOS>3) and poor (GOS ≤3) outcome patients differ significantly in HMGB1 level on admission ($p<0,01$). The strongest correlation to patients' outcome was found for Hunt and Hess scale ($R=-0,88$, $p<0,01$) and HMGB1 ($R=-0.86$, $p<0.01$). Constant and high HMGB1 level of ≥10ng/ml in consecutive csf samples identifies non-survivors.
Conclusions: Our study confirms that HMGB1 protein has a high prognostic value in subarachnoid hemorrhage.

PAIN - NEUROBIOLOGICAL PERSPECTIVE

27. Is there a link between OA-related pain behavior and cartilage degradation?

Agnieszka Pająk, Magdalena Kostrzewa, Natalia Małek, Michał Korostyński, Katarzyna Starowicz

agnieszka_pajak@interia.pl

Laboratory of Pain Pathophysiology, Department of Pain Pharmacology, Institute of Pharmacology, Polish Academy of Sciences, Cracow, Poland

Background: Osteoarthritis (OA) is the progressive disease of the joints accompanied by chronic joint pain and functional disability. During pathological OA processes, progressive ECM degradation and further cartilage loss can be observed. Members of matrix metalloproteinases (MMPs) are considered to play key roles in the degradation of cartilage ECM. Therefore, the aim of our study was to determine relationship between joint pain perception and joint tissue MMPs-mediated deterioration in rat model of OA.
Methods: OA was induced in male Wistar rats by intra-articular injection of 3 mg sodium monoiodoacetate (MIA). Rats were monitored for OA-related pain symptoms by means of using two behavioral tests (DWB, PAM). Additionally, we evaluated selected genes and proteins engaged in ECM turn-over in joint tissue explants using mRNA microarrays and Western Blot.
Results: Based on the behavioral, transcriptomic and proteomic data we observed correlation between increased pain sensation after day 14th and late stage accumulation of MMPs, especially MMP-3 and MMP-13.
Conclusions: Thus, we concluded that elevated pain sensation in advanced stage of the disease might be linked with level of joint weakening. We suggest that targeting of relevant enzymes associated with OA may offer a new therapeutic strategy.
Acknowledgments: Supported by SONATABIS/NCN/2012/07/E/NZ7/01269 grant.

28. IL-1 receptor antagonist reverses the impaired efficiency of morphine and buprenorphine in a rat neuropathic pain model

Dominika Pilat, Ewelina Rojewska, Agnieszka Jurga, Anna Piotrowska, Wioletta Makuch, Barbara Przewlocka, Joanna Mika

Department of Pain Pharmacology, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

Our study investigated the potential role of IL-1 family members in reduced beneficial efficacy of opioids in neuropathy. We have studied the time-course changes, in rats after chronic constriction injury (CCI) of the sciatic nerve, of IL-1alpha, IL-1beta, IL-1R1 and IL-1Ra mRNA and protein level using qRT-PCR and Western blot analysis. In CCI-exposed rats, spinal IL-1alpha mRNA is slightly downregulated at day 7 and protein levels were not changed on day 7 and 14. The IL-1Ra and IL-1R1 were slightly upregulated in the spinal cord on day 7 and 14, however the protein level was not changed. We observed that IL-1beta mRNA and protein level were strongly spinaly elevated on day 7 and 14. Moreover, in rats exposed 7 and 14 days after CCI, single intrathecal administration of an IL-1 receptor antagonist attenuated symptoms of neuropathic pain and enhance the morphine and buprenorphine analgesia. Restoration of the analgesic activity of morphine and buprenorphine by blockade of IL-1 signaling suggests that the increased IL-1beta responses may account for the decreased analgesic efficacy of opioid observed in the treatment of neuropathic pain.
Acknowledgements: Supported by OPUS-NCN-2011/03/B/NZ4/00042 and statutory funds. A. Jurga - scholarship from KNOW sponsored by Ministry of Science and Higher Education.

29. The role of selected chemokines from the CXC group in a mouse diabetic neuropathy model

Magdalena Zychowska, Ewelina Rojewska, Dominika Pilat, Joanna Mika

zychow@if-pan.krakow.pl

Department of Pain Pharmacology, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

Diabetic neuropathy is a disease in which immunological and nervous systems are involved in its development. Currently, much attention is paid on the role of chemokines in this process. The goal of our study was to verified how the chemokines from the CXC-group varies in diabetic neuropathy and how they affect nociceptive transmission. All experiments were performed on Swiss mice and carried out in accordance to the Institute`s Bioethics Committee and IASP rules. A single intraperitoneal injection of streptozotocin (STZ; 200mg/kg) resulted in an increased plasma glucose parallel with the development of allodynia and hyperalgesia measured seven days after STZ administration by von Frey and cold plate, respectively. Using Antibody Array techniques, the increases in CXCL1, CXCL5, CXCL9 and CXCL12 protein levels were detected in STZ-injected mice, however no changes in CXCL11 and CXCL13 levels were

observed. The single intrathecal administration of CXCL1, CXCL5, CXCL9 or CXCL12 shows their pronociceptive properties as was evaluate using the tail-flick, von Frey and cold plate tests. These findings indicate that the chemokines CXCL1, CXCL5, CXCL9 and CXCL12 are important in nociceptive transmission and may play a role in the development of diabetic neuropathy. Acknowledgements: Supported by 2011/03/B/NZ4/00042, 2012/05/N/NZ4/02416, KNOW scholarship and statutory funds.

30. Analgesic effects of novel nociceptine analogues in neuropathy

Joanna Starnowska[a], Joanna Mika[a], Ewelina Rojewska[a], Wioletta Makuch[a], Karel Guillemyn[b], Steven Ballet[b], Barbara Przewłocka[a]

starnow@if-pan.krakow.pl

[a] Department of Pain Pharmacology, Institute of Pharmacology, Polish Academy of Sciences, Krakow
[b] Laboratory of Organic Chemistry, Departments of Chemistry and Bio-engineering Sciences, Vrije Universiteit Brussel, Belgium

Nociceptin/orphanin FQ (N/OFQ) receptor agonists are described as antinociceptive peptides, which was proved by our former studies on rats [Mika et al., 2004]. Nociceptine receptors (NOP) have high sequence similarity to κ-opioid receptors, but are not activated by classical opioid agonists. The nociceptine system may contribute to poor efficacy of opioids under neuropathic pain conditions in connection with their pro- and anti-nociceptive action in pain pathway. This study was to evaluate the effectiveness of novel compounds acting via N/OFQ system in attenuating typical symptoms of neuropathic pain. A novel nociceptine-based compound and its analogues were tested in mice neuropathic pain model of chronic constriction injury (CCI), proving their anti-hyperalgesic and anti-allodynic properties as measured by cold plate and von Frey test, respectively. All tests were conducted in time-course of 30', 90' and 180' after intrathecal administration of the compounds. The lumbar sections of mouse spinal cord were analyzed with qRT-PCR method to determine the changes of nociceptine and opioid receptors mRNA levels. The study contributes to search for innovative treatment approaches of neuropathic pain symptoms. Acknowledgements: MAESTRO NCN2012/06/A/NZ4/00028;statutory funds; J. Starnowska -KNOW scholarship sponsored by Ministry of Science and Higher Education, Poland.

31. The influence of maraviroc on neuropathic pain development and opioids effectiveness

Klaudia Kwiatkowski, Ewelina Rojewska, Anna Piotrowska, Wioletta Makuch, Agnieszka Jurga, Joanna Mika

kwiatkowski.klaudia@gmail.com

Department of Pain Pharmacology, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

Neuropathic pain is caused by the nervous system damage and still no optimally efficient treatment is known, therefore scientists started to focus on neuroimmune aspects. The role of CCR5 chemokine receptor in neuropathic pain development was suggested. The aim was to examine the influence of maraviroc (CCR5 antagonist) on opioids effectiveness and its associated changes in the protein and mRNA levels of CCR5 and glia markers in rat model of neuropathic pain. All experiments were performed according to IASP rules. Rats were implanted with intrathecal catheters and then we performed chronic constriction injury (CCI) of the sciatic nerve. Behavioral tests were conducted seven days after CCI to measure hyperalgesia and allodynia. The protein and mRNA levels were examined by Western blot and qRT-PCR, respectively. We provide evidence that chronic i.th. administration of maraviroc enhanced effectiveness of opioids on day 7 in CCI-exposed rats. Maraviroc diminished the protein levels of CCR5, IBA1 (microglial activation marker) and GFAP (astroglial activation marker) on day 7 post-CCI. In addition, down-regulation of CCR5, C1q and GFAP mRNA levels were observed in maraviroc-treated CCI-exposed rats. Our results suggest that CCR5 is a potential novel target for neuropathic pain drug development. Acknowledgments: NCN2011/03/B/NZ4/00042, KNOW-scholarship and statutory founds.

32. The role of microglia in opioid analgesia - in vivo and in vitro studies

Katarzyna Popiolek-Barczyk, Ewelina Rojewska, Wioletta Makuch, Katarzyna Starowicz-Bubak, Barbara Przewlocka, Joanna Mika

katarzyna.popiolek@gmail.com

Department of Pain Pharmacology, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

Neuropathic pain is a common consequence of nervous tissue damage. The mechanisms underlying neuropathy still remain unclear, and the currently available drugs are frequently ineffective, making treatment a major clinical challenge. The aim of our studies was to investigate the influence of minocycline-induced inhibition of microglial activation on the analgesic effects of opioid receptor agonists: morphine, DAMGO, U50,488H, nociceptin, DPDPE, deltorphin II and SNC80 after chronic constriction injury (CCI) to the sciatic nerve in rats. Allodynia (von Frey) and hyperalgesia (cold plate) were measured. The analgesic effects of intrathecally administered MOP, KOP and NOP

ligands were significantly potentiated in rats after minocycline, but no such changes were observed after DOP ligands administration. Our study of rat primary microglial cell culture using qRT-PCR, Western blotting and immunocytochemistry confirmed the presence of MOP, KOP and NOP receptors, further we provide the first evidence for the lack of DOP on microglial cells. In summary, DOP analgesia does not dependent on injury-induced microglial activation. DOP agonists appear to be the best candidates for new drugs to treat neuropathic pain. Acknowledgments: grants NCN OPUS-2011/03/B/NZ4/00042 PRELUDIUM-2012/07/N/NZ3/00379, KNOW-scholarship and statutory funds.

33. Progression of chronic pain due to Toll-like receptors' mediated inflammatory state and its reversion by TLR4 antagonist administration

Agnieszka Jurga, Ewelina Rojewska, Anna Piotrowska, Dominika Pilat, Wioletta Makuch, Barbara Przewlocka, Joanna Mika

jurga@if-pan.krakow.pl

Department of Pain Pharmacology, Institute of Pharmacology Polish Academy of Sciences, Krakow, Poland

Chronic pain is one of the most urgent clinical problems because of its inadequate therapy. It can be divided into inflammatory and neuropathic pain which appear after neuronal damage or during various diseases. Evidence is accumulating that Toll-like receptors (TLRs) play a significant role in pain development. We decided to explore the development of pain after injury and its biochemical course in three time points and estimate contribution of TLR2/4 in modulation and maintenance of chronic pain. Neuropathic pain was developed using CCI Bennett's model and LPS-RS (TLR2/4 antagonist) administration was provided. Biochemical analysis (WB, qRT-PCR) of the lumbar spinal cord and DRG tissue, and behavioral tests (von Frey, cold plate), were performed on Wistar rats. Experiments are in agreement with recommendations of IASP and the Local Bioethics Committee. Biochemical analysis showed gradual up-regulation of TLR2/4 and its' key downstream signaling molecules in progression of pain on both mRNA and protein levels comparing to naïve animals. Repeated intrathecal administration of LPS-RS attenuated allodynia and hyperalgesia as measured on days 2nd and 7th after injury. Our data suggest that TLRs could play role in chronic pain development. Acknowledgements: Grant-OPUS2011/03/B/NZ4/00042 and statutory funds. A. Jurga is a KNOW scholarship holder.

34. The role of chemokin receptor CCR2 under neuropathic pain

Anna Piotrowska[a], Klaudia Kwiatkowski[a], Ewelina Rojewska[a], Joanna Ślusarczyk[b], Wioletta Makuch[a], Agnieszka Basta-Kaim[b], Joanna Mika[a]

ania.piotrowska@uj.edu.pl

[a] Department of Pain Pharmacology, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland
[b] Department of Experimental Neuroendocrinology, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

Chemokines and chemokine receptors are widely expressed by immune and nervous system cells, contributing to development and maintenance of neuropathic pain. The study examined the influence of minocycline (inhibitor of microglia activation) on neuropathy development after chronic constriction injury of sciatic nerve (CCI) in rats, and on transcription levels of CCR2, CCL2 and CCL7 in lumbar spinal cord's and LPS-treated primary cultures of microglia. Additionally, we examined the RS504393 (CCR2 antagonist) analgesic properties. Minocycline (intraperitoneally, 30mg/kg) and RS504393 (intrathecally, 10μg/5μl) were administered, preemptively and then for 7 days after CCI. Allodynia/hyperalgesia were measured by von Frey/cold plate test, respectively. CCR2, CCL2 and CCL7 mRNA was marked in spinal cord and culture of primary microglia using RT-PCR. Minocycline inhibited the development of allodynia/hyperalgesia seven days after CCI, similar effects we obtain using RS504393. We have found minocycline treatment inhibited microglial activation and parallel spinal mRNA expression of CCR2, CCL2 and CCL7. In vitro primary cell culture studies have shown that CCR2, CCL2 and CCL7 are of microglial origin. These results prove that CCL2&CCL7/CCR2 signaling pathway may play an important role in neuropathic pain. Inhibition of CCR2 receptor by minocycline creates a novel approach for neuropathy. Acknowledgments: OPUS/2011/03/B/N24/00042, statutory founds, KNOW scholarship.

35. Why osteoarthritis is a disease of nervous system?

Natalia Malek[a], Magdalena Kostrzewa[a], Michal Korostynski[b]; Katarzyna Starowicz[a]

n.malek@if-pan.krakow.pl

[a] Laboratory of Pain Pathophysiology, Department of Pharmacology of Pain, Institute of Pharmacology PAS, Cracow, Poland
[b]Department of Molecular Neuropharmacology, Institute of Pharmacology PAS, Cracow, Poland

Osteoarthritis is degenerative joint disease, accompanied by chronic pain, often refractory to currently used therapy. Our aim was to determine degenerative changes spinal cord and DRG occurring with osteoarthritis development. Animal model was induced in male Wistar rats by intra-articular injection of sodium monoiodoacetate. Rats were monitored for pain symptoms by means of hindlimb dynamic weight bearing, pressure application measurements and Von Frey's test. Expression of immunological and degenerative markers in joint tissue, spinal cord and DRG of osteoarthritic rats, was evaluated using microarrays and qPCR technique.
Pro-apoptotic markers demonstrated gradual increase in joint tissue during development of osteoarthritis. That correlate with behavioral symptoms of osteoarthritis development. Signs of neuropathic pain were present only in late stage of the disease, together with high levels of inflammatory markers were present in SC and DRG of osteoarthritis rats, which indicates presence of pathological neuronal activity.
Herein we provide data supporting development of neuropathic pain in late state of osteoarthritis, which might be responsible for current treatment refractory. Our results may lead to change in treatment strategy, which can benefit in management of osteoarthritis -related pain.
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36. PD98059 influences immune factors and enhances opioid analgesia in a rat model of neuropathic pain

Ewelina Rojewska, Natalia Kolosowska, Katarzyna Popiolek-Barczyk, Magdalena Zychowska, Wioletta Makuch, Barbara Przewlocka, Joanna Mika

rojewska@if-pan.krakow.pl

Department of Pain Pharmacology, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

Neuropathic pain treatment remains challenging due to ineffective therapy and resistance to opioid analgesia. We have observed an increasing number of results showing that MAPK pathways strongly regulate neuropathic pain. The aim was to examine the influence of administration of PD98059 (inhibitor of MAPKK) on nociception and opioid effectiveness. Moreover, we examined how PD98059 influences the selected nociceptive factors. The chronic constriction injury (CCI) of the sciatic nerve in Wistar rats was performed. To evaluate allodynia/hyperalgesia, the von Frey/cold plate tests were used, respectively. The PD98059 (2.5μg,) was intrathecally preemptively and then for 7 days. At day 7 after CCI the PD98059-treated rats received morphine or buprenorphine. Using Western blot technique in PD98059-treated rats we analyzed the protein level of IL-1beta, IL-6, iNOS and IL-10 in the lumbar spinal cord. Our results indicate that PD98059 has significant analgesic effects. PD98059 single and repeated administration potentiates morphine and/or buprenorphine analgesia. PD98059 administration also diminishes pro-nociceptive factors (IL-1beta, IL-6, and iNOS) but enhances anti-nociceptive factors (IL-10). The PD98059 diminished pain and increased the effectiveness of opioids in neuropathic pain. The inhibition of MEK pathway might influences pro- and antinociceptive cytokine important for neuropathic pain development. Acknowledgements: Grant-OPUS2011/03/B/NZ4/00042 and statutory funds. K.Popiolek-Barczyk & M.Zychowska-KNOW scholarship.

37. Dual blocker of fatty acid amide hydrolase (FAAH) and transient receptor potential vanilloid Type-1 (TRPV1) channels exerts antiallodynic effects in a rat model of neuropathic pain

Mateusz Kucharczyk[a], Natalia Malek[a], Magdalena Kostrzewa[a], Fabiana Piscitelli[b], Wioletta Makuch[a], Barbara Przewlocka[a], Vincenzo Di Marzo[b], Katarzyna Starowicz[a]

mateusz.kucharczyk@uj.edu.pl

[a] Department of Pain Pharmacology, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland
[b] Endocannabinoid Research Group, ICB CNR, Pozzuoli, Italy

Endocannabinoids such as anandamide (AEA) produces effects on cannabinoid receptors (Cb1/Cb2) and also bind to vanilloid TRPV1 receptor, upon which they act as full agonists. Elevation of AEA levels by inhibiting its breakdown with fatty acid amide hydrolase (Faah) inhibitors has been shown to cause antinociceptive effects. Likewise blockage of Trpv1 receptor alleviates pain. We applied the Bennett's rat model of the neuropathic pain (CCI) to compare the role of N-arachidonyl-serotonin (AA-5-HT), a dual blocker of the Faah enzyme and a Trpv1 antagonist, with other single acting compounds and compared their antinociceptive efficacy in behavioural tests. Changes in mRNA levels of endocannabinoid system, in lumbar spinal cord and L4-L6 dorsal root ganglia post-dosing were also analyzed by qPCR and LC-MS analysis. Single acting compounds showed lower efficacy than AA-5-HT, even at higher doses Co-administrations with Cb1/Trpv1 antagonist did not fully reversed actions of AA-5-HT.. We also observed significant changes in the expression of endocannabinoid system both in spinal cord and DRG. Levels of AEA and related fatty acid amides were upregulated both in spinal cord and DRG. We proved that dual-acting compounds demonstrate greater antinociceptive efficacy, compared with those acting on single target.
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NEUROTOXICITY

38. The effect of MEHP on viability and apoptosis in mouse cortical neurons in vitro

Agnieszka M. Sitarz, Konrad A. Szychowski, Anna K. Wójtowicz

ag.sitarz@gmail.com

Department of Animal Biotechnology, Animal Sciences Faculty, University of Agriculture in Krakow, Poland

Mono-(2-ethylhexyl) phthalate (MEHP) is metabolite of one of the most popular plasticizers Bis-(2-ethylhexyl) phthalate (DEHP) used in a large variety of products including flexible PVC materials, enteric coatings of pharmaceutical tablets and household products such as paint and glues. There has been a growing concern regarding potential toxicity and endocrine disrupting effect to human associated with MEHP. The aim of this research was to investigated the cytotoxicity of MEHP and its impact on apoptosis in mouse cortical neurons in vitro. The cultures of cortical neurons were prepared from Swiss mouse embryos on 15/16 days of gestation. The cells were cultured in phenol red-free Neurobasal medium supplemented with B27 and glutamine in the presence of rising concentration of MEHP for 6, 24 and 48 h. Afterwards, lactate dehydrogenase (LDH) releases, caspase-3 activity and apoptotic bodies formation were studied. The results showed that after 6, 24 and 48 hours of exposition to MEHP the increase in LDH release was observed as well as caspase-3 activity and amount of apoptotic bodies. To conclude, MEHP enhance cortical neurons apoptosis in dose dependent manners. Support by NCN grant 2012/07/B/NZ4/00238

39. Anti-apoptotic effect of diindolylmethane in neurons undergoing hypoxia is tissue-dependent

Joanna Rzemieniec, Litwa E, Wnuk A, Lasoń W, Kajta M

rzemien@if-pan.krakow.pl

Department of Experimental Neuroendocrinology, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

The selective aryl hydrocarbon receptor modulator (SAhRM) - 3,3'- diidolylmethane (DIM) is currently used in clinical trials to inhibit prostate and breast cancer. Recent studies have shown the protective potential of DIM in in vivo and in vitro models of Parkinson's disease. However, there is no data showing properties of DIM in the hypoxia-subjected neurons. Therefore, the aim of the present study was to investigate neuroprotective effects of DIM against hypoxia-induced damage in the neocortical and hippocampal cells, with a particular focus on DIM interactions with the aryl hydrocarbon receptor (AhR) and its nuclear translocator ARNT. We have shown that DIM (0.1-10 μM) protected both hippocampal and neocortical cells against hypoxia, as evidenced by diminished level of hypoxia-induced lactate dehydrogenase (LDH) release. DIM also inhibited hypoxia-induced caspase-3 activity and reduced the protein levels of AhR and ARNT. However, DIM inhibited caspase-3 activity only in hippocampal neurons, thus suggesting tissue-specific effect. Our results provided evidence for AhR- and ARNT-dependent mechanisms of DIM-mediated neuroprotection, which may represent a novel approach for the treatment or prevention of hypoxic brain injury.

40. Retinoid X receptor is involved in apoptotic and toxic effects of dichlorodiphenyldichloroethane (DDE) in mouse embryonic neuronal cells

Agnieszka Wnuk, Rzemieniec J, Litwa E, Lasoń W, Kajta M

wnuk@if-pan.krakow.pl

Department of Experimental Neuroendocrinology, Institute of Pharmacology Polish Academy of Sciences, Krakow, Poland

Dichlorodiphenyldichloroethylene (DDE) is one of the most toxic compounds belonging to organochlorines. It is metabolic degradation product of the pesticide DDT. DDE remains in the environment because its resistance to degradation and ability to bioaccumulate in the food chain. DDE is fat soluble and accumulate in adipose and brain tissues. There is increasing body of evidence that DDE causes brain damage and disrupts neurodevelopmental processes. Data suggest that exposure to DDE is associated with mental and psychomotor retardation, impairment of cognitive skills and ADHD-like behaviors. Significantly enhanced level of DDE was detected in serum levels of patients with Alzheimer's and Parkinson's diseases.

Our study demonstrated that DDE-induced apoptotic and neurotoxic effects in the mouse primary neuronal cells involves retinoid X receptors RXRα and RXRβ. The engagement of RXRs in the actions of DDE was verified by the use of potent antagonist HX531 and supported by measurements of RXRα and RXRβ protein levels, as evidenced by ELISAs and Western Blot. Accordingly Hoechst 33342 and calcein AM staining visualized apoptotic nuclei fragmentation and impaired cell survival in DDE-treated hippocampal cells.

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41. Changes in reduced glutathione concentration after intraperitoneal injection of acrylamide

Kopańska M. [a], Kraska K.[a] , Zagata P.[b] , Semla M.[a] , Batoryna M.[a] , Formicki G.[a]

martakopanska@poczta.onet.pl

[a] Department of Animal Physiology and Toxicology, Institute of Biology, Pedagogical University of Cracow, Poland
[b] Department of Microbiology, Pedagogical University of Cracow, Poland

Reduced glutathione is is an important antioxidant. Glutathione and its metabolites also interface with energetics and neurotransmitter syntheses through several prominent metabolic pathways. In our research, we have examined acrylamide's reactions with GSH, one of the most abundant thiols in the rodents and human body. Researchers in Europe and the United States have found acrylamide in certain foods that were heated to a temperature above 120 degrees Celsius. The aim of our work was to estimate the concentration of GSH in different brain structures after acrylamide: the right hemisphere, the left hemisphere, cerebellum and brainstem. The experiment was carried out on 25 male mice of Swiss strain. The measurements were performed after 48, 72 and 192 hours after acrylamide injection in two doses – 40 mg/kg and 80 mg/kg.
Our studies indicated significant dose dependent influence of acrylamide on the glutathione concentration in different brain structures. This influence is probably connected with oxidative stress and increased production of free radicals.

42. JWH133, a novel synthetic cannabimimetic, exerts neurototoxic and genotoxic activity

Jakub Wojcieszak[a], Wojciech Krzemień[a], Anna Mereczb, Jolanta B. Zawilska[a]

jakub.wojcieszak@umed.pl

[a] Department of Pharmacodynamics, Medical University of Lodz, Poland
[b] Food Science Department, Medical University of Lodz, Poland

Background: JWH133 is a novel psychoactive substance belonging to the cannabimimetic group, which is gaining popularity in recent years. For recreational purposes, synthetic cannabimimetics are generally administered by inhalation as substitutes for marijuana.
Methods: Neurotoxicity of JWH133 was investigated in vitro on a model cell line SH-SY5Y derived from human neuroblastoma, with the aid of MTT test measuring mitochondrial activity and LDH assay evaluating cell membrane integrity. Genotoxicity was evaluated using comet assay on a human cell line RPMI 2650 derived from squamous cell carcinoma, widely applied as a model of airway epithelium.
Results: 24-Hour incubation of SH-SY5Y cells with JWH133 (10-40 μM) resulted in potent, concentration-dependent decrease of mitochondrial activity, and increase of the extracellular lactate dehydrogenase, indicating cell damage.
24-Hour incubation of RPMI 2650 cells with JWH (20 μM and 40 μM) resulted in a significant increase of the amount of DNA in comet tails from 0.54% in control group to 3.43% and 4.62%, respectively, an observation indicating damage of DNA.
Conclusions: We have demonstrated neurotoxic and genotoxic activity of JWH133, the novel synthetic cannabimimetic. Our results point that the recreational use of JWH133 can pose serious risk to the human health.
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43. Differential effect of ATM kinase inhibitor in model of hydrogen peroxide- and rotenone-induced cell death in neuronal-differentiated neuroblastoma SH-SY5Y cells

Jakub Chwastek, Danuta Jantas, Władysław Lasoń

chwastek@if-pan.krakow.pl

Department of Experimental Neuroendocrinology, Institute of Pharmacology, Polish Academy of Sciences, Cracow, Poland

The experimental data collected during the recent years point to additional functions of ATM kinase apart its involvement in DNA repair system. Recently, the engagement of this protein in regulation of cellular response to oxidative stress and mitochondrial homeostasis has been suggested. In order to widen the knowledge about the role of ATM kinase in neurodegeneration, we tested the effect of ATM specific inhibitor, KU55933 against hydrogen peroxide- and rotenone-induced cell death in retinoic acid (RA)-differentiated human neuroblastoma SH-SY5Y cells. The data showed that KU55933 (1-10 uM) when being neuroprotective against H2O2-induced cell death, it enhanced the cell damage induced by rotenone. Further qPCR analysis of ATM-related genes revealed a decrease in Atm and Atmin genes expression in both models of oxidative stress, whereas a lower Dynll1 transcript level was found only in rotenone one. Our data point to differential effect of inhibition of ATM kinase in hydrogen peroxide- and rotenone-evoked cell damage. It is not excluded that a reduction in Dynll1 gene expression could be responsible for KU-55933 mediated exaggeration of cell death induced by rotenone.

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44. Cactus pear seed oil and Argan oil phytosterols as potential new LXR agonists

Youssef El Kharrassi[a b], Mohammad Samadi[c], Tatiana Lopez[d], Thomas Nury[a], Riad El Kebbaj[a b], Pierre Andreoletti[a], Hammam I. El Hajj[a], Joseph Vamecq[e], Khadija Moustaid[b], Norbert Latruffe[a], M'Hammed Saïd El Kebbaj[f], David Masson[d], Gérard Lizard[a], Boubker Nasser[b], Mustapha Cherkaoui-Malki[a]

elkharrassiyoussef@gmail.com

[a] Laboratoire Bio-PeroxIL, Université de Bourgogne, Dijon, France
[b] Laboratoire de Biochimie et Neurosciences, Faculté des Sciences et Techniques, Université Hassan I, Settat, Morocco
[c] LCPMC-A2, ICPM, Department of Chemistry, Université de Lorraine, Metz, France
[d] CRINSERM 866, Dijon, France
[e] INSERM and HMNO, CBP, CHRU Lille, France
[f] Laboratoire de recherche sur les Lipoprotéines et l'Athérosclérose, Faculté des Sciences Ben M'sik, Université Hassan II-Mohammedia-Casablanca, Morocco

In the brain, microglia involve neuroinflammation. Indeed, these microglial cells are resident macrophages can produce inflammatory cytokines. LXR (Liver X receptor) is a controller which nuclear receptor activation inhibits NF kB-dependent gene expression in inflammation. The aim of this study was to analyze the mechanisms involved in the activation of LXR in microglial BV2 murine cells. So we evaluate the biological activities of the major phytosterols present in argan oil (AO) and in cactus seed oil (CSO) in BV2 microglial cells. Accordingly, we first determined the sterol composition of AO and CSO, showing the presence of Schottenol and Spinasterol as major sterols in AO. While in CSO, in addition to these two sterols, we found mainly another sterol, the Sitosterol. The chemical synthesis of Schottenol and Spinasterol was performed. Our results showed that these two phytosterols, as well as sterol extracts from AO or CSO, are not toxic to microglial BV2 cells. However, treatments by these phytosterols impact the mitochondrial membrane potential. Furthermore, both Schottenol and Spinasterol can modulate the gene expression of two nuclear receptors, liver X receptor (LXR)-α and LXRβ, their target genes ABCA1 and ABCG1. Nonetheless, only Schottenol exhibited a differential activation vis-à-vis the nuclear receptor LXRβ. Thus Schottenol and Spinasterol can be considered as new LXR agonists, which may play protective roles by the modulation of cholesterol metabolism.
Keywords: ABCA1; ABCG1; Argan oil; BV2 cells; Cactus oil; LXR; Phytosterols; Schottenol; Spinasterol.

EMOTIONAL PROCESSING

45. Getting to the heart of emotion regulation in youth: a study of heart rate variability, interoceptive awareness, and emotion regulation strategies

Nele A.J. De Witte[a], Stefan Sütterlin[b, c, d], Caroline Braet[a], Sven C. Mueller[a]

nele.dewitte@ugent.be

[a] Ghent University, Belgium
[b] Lillehammer University College, Norway
[c] Oslo University Hospital - Rikshospitalet, Norway
[d] University of Leuven, Belgium

In adolescence emotion regulation is still under development and there is evidence that the association between physiology and emotion regulation could predict adolescent well-being and development of psychopathology. Indeed, some studies suggest that individual differences in underlying physiology (Heart rate variability; HRV) and the subjective ability to perceive such changes in heart rate (interoceptive awareness; IA) might inform on the ability to properly regulate ones emotion. The present study investigates the relationship between HRV at rest, IA (heartbeat counting task), and self-reported habitual ER strategies (adaptive, maladaptive and external as measured by the FEEL-KJ) in 37 youngsters (21 female; Age: M = 13.29, SD = 2.00). Results showed that IA was related to the use of maladaptive emotion regulation, specifically rumination, while HRV was related to external ER (mainly support seeking). Given that age, gender or physical exercise might influence the results, all analyses were controlled for these factors. In conclusion, IA and HRV are associated with different emotionregulationprocesses independently of one another.

46. The relationship between individual differences in heart rate variability, trait anxiety and cognitive control in an emotional and non-emotional flanker task: an ERP study

Mikołaj Szulczewski[a], Tomasz Oleksy[b], Rob H.J. van der Lubbe[ac]

mikolaj.szulczewski@gmail.com

[a] University of Finance and Managment, Warsaw, Poland
[b] Warsaw University, Poland
[c] University of Twente, the Netherlands

Chronic anxiety has been associated with trait-like patterns of the autonomic nervous system activity. Heart rate variability(HRV) is generally considered as an index of parasympathetic influence on the heart, which has been linked with traitanxiety. Previous research has shown that both low HRV and anxiety are related with adverse effects in tasks that recruit executive functions. These negative effects are characterized by an enhanced influence of stimulus driven bottom-up over goal-directed top-down processes. The N2 component, which is associated with the monitoring of conflict in information processing, has been shown to be enlarged for individuals that score high on trait anxiety and for those with a low HRV. The present study investigated whether individual differences in resting HRV and trait anxiety are associated with performance changes in the emotional and non-emotional lanker task, and with dfferences in N2 component. Contrary to the predictions, trait anxiety was not related to HRV. The results showed that participants with low HRV performed the flanker tasks worse than those with high HRV, and had higher N2 amplitude. There was no relationship between trait anxiety and task performance but trait anxiety predicted N2 amplitude in congruent trials, which may be interpreted as less discriminative conflict monitoring.

47. Emotion duality model and EEG correlates of Lexical Decision Task

Kamil Imbir[a], Tomasz Spustek[b], Jarosław Żygierewicz[b]

kamil.imbir@gmail.com

[a] The Maria Grzegorzewska Academy of Special Education, Warsaw, Poland
[b] Faculty of Physic, University of Warsaw, Poland

Duality of mind perspective recently was adopted in domain of emotions by model distinguishing automatic and reflective origins of emotional processes (Jarymowicz & Imbir, 2014). The main difference between both proposed origins is mechanism of evoking them. Automatic emotions are immediate reactions to the stimulation whereas reflective require language based appraisals. We wanted to check if factors like origin and valence of emotional words influence ERPcorrelates of Lexical Decision Task performance. To do so we constructed factorial manipulation based on words taken from Affective Norms for Polish Words (Imbir, 2014). We contrasted 3 levels of valence (Negative, Neutral and Positive) with 3 levels of origin (Automatic, Control and Reflective) controlled for concreteness, frequency of appearance and length . Pseudowords were matched in length and created by subtracting some letters from existing words, then chosen by judge competent. 36 individuals18 women) were invited to the study and asked to decide if presented word is a natural word or pseudoword. We found that amplitude was modulated at a tame range of 260-400 ms by valence of presented words and interaction between valence and arousal.

48. The role of the prefrontal cortex in automatic and voluntary affective modulation – an effective connectivity study

Tomasz Ligeza[a], Miroslaw Wyczesany[a], Agnieszka Tymorek[b]

tsl@poczta.fm

[a] Psychophysiology Lab, Institure of Psychology, Jagiellonian University, Krakow, Poland
[a] Insittute of Zoology, Jagiellonian University, Krakow, Poland

As yet, neuroscience has focused mainly on volitional forms of emotional control. However, growing evidence shows that emotional control may be also based on automatic regulatory mechanisms. Both mechanisms are reflected in prefrontal activations – they act in parallel to simultaneously inhibit the activity of the emotional brain areas. Little is known how these control instances affect visual and attentional areas, which may be considered as an early stage of affective modulation. The aim of this study was to identify effective connectivity patterns distinguishing these two forms of emotional control. The Directed Transfer Function was applied to EEG recordings to quantify the direction and intensity of information flow during passively watching (automatic control) or reappraising (volitional plus automatic control) negative film clips. Successful reappraisal was mostly associated with increased top-down influences from the right dorsolateral PFC (DLPFC) over attentional and perceptual areas, modulating the initial stages of emotional processing. Passively watching clips triggered monitoring processes with increased flows from attentional areas to the left DLPFC. Results point to the DLPFC as the control center with apparent lateral specialization: while the right hemisphere was associated with voluntary control, the left one was, to a greater extend, was associated with automatic monitoring processes.

49. Individual differences in the tendency to ruminate and emotional control circuit - EEG effective connectivity study

Magdalena Ferdek, Miroslaw Wyczesany

magdalena.ferdek@gmail.com

Psychophysiology Laboratory, Jagiellonian University, Krakow, Poland

Depressive ruminations are repetitive thoughts associated with symptoms, causes and consequences of one's negative feelings. Tendency to ruminate is a predictor of depressive episodes and is related to the impaired emotional control. Theemotional control circuit is comprised of regulatory loop between the frontal cortex structures and limbic regions. The aim of this study was to explore the characteristics of this regulation circuit which differs between RUMINATORS (hightendency to ruminate) and NON¬RUMINATORS (low tendency to ruminate). Participants were assigned to one of the two groups based on the Ruminative Responses Scale score. The Directed Transfer Function was used to assess effectiveconnectivity between selected cortical areas. The EEG data were collected during induced depressive ruminations and compared with positive and neutral conditions. It was hypothesized that RUMINATORS comparing to NON-RUMINATORS are characterized by decreased information flow from the dorsolateral prefrontal cortex to the paralimbic temporal area and from dorsolateral prefrontal cortex to anterior cingulate cortex, especially in the depressive rumination condition. Indeed, the connectivity strength from the dorsolateral prefrontal cortex to the temporal area was decreased in RUMINATORS. Less information flow from prefrontal regions to limbic cortices may be related to the ineffective, cognitive control of one's emotional state.

50. The menstrual cycle modulates the engagement of visual attention by emotional images. An eye-tracking study

Joanna Pilarczyk, Emilia Schwertner, Michał Kuniecki

joanna.pilarczyk@uj.edu.pl

Psychophysiology Lab, Institute of Psychology, Jagiellonian University, Krakow, Poland

Variations in hormone levels across the menstrual cycle affect women's mood, cognition and behavior. Particularly, during the pre-ovulatory (follicular) phase women are more sensitive to reproductively-relevant stimuli, while in the post-ovulatory (luteal) phase they are sensitive to stimuli related to risk of pregnancy termination. The engagement of attention by evolutionary-relevant stimuli measured using eye-tracking should reflect changes in this sensitivity. Female participants (N=20) were tested twice, first in the luteal and then in the follicular phase, or vice-versa. Progesterone level was measured from saliva sample. One hundred and twenty images from six evolutionary-relevant categories were presented: Children, High-calory food, Low-calory food, Threat, Disgusting objects, and Erotic scenes. Images were segmented to key region (e.g., figure of an aggressor in case of Threat) and background. Eye movements were recorded during 5-second presentation of each image. Number of fixations in the key region were compared in the two menstrual phases. In the luteal phase first fixation fell more often in the key regions of Children ($t(19) = 2.4$, $p = .026$) and Threat images ($t(19) = 3.0$, $p= .007$) than in the follicular phase. This tendency was sustained during following fixations in case of Threat; $t(19) = 2.2$, $p=.042$. Phase of the menstrual cycle influenced automatic and rapid capture of attention, as it modulated chance of the first fixation being drawn towards meaningful objects. In the luteal phase woman might be pregnant, which may cause enhanced attending to children and facilitation of detecting danger. The tendency to avoid risk is also reflected by sustained attention towards threatening objects.

51. Emotional content modulates response inhibition and error monitoring: Neural and behavioral data

Magdalena Senderecka

magdalena.senderecka@uj.edu.pl

Cognitive Science Department, Jagiellonian University, Krakow, Poland

The aim of the present study was to determine the effect of emotion on response inhibition and error monitoring using event-related potentials. Thirty-seven right-handed students, aged between 20 and 25 years, participated in the study. Participants performed an emotional stop-signal task that required response inhibition to aversive and neutral auditory stimuli. The behavioral data revealed that aversive sounds facilitated inhibitory processing by decreasing the stop-signal reaction time and increasing the inhibitory rate relative to neutral tones. The perceptual processing of affectively significant stop-signals resulted in a larger and earlier N1 auditory component. The N2 component was reduced in the emotionalstop-signal condition, suggesting there was a smaller conflict between the go and inhibitory responses. Aversive sounds evoked a stronger and faster P3 relative to neutral tones, indicating an improvement in cognitive control operations. The Pe component associated with error monitoring was markedly larger and faster in emotional than neutral trials, suggesting a more effective conscious evaluation of errors, or more intense affective

processing related to erroneous responses. Prioritized perceptual processing of the stop-signal was associated with better conscious error monitoring. These results support the hypothesis that task-relevant aversive stimuli improve executive function due to the prioritization of emotional content processing.

52. Happy and blind to response errors? New insights from error-related event-related-brain potentials

Katharina Paul[a], Jasmina Bakic[a], Wioleta Walentowska[b,a], Gilles Pourtois[a]

katharina.paul@univie.ac.at

[a] Psychopathology and Affective Neuroscience Laboratory, Ghent University, Belgium
[b] Psychophysiology Laboratory, Jagiellonian University, Krakow, Poland

Human behavior is characterized by large flexibility: within less than a second, mismatches between actions and intentions can be detected to adapt behavior. While many studies have focused on influences of negative affect on goal-adaptive behavior, little is known about effects of positive affect, and whether they are deemed beneficial or detrimental. To address this question, we used a standard (positive) mood induction procedure (based on guided imagery) and asked participants to perform a speeded Go/no-Go task, while 64-channels EEG was recorded. Results showed that the ERN component, reflecting early error detection, was not influenced by positive mood. In contrast, the subsequent Pe component, related to the conscious appraisal of errors, was topographical reliably reduced in amplitude in the happy relative to the neutral mood group. Complementing source localization analyses showed that this effect was explained by a decreased activation within the right parietal lobule. These findings challenge existing literature: While negative affect is characterized by overactive ERNs, our results show that happy mood modulates the conscious appraisal of response error selectively (Pe), while leaving the early error detection process (ERN) unaltered. Moreover our ERP results indicate that positive mood influence error monitoring processes via changes in attention control mechanisms.

53. Reward motivation impacts the primary visual cortex

Mareike Bayer[a], Annika Graß[a], Valentina Rossi[b], Naomi Vanlessen[b], Gilles Pourtois[b], Annekathrin Schacht[a]

mbayer@uni-goettingen.de

[a] Courant Research Centre Text Structures, University of Göttingen, Germany
[b] Psychopathology and Affective Neuroscience Laboratory, Dept. Experimental-Clinical and Health Psychology, Ghent University, Belgium

Monetary reward has proven to be a powerful way to improve human task performance by directing attentional resources. The present study aimed to investigate whether this effect could be traced back to the activity of the primary visual cortexas indexed by the C1 component of the event-related potentials. Additionally, we analyzed pupillary reactions as an indicator of cognitive resource allocation. Participants performed a demanding pattern discrimination task on shortly presented peripheral stimuli while maintaining central fixation. Importantly, a cue presented 0.9 s before the stimulus provided information whether a) the peripheral stimulus would be presented in the upper or lower visual field (spatial cueing); and whether b) a trial was reward-relevant (meaning that participants could gain/lose money depending on their performance), or not. Results showed that reward/loss prospect increased C1 amplitudes. Spatial cueing did not affect this component, but decreased reaction times, especially in reward-relevant trials. Pupil dilations were increased for both reward-relevant and uncued trials, indexing increased resource allocation. This indicates that both reward/loss prospect and spatial cueing impact resource allocation and reaction times. However, only the first, but not the latter, is able to alter attentional processing already in the primary visual cortex.

54. Cross-modal comparison of event-related brain potentials to emotional meaning in written and spoken language processing

Annika Grass, Wiebke Hammerschmidt, Annekathrin Schacht

agrass@gwdg.de

Courant Research Centre Text Structures, University of Göttingen, Germany

Language is comprised of two domains: speech and writing. While plenty of studies investigated the influence of emotionalmeaning on the different stages of written word processing, such evidence is scarce for spoken words, even thoughspoken language may play a more important role in human communication. In the present study, the processing ofemotional words in two modalities was compared by means of event-related brain potentials (ERPs). In a 1-back task, participants were presented with identical words that were either written or spoken by a human voice. For written words, emotion effects were evident in ERP components previously shown to be modulated by emotional content: the early posterior negativity (EPN) and the late positive complex (LPC). In the auditory domain, word

processing elicited effects ofemotional meaning in ERPs, starting around 260 ms after word onset. Interestingly, ERP differences for spoken words ofemotional content between 364 and 491 ms showed highly similar topographies to the visual EPN. The activation underlying both EPN difference waves seem to trace back to a boost in modality-specific areas which should be clarified by a source localization.

55. Erotic subset for the Nencki Affective Picture System (NAPS ERO) and its application to neuroscience research

Małgorzata Wierzba[a], W. Ł. Dragan[b], M. Gola[c], M. Riegel[a], K. Jednoróg[d], A. Marchewka[a]

m.wierzba@nencki.gov.pl

[a] Laboratory of Brain Imaging, Neurobiology Center, Nencki Institute of Experimental Biology, Polish Academy of Sciences, Warsaw, Poland
[b] Faculty of Psychology, University of Warsaw, Poland
[c] Institute of Psychology, Polish Academy of Sciences
[d] Laboratory of Psychophysiology, Nencki Institute of Experimental Biology, Polish Academy of Sciences, Warsaw, Poland

Evidence from neuroscience research revealed that sexual stimuli possess high priority in human cognition (Costumero et al., 2013). Although sex differences in response to sexual stimuli were widely discussed (Gorgiadis et al., 2012), relatively little consideration was given to the sexual orientation (Hu et al. 2011; Sylva et al., 2013). Since the availability of suitable experimental material is rather limited (Jacob et al., 2011), the Nencki Affective Picture System (NAPS, Marchewka et al., 2014) has been supplemented with 200 standardized arousing erotic pictorial stimuli profiled for heterosexual and homosexual males and females. 200 erotic images were chosen to represent the following categories: Single Woman, Single Man (depicting individuals in an erotic setting), Hetero, Gay and Lesbian (depicting couples engaging in different forms of sexual activity). 40 heterosexual (20 F, 20 M) and 40 homosexual (20 F, 20 M) subjects aged 18-35 were invited to rate the images on the scales of valence and arousal. The comparison of ratings obtained from different groups revealed that evaluation oferotic content depends essentially on recipient's sexual orientation and gender. Preliminary data and potential applicationof NAPS ERO to neuroscience research will be discussed. The NAPS ERO subset can be accessed at http://naps.nencki.gov.pl.

56. Deficits in monitoring underlie hallucinations-like experiences in normal population

Ewelina Cichoń, Remigiusz Szczepanowski

ecichon1@st.swps.edu.pl

University of Social Sciences and Humanities, Faculty in Wroclaw, Poland

Recent cognitive approaches in the conceptualization of psychotic symptoms suggest that hallucinations may reflect a bias in monitoring internal events that is influenced by meta-level processes (metacognition) including beliefs and expectations. To test such hypothesis we examined relation between metacognitive factors and hallucinations-like experiences in response to threat-related information in normal population (N=62). Having participants performed a backward masking task with subliminal fearful faces (33ms) we examined relation between confidence measures and hallucination proneness measured by the Polish version of the Revised Hallucination Scale. Our preliminary results showed that metacognition was negatively associated with auditory hallucination-like experiences indicating that hallucination phenomena may be implicated by monitoring abnormality. These findings are in accordance with a neuropsychiatric view on metacognition in psychosis suggesting that monitoring deficits in schizophrenic patients develop as the effect of dysfunction in prefrontal regions in the brain that are neural basis of Self-related component of metacognition.

57. Sex differences in relation between ADCYAP1R1 polymorphisms and brain structure and function

Wojciech Dragan[a], Piotr Czerski[b], Artur Marchewka[c]

wdragan@psych.uw.edu.pl

[a] Faculty of Psychology, University of Warsaw, Warsaw, Poland
[b] Laboratory of Psychiatric Genetics, Poznan University of Medical Sciences, Poznan, Poland
[c] Laboratory of Brain Imaging, Neurobiology Center, Nencki Institute of Experimental Biology, Warsaw, Poland

Introduction: Pituitary adenylate cyclase-activating polypeptide (PACAP) and its receptor (PAC1) are involved in orchestrating behavioral stress responses. Recently, gender-specific relation of variation in ADCYAP1R1 gene (coding for PAC1) to PTSD has been found. Method: We performed structural and functional MR imaging in a group of 48 participants (25 men and 23 women) selected on the basis of genotype at ADCYAP1R1 locus (rs2267732). Participants underwent functional scans while facing a reliable psychosocial stressors (the Montreal Imaging Stress

Task, MIST). Whole brain imaging was performed with a 3-Tesla MRI scanner (Siemens Magnetom Trio TIM, Erlangen, German) equipped with 32-channel phased array head coil. Results and Discussion: We found that rs2267732 polymorphism modulates the gray matter volume differently in men and women. We also found sex specific association between SNP and brain activation patterns during MIST paradigm.Differences were observed within two clusters. The first one incorporated the right and left medial frontal gyrus, the right insula and the right middle frontal gyrus. The second encompassed the right superior frontal gyrus and the right and left cingulate gyrus. We postulate that ADCYAP1R1 variation may modulate emotion regulation and threat appraisal processes thus affecting the proneness to PTSD.

ATTENTION, MEMORY, LEARNING, & HIGHER COGNITIVE FUNCTIONS

58. Sex, handedness and lateralization of attention

Małgorzata Gut[a, b], Magdalena Kozłowska[c]

malgorzata.gut@gmail.com

[a] Nicolaus Copernicus University, Toruń, Poland
[b] Centre for Modern Interdiscyplinary Technologies, Toruń, Poland
[c] University of Finance and Management, Warsaw, Poland

It is well known that some cognitive functions are lateralized in the brain, also orienting and executive attention. This brain asymmetry patterns differentiate males and females as well as left- and right-handers. We examined the effect ofhandedness and sex on the reaction time (RT) and percentage of correct responses (PCR) with the Lateralized AttentionNetwork Test (LANT) paradigm. Each trial consisted of the congruent or incongruent stimulus proceeded by lateralized or central cue (to study orienting and executive attention). Additionally, the stimuli were presented on the left or right side (in order to study these attention networks for each hemisphere separately). The results revealed main effect of congruency: faster and more correct responses to congruent stimuli; and side: shorter RTs to stimuli displayed on the left. Moreover, we obtained significant interaction for RTs between side and sex: males responded faster to stimuli displayed on the left than these on the right; side and handedness: only left-handers responded faster to stimuli displayed on the left than these on the right; and interaction for PCRs between congruency and side: the significant difference between PCR to congruent and incongruent stimuli was obtained only in case of left side presentations.

59. Leftward bias in gymnastic exercise and spatial attention

Piotr Wolski[a], Leon Biskup[b], Małgorzata Wolna[a], Jan Blecharz[b]

piotr.wolski@uj.edu.pl

[a] Institute of Psychology, Jagiellonian University, Krakow, Poland
[b] University of Physical Education, Krakow, Poland

We have measured performance asymmetry in gymnastic exercise in 70 male freshmen of the University of Physical Education in Krakow. The students performed forward and backward jumps off the box with or without rotation, aiming to land at a spot marked on the floor. The distance from the target and lateral deviation were measured. We found a consistent group level leftward bias, inversely related to targeting precision. The size of the bias was linearly related to the jump difficulty. The students were tested individually at the side of the gymnastics hall while the rest of the group was working-out. This asymmetric distraction could have been responsible for the bias we observed. To check for that possibility, we conducted a replication having each participant perform the exercises with the distraction to the left or to the right. Again we found theleftward side bias proportional to difficulty. The effect was mostly unaffected by the spatial location of the distraction. Either attentional (pseudo-neglect), or motivational (left frontal involvement in approach motivation) brain asymmetries have been hypothesized to be at play in behavioral asymmetries in sports. The immunity of the bias to spatial attentionmanipulation seems more compatible with the latter than the former explanation.

60. Age-related alterations in attentional set-shifting

Dominika Radziun, Maksymilian Korczyk, Aleksandra Gruszka-Gosiewska

nika.radziun@gmail.com

Jagiellonian University, Krakow, Poland

Learned irrelevance and perseveration are mechanisms thought to be responsible for diffiuculties in attentional set-shifting in both healthy participants and various patient populations. Previous studies have suggested that

perseveration, but not learned irrelevance, is particularly prone to the age-related decline. Thus, in this study, inconstancy of these processes during lifespan was investigated. A group of 19 young participants (aged 19-25), and a group of 19 older participants (aged 45-75), performed the visual discrimination task modelled after Wisconsin Card Sorting Test, designed specifically to isolate the effect of learned irrelevance and perseveration. In line with the previous studies, it was hypothised that age related decline would be observed in case of perseveration but not in case of learned irrelevance. Analysis of contrast run to obtain a significance test directly reflecting the hypothesis revealed that the older group committed significantly more errors than the younger participants but only under the perseveration 'overcoming' condition ($F(1,38)=7,73$, $p<0.008$). This result is consistent with the hypothesis, implying that learned irrelevance and perseveration constitute two cognitively distinct processes.

61. Investigation of ERP components in the Eriksen Flanker task

Patrycja Kałamała, Jakub Szewczyk, Magdalena Senderecka, Joanna Durlik, Zofia Wodniecka

patrycja.kalamala@gmail.com

Psychology of Language and Bilingualism Lab, Institute of Psychology, Jagiellonian Univeristy, Krakow, Poland

ERP studies on go/no-go tasks typically report a centro-frontal N2 component to no-go trials. Based on these experiments, centro-frontal N2 started to be interpreted as reflecting inhibitory control. ERP studies of a different task, Eriksen Flankertask also reported N2 component to incongruent trials, based on the interpretation that the two tasks tap upon a similar control mechanism. However, a careful review of the Flanker ERP literature reveals that the "N2" component has wildly varying scalp distribution and time-course, undermining its labelling as "the N2". We ran a large-sample study (58 participants tested three times over two years) in which we had participants perform Eriksen Flanker task while recording their EEG. Contrary to the literature, we found no sign of N2. Instead, we found a frontal positivity for incongruent trials in the 200-300ms, followed by the P3b. We discuss possible interpretations of the frontal positivity, in the context of differences between tasks measuring various aspects of inhibitory control.

62. The effect of parental loss on cognitive and affective interference in adolescent boys from a post-conflict region

Sven Mueller, Rose Baudoncq, Maarten De Schryver

sven.mueller@ugent.be

Ghent University, Belgium

Little is known about the impact of early-life stressors such as parental loss on cognitive-affective processing during adolescence, especially in regions chronically affected by war and armed conflict. Here, we tested 72 male adolescents living in Northern Uganda (ages 14-19), 52 of whom still had both of their parents and 20 participants who had experienced parental loss. Participants completed a classic color-naming Stroop task as well as an affective interferencetask, the opposite emotions test (OET). Adolescents with parental loss showed a decrease in performance over time, especially on the Stroop task. Critically, this decrement in performance was positively associated with reported symptoms of trauma, but only in the parental loss group. The current data suggest a difficulty in maintaining cognitive control performance in youths with experience of parental loss. The findings are discussed in relation to traumatic stress and mental health in post-conflict regions.

63. The effect of stimulus modality on memory processing

Aurélie Manuel Stocker[a], Armin Schnider[a,b]

aurelie.manuelstocker@hcuge.ch

[a] Laboratory of Cognitive Neurorehabilitation, Department of Clinical Neurosciences, University of Geneva, Switzerland
[b] Division of Neurorehabilitation, Department of Clinical Neurosciences, University Hospital of Geneva, Switzerland

How the brain efficiently handles items in working memory to further consolidate them is still largely unresolved. While immediately repeated stimuli are better recognized than stimuli repeated after a delay, this comes at the price of less efficient long-term retention. Recent EEG studies showed that immediate repetitions of meaningful pictures in a continuous recognition task were processed with different timing (200-300ms) and in different areas (left medio-temporal lobe; MTL) than were delayed repetitions or new items. Here, we tested whether stimulus' modality affected encoding and the transition from short- to long-term memory. Participants performed the continuous recognition task with abstract verbal and non-verbal stimuli. Our results showed that there were differences in the timing and localization according to modality. Immediate repetitions were processed in a specific way: non-verbal immediate repetitions induced a specific electrocortical response at 200-280ms in temporal areas while verbal immediate repetitions showed specific activity in frontal areas at 500ms. At post-test after 30 minutes, there were

electrophysiological differences regarding modality but independently of whether stimuli had been repeated immediately or after intervening items. Altogether, our results show that memory processing differs according tomodality. The seaming absence of MTL activity in this study might reflect wider temporal dispersion for processing abstract stimuli than for concrete stimuli as used in previous studies.

64. Influence of a working memory task on resting state functional connectivity

Raphaël Thézé, Adrian G. Guggisberg, Louis Nahum, Aurélie L. Manuel, Armin Schnider

raphael.theze@hcuge.ch

Laboratory of Cognitive Neurorehabilitation, Division of Neurorehabilitation, Department of Clinical Neurosciences, University Hospital and University of Geneva, Switzerland

Brain activity is highly organized into large-scale coherent networks across various frequencies. Those networks can be observed during active tasks, such as a memory task, or during a task-free resting state. Recent studies have shown that behavioral task performance depends not only on the neural synchronization during tasks, but also on resting-statesynchronization. Here we investigated whether cognitive processes during a memory task have after-effects on synchronized activity during a resting-state after the task. High-density electroencephalograms were recorded at rest from 17 healthy subjects, before and after they performed a continuous recognition task. We compared the recordings prior to and following the task. Preliminary results show that functional connectivity between the right insula and the rest of the cortex was higher in the alpha and beta bands after the memory task than before. Also, overall task performance was correlating with coherence levels in the same area and frequency band prior to the task. Our findings suggest that working memory tasks can leave imprints on cross-regional neural synchrony which persists to some extent after the task. Future studies will need to address the mechanisms and role of such after-effects.

65. UnREST during REST: Suppressing Mind-Wandering for Better Memory Consolidation

Samarth Varma, Sander Krewinkel, Lily Fu, Roy Kessels, Sander Daselaar

s.varma@donders.ru.nl

Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, The Netherlands

By virtue of ceaseless hippocampal plasticity, implicit or explicit learning and recall can cause forgetting. These can be real-life sensory distractions; incidental learning such as passive listening, reading a newspaper; or intentional learning of semantically conflicting lists in a laboratory. Despite that, declarative memories have been shown to consolidate well during periods of quiet wakeful REST, even in MCI and AD patients. However, REST is not that restful after all. Default Mode Network (DMN) research has shown that REST is a period of high cortical activity involving spontaneous autobiographical thinking and self-monitoring. As such, periods of REST can cause internally generated interference to consolidation of recently encoded items. This research aims to minimize this activity using a post-encoding, non-semantic working memory task that requires minimal encoding and retrieval: the n-Back task. We present a counterbalanced within-subject design where participants incidentally encode lists of word-picture pairs prior to 12mins of REST or an n-Back task. By minimizing mind-wandering through n-Back performance, we demonstrate increased episodic memory performance as compared to equivalent periods of quiet REST. Our findings suggest that memories are better consolidated when interference caused by spontaneous DMN activity during REST is suppressed by an engaging non-semantic task.

66. Effortful semantic decision-making boosts memory performance in older adults

Lily Fu, Samarth Varma, Roy Kessels, Sander Daselaar

l.fu@donders.ru.nl

Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, The Netherlands

In current times, finding effective cognitive mediation therapies to counteract the effects of aging are crucial. There is a tremendous increase in longevity. This impacts our retirement age, and consequently, age-related performance decline on the work floor. One of the major age-related deficits concern a decline in episodic memory, the encoding, storage and retrieval of personally-experienced past event. Previous research shows that 'semantically' processed, as compared to 'perceptually' processed information, is retained better. Additionally, a positive relationship between cognitive effort and memory performance has been reported. To investigate the influence of two factors on episodic memory in the ageing population, we manipulated the level of processing (semantic vs. perceptual) and cognitive effort (difficulty) in an incidental encoding task. Memory performance was later tested employing a recognition task. Results (20 young, 21 older adults) show a positive effect of semantic encoding and increasing task-difficulty for both groups. Yet, as compared to the young, older adults seem to take greater advantage from the more effortful semantic conditions boosting their memory performance to the level of younger adults. In conclusion, we show that older adults can benefit from effortful semantic strategies for episodic memory.

67. Episodic Memory Decline in Older Adults: The Inhibition-Deficit Theory

Syanah Wynn, Samarth Varma, Lily Fu, Ole Jensen, Roy Kessels, Sander Daselaar

s.c.wynn@outlook.com

Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, The Netherlands

One of the main complaints in older adults (OAs) are deficits in memory. According to the inhibition-deficit theory (IDT), memory deficits in OAs are the result of a reduced capacity to inhibit irrelevant information, at the expense of attending to relevant information. While IDT has received support in the working memory domain, the link between IDT and episodic memory – memory for personally-experienced events – is still unclear. The current study explores this topic using an incidental encoding task (manmade or natural decisions). Three types of trials are presented: word, picture and inhibition trials. In the word and picture trials, a single word or picture will be presented. In the inhibition trials, a target word (manmade/natural) will be presented together with a distracting, to-be-ignored, picture in the background. This paradigm allows showing that OAs have more difficulties inhibiting distracting pictures than younger adults (YAs) by looking at subsequent memory performance. In line with IDT, we expect OAs to be less able to inhibit irrelevant pictures, and therefore will remember more of the pictures as compared to YAs. Initial results are in line with our prediction. This is the first study indicating that age-related inhibition deficits also play a role in episodic memory.

68. Age-related differences in auditory working memory: an ERP study

Kamila Nowak, Anna Dacewicz, Anna Bombińska, Elżbieta Szeląg

ka.nowak@nencki.gov.pl

Nencki Institute of Experimental Biology, Warsaw, Poland
University of Social Sciences and Humanities, Warsaw, Poland

Working memory (WM) impairment is one of the most pronounced symptom of cognitive aging. This study investigates neural correlates of auditory WM in healthy aging using the ERP method.
Thirty three healthy volunteers (15 young , aged: 21-29 years; 15 elderly, aged: 65- 74 years) performed the auditory N-back task during the EEG recording session. The task was to press a button whenever the presented syllable was identical as the previously presented one (N1-back condition) or as one before last (N2-back condition). A set of 30 syllables, equal in loudness and duration was used as stimuli.
Preliminary analysis of the psychophysical data revealed age-related differences in the number of correct answers (hits) in N2-back task. It was significantly lower in elderly than in young participants, which confirmed declined auditory WM in elderly people. ERP results revealed differences in N100 topography between the two age-groups. The highest amplitude of N100 in elderly participants was registered over the left hemisphere, whereas, in the young group the topography of the peak was central. Such result may suggest that age-related differences in N-back task may be associated with differences at early stages of coding of incoming stimuli. Supported by the grant: INNOTECH-K1/IN1/30/159041/NCBR/12

69. Relation between working memory capacity, burnout and engagement in university students - a pilot study

Konrad Kulikowski[a], Katarzyna Potasz-Kulikowska[b]

konrad.kulikowski@uj.edu.pl

[a] Institute of Psychology, Jagiellonian University, Krakow, Poland
[b] Jagiellonian University Medical College, Krakow, Poland

Engagement in studying (SE) is characterized by vigor, dedication and absorption whereas students' burnout (SB) is described as exhaustion, cynicism, and reduced efficacy. There is a grow field of research on SE and SB in relation to academic performance and well being but still a little is known about their links with cognitive functioning. The aim of thisstudy was to analyze a relationship between working memory capacity (WM) and SE, SB. To asses WM (processing and storage components) we used: AutoOSPAN task (AO), n-back task with a letter stimuli (NBL) and with shapes stimuli (NBS). To asses SE, SB two questionnaires were used: Maslach Burnout Inventory for students and Utrecht WorkEngagement Scale–Students. Study involved 20 students (mean age 22). There was no relationship between NBL and SE, SB. There was significant negative relationship between numbers of NBS false alarms and dedication (Spearman\'s rho ρ=-0,501). There was significant positive relationship between numbers of AO math accuracy errors and dedication (ρ=0,531) and SE (ρ=0,545) but negative relationship whit exhaustion (ρ=-0,531) and cynicism (ρ=-0,734). This study demonstrates for the first time a possible relation between Wmcapacity and SE, SB. Interestingly, processing but not storage components of WM shows some significant link with SE, SB.

70. Visual and phonological aspects of working memory - the same or different mechanism?

Katarzyna Potasz-Kulikowska, Konrad Kulikowski

katarzyna.potasz@uj.edu.pl

Jagiellonian University Medical College, Krakow, Poland

There are two main theories describing working memory (WM). The first, Baddeley's WM theory, includes a central executive system and two modality-specific slave stores: phonological loop (remembering letters, words) and visuospatial sketchpad (remembering shapes). The Cowan's theory describes WM as homogeneous term and part of long-termmemory. WM is the active piece of information in particular time; attentional processes let us be aware of these. The aim of our study was to analyze the possibly mechanisms of WM. We used n-back task (N=2, 3, 4) with letters and unfamiliar shapes (19 participants). There was significant statistical difference (Wilcoxon test) in numbers of correct responses between shapes and letters stimuli for 2N condition: shapes Me=14 vs letter Me=18, p=0,005; for 3N condition shapes Me=9,5 vs letter Me=14, p=0,005; for 4N condition shapes Me=9 vs letter Me=10, p=0,029. Surprisingly, there was no difference in correct responses time between shapes and letters for 2N condition: shapes Me=674 vs letter Me=643, p=0,198; for 3N condition shapes: Me=919 vs letter Me=828, p=0,126; for 4N condition: shapes Me=853 vs letter Me=835, p= 0,091. Different accuracy in processing phonological andvisual stimulus may suggest different mechanisms underlying these aspects of WM. However, comprehensive discussion on the background of current researches is required.

71. The gap between time and space: The effect of temporal gap on binding within an episode in episodic memory

Dominika Kras[a], Kevin Allan[b]

dominika.j.kras@gmail.com

[a] Wroclaw University, Poland
[b] University of Aberdeen, Scotland, UK

The question of how episodes, the components of episodic memory are formed from our ongoing dynamic experience poses a challenging question. In the current study the timing of stimuli within an episode was manipulated in order to investigate whether simultaneous presentations or presentations with temporal gaps are optimal for the binding of disparate elements together in an episodic representation. 86 participants were presented with a computer-based viewing task where 30 pairs of object-frame combinations were shown. The study was divided into two experiments with identical design but different gap condition-either long presentation (3s) or short (0.5s). Object-frame pairs appeared simultaneously (0s gap) or with a gap (either the frame first or the object). All object stimuli were grayscale images of everyday items and the associated coloured oval frames were either green or red. We measured the effect of stimulus timing during encoding by asking participants to view the objects again without their frame, and to try and recollect the frame colour. We observed that recollection of frame colour was enhanced for simultaneous vs. Gap presentations in both Experiment 1 (long duration-3s) and Experiemnt 2 (short duration-0.5s). Our findings highlight the need for more work on temporal factors that govern the formation of episodicrepresentations in long term memory.

72. Level of the cognitive reserve as a predictor of spatial memory functioning in the elderly (65+)

Magdalena Szmytke, Natalia Pawlaczyk, Bibianna Bałaj, Artur Nasiadko, Radek Bojarczyk, Jakub Klima, Paweł Dreszer-Drogorób, Maciej Kowalski, Agnieszka Osińska, Paweł Grabowski

szmytkemagdalena@gmail.com

Interdisciplinary Centre for Modern Technologies Nicolaus Copernicus University in Toruń, Poland
Institute of Philosophy, Faculty of Humanities, Nicolaus Copernicus University in Toruń, Poland
Tadeusz Kościuszko High School in Toruń, Poland

Spatial memory, which is responsible for recording information about one's environment and its spatial orientation, may change during a lifetime. However ageing processes as well as cognitive functioning are highly singular. According tocognitive reserve hypothesis there are individual differences in task processing, which allow some people to cope with cognitive challenges better than others. Factors such as age, education, style of leisure activity can be indicators of cognitive reserve, and we conducted a study to varify the differences in copying with spatial memory tests (standard and non-standard) using participants in groups with higher and lower cognitive reserve. We tested 30 healthy individuals (83% women) aged 65 to 87 and results showed that there are a significant differences between people with high and low cognitive reserve. Participants with higher level of education achieved more correct answers in ecological tests measuring capacity of spatial memory whereas people who spent their free time in a more cognitively active way scored higher in the non-standard task. In addition, a lower age of participants was associated with a lower level of errors in computer tests. Our results showed that cognitive reserve, which is supported and

permanently shaped by some factors can be expressed in quality of spatial memory functioning in elderly people (65+).

73. Resting state functional connectivity predicts BOLD activity during working memory task

Karolina Finc[a], Jan Nikadon[a], Jan Szczypiński[a], Magdalena Szmytke[a], Kamil Bonna[a], Maciej Sadlok[a], Natalia Pawlaczyk[a b], Jakub Wojciechowski[a], Patryk Wach[a], Jaromir Patyk[a], Bibianna Bałaj[c], Joanna Dreszer-Drogorób[c], Tomasz Wolak[d] Monika Lewandowska[a d]

karolinafinc@gmail.com

[a] Centre for Modern Interdisciplinary Technologies, Nicolaus Copernicus University in Torun, Poland
[b] Kazimierz Wielki University, Bydgoszcz, Poland
[c] Department of Humanities, Nicolaus Copernicus University, Centre for Modern Interdisciplinary Technologies Nicolaus Copernicus University in Toruń
[d] Bioimaging Research Center, Institute of Physiology and Pathology of Hearing, Kajetany, Poland

The coherent low-frequency BOLD fluctuations during resting state reflects direct and indirect anatomic projections in the human brain. However, the relationship between resting state functional connectivity and task-induced BOLD response is still not fully understood. We investigated relationship between patterns of resting state functional connectivity and task-induced BOLD activation as demands on working memory increased from n = 1 to n = 2 on the standard n-back task in healthy young adults. We conducted seed-voxel analysis with seeds located in Dorsal Attention Network (task-positive) and Default Mode Network (task-negative) as well as in areas activated during working memory task. We showed thatactivity patterns significantly changed from 1-back to 2-back task conditions. We also found that there is a relationship between activity change in n-back conditions and functional connectivity patterns in task-positive and task negative brain networks during resting state.

74. Investigation of SSVEP propagation using coherency-based connectivity estimators

Dominik Krzemiński, Maciej Łabęcki, Piotr Suffczyński

dkkrzem@gmail.com

Department of Biomedical Physics, Faculty of Physics, University of Warsaw, Poland

Steady State Visually Evoked Potentials are the steady-state brain responses in the EEG induced by a visual stimulation, flickering at a constant frequency between approximately 6 and 100 Hz. It was shown that the SSVEP is present throughout the scalp but the strongest response is observed in the area of visual cortex (V1). It is still not confirmed whether SSVEP signal propagates from V1 to other brain areas along neural pathways, or rather by volume conduction. In this study we look into this problem through coherency based methods applied to EEG multichannel recordings. Two connectivity estimators are compared: Phase Slope Index and imaginary part of coherency (Haufe S. et al., Neuroimage, 2013). Their specific properties allow to eliminate effect of volume conduction. Despite of some differences in both methods, we received consistent results, which do not provide evidence for SSVEP propagation along pathways. Comparing connectivity topographies with phase distribution maps a lot of similarities can be observed. It may suggest that a driven tangential dipole is a source of SSVEP signals and volume conduction effects are responsible for their spatial distribution.

75. Implicit associative learning: a new design to unveil the unconscious brain

Andrea Alamia[a], J.J. Orban de Xivry[b], Axel Cleeremans[c], Etienne Olivier[a], Alexandre Zenon[a]

andrea.alamia@uclouvain.be

[a] Institute of Neuroscience, Université catholique de Louvain, Brussels, Belgium
[b] Movement Control Neuroplasticity Research Group, Katholieke Universiteit Leuven, Leuven, Belgium
[c] Consciousness, Cognition Computation Group, Université Libre de Bruxelles, Brussels, Belgium

Implicit learning provides a rare opportunity to investigate how the brain operates in the absence of conscious intent. It has been studied in many different domains, from sequence to statistical learning and from artificial grammar learning to contextual cueing in visual search. In the current study, we propose a new experimental design to investigate how simple stimulus-response associations can be learned implicitly. Specifically, the participants had to report the motion direction of a patch of dots. In each trial, the dots could be of three different colors, and unbeknownst to the participants, two of these colors were always associated with the same direction/response, while the third color was uninformative. Across a series of four experiments, we showed that the participants learned systematically the association between color and direction, while remaining strikingly unaware of it. In addition, we showed that performance feedback was crucial to the occurrence of implicit learning in this task, and that both the stimulus-response and stimulus-stimulus associations could be implicitly learned. This simple task provides a robust behavioral framework to study important aspects of implicit learning that have so far escaped scientific scrutiny.

76. From neural oscillations to reasoning ability: Simulating the effect of the theta-to-gamma cycle length ratio on analogy making

Adam Chuderski

adam.chuderski@gmail.com

Jagiellonian University, Krakow, Poland

Several computational and empirical studies suggested a positive relationship between working memory capacity (WMC) and the individual ratio of theta to gamma oscillatory band lengths. As WMC strongly predicts reasoning, it might be expected that this ratio also predicts reasoning performance. Here, we propose a novel model of how oscillatory patterns in the brain constraints figural analogical reasoning. In the model, the gamma cycle encodes the bindings between objects/features and the roles they play in the relations processed. Asynchrony between consecutive gamma cycles results from lateral inhibition between oscillating bindings. Computer simulations showed that achieving the highest WM capacity required reaching the optimal level of inhibition. When too strong, this inhibition eliminated some bindings from WM, whereas, when inhibition was too weak, the bindings became unstable and fell apart or became improperly grouped. The model aptly replicated several empirical effects and the distribution of individual scores, as well as the patterns of correlations found in the 100-people sample attempting the same reasoning task. Most importantly, the model's reasoning performance strongly depended on its theta-to-gamma ratio in same way as the performance of human participants depended on their WM capacity.

77. Feeling the rhytm – how to measure theta-gamma EEG rhytms coupling?

Daniel Borek[a], Maciej Kamiński[b]

dtborek@gmail.com

[a] College of Inter-Faculty Individual Studies in Mathematics and Natural Sciences, University of Warsaw, Poland
[b] Faculty of Physics, University of Warsaw, Poland

Neuronal oscillations play an important role in processing and maintaining information within the brain. Underlying synchronisation of neuronal population is closely related to synaptic plasticity and memory formation, although the mechanism how oscillations influence each other on different ranges and scales (from single neurons to whole brain networks) is still unknown. Gamma oscillations have been found to be locked to the phase of the theta oscillations, supporting memory trace formation and interplay between these rhytms has been identified within human neocortex during word recognition. working memory maintenance, and in successful long-term memory encoding. In this study we examined interdependence between EEG rhytms in a simple memory task. We studied the level of phase-amplitude coupling between gamma and theta bands frequencies using several measures, one of them was the modulation index (MI), a measure which perform well in electrophysiological studies. We examined performance of choosen measures using simulated data, addressing the dependence of each measure on signal to noise level, epoch length and other factors. We analyse the data with the one best performing and point to potential nuissances.

78. The EEG spectral power differences between groups with distinct creative thinking styles

Zhanna Nagornova, Natalia Shemyakina

nagornova_zh@mail.ru

I.M. Sechenov Institute of Evolutionary Physiology and Biochemistry of the Russian Academy of Sciences, Saint Petersburg, Russia

The aim of the study was to reveal EEG characteristics during creative tasks performance in groups with predominant verbal or imaginative styles of creative thinking. Twenty volunteers took part in this study (mean age 20.3, 1.3 [SD]). Participants were to perform verbal and figurative creative and noncreative tasks. All tasks were carried out mentally during the EEG registration (3 min for each); after the end of the tasks performance the participants gave self-reports. Estimation of verbal and figurative tasks effectiveness was used for dividing group of volunteers into two subgroups by k-means cluster analysis: first group was with higher efficiency of figurative creative task performance (imaginary style) and the second group with opposite effect (verbal style). Spectralpower values were calculated on the artifact-free EEG intervals and normalized in 6 EEG bands. We used ANOVA for factors interaction with grouping variable. The influence of on EEG spectral power was observed in theta and alpha1 bands - theta: F=2.5, e(G-G)=0.24, t;0.05; alpha1: F=1.8, ;0.05 (without G-G correction). EEG spectral power in theta and alpha1 frequency bands was higher in group with verbalthinking style in comparison with group of imaginary style irrespective of tasks type.

79. Training associative search influence on EEG spectral power

Natalia Shemyakina, Zhanna Nagornova

shemyakina_n@mail.ru

I.M. Sechenov Institute of Evolutionary Physiology and Biochemistry of the Russian Academy of Sciences, Saint Petersburg, Russia

The study aimed to explore EEG changes during verbal associative task performance, considered as the long-lastingtraining session of associative search. Sixteen subjects (aged 25±7) were to find combining adjectives to pairs of nouns from remote semantic fields for an hour. For EEG spectral power analysis were taken three artifact free (in the beginning, middle, end) 5-minutes intervals of the task performance of those subjects, who reported felt interest and a feeling like playing a game. The spectral power of alpha1,2 EEG bands increased from the beginning of the task to the half time of its performance and didn't grow significantly any more to the end of the task. Effect of alpha power increases was widespread across the cortex, while for beta1,2 frequency bands were obtained local changes with both –increase in frontal zones and decrease in temporal and occipital zones. Percent of given answers at the beginning and the end of the task didn't differ significantly and was around 77±2%. Obtained results were supposed to reflect subjects adaptation and entrance to the convenient state for verbal associative search during training with possible block of unnecessary external information.

80. Mental effort induces a shift in the performance-difficulty function

Emanuele Pasqualotto, Andrea Alamia, Etienne Olivier, Alexandre Zénon

emanuele.pasqualotto@uclouvain.be

Institute of Neuroscience, Université catholique de Louvain, Brussels, Belgium

Background. There is currently no consensual definition of mental effort (ME), which is often assumed to vary according to the cognitive workload, or to correlate with pupil size.
Aim. Here, we define ME as the modulation of the cognitive processes efficiency and aim to provide a new objective measure of ME.
Method. Volunteers (n=15) were instructed to report the direction of moving dots motion. Trial difficulty was determined by movement coherence (easy: 100%; difficult: 40%) whereas blockwise difficulty levels were defined by the percentage of easy/difficult trials (easy blocks: 80% easy trials, difficult blocks: 80% difficult trials). We recorded response accuracy and pupil size.
Results. We found that accuracy in the difficult trials was larger in the blocks in which they were more frequent ($F= 7.37$, $p=.017$), while reaction time did not increase. Surprisingly, we found no change in the pupil size as a function of blockdifficulty, but found that participants with higher performance had smaller pupil responses ($F= 5.76$, $p=.024$).
Conclusions. During difficult blocks, participants increased their performance to cope with the task's increased demands. This can be regarded as a signature of ME. The lack of concurrent pupil dilation may require reconsideration of the classical pupil-effort relationship.

81. Complexity analysis of creative thinking in computerized Alternative Uses Task – an EEG pilot study

Ewa Ratajczak[a], Jakub Wojciechowski[a], Jan Nikadon[a], Jan Szczypiński[a], Bibianna Bałaj[a], Joanna Dreszer-Drogoróba[a,b], Włodzisław Duch[c]

trufliczka@gmail.com

[a] Centre for Modern Interdisciplinary Technologies, Nicolaus Copernicus University, Toruń, Poland
[b] Faculty of Humanities, Nicolaus Copernicus University and Centre for Modern Interdisciplinary Technologies, Toruń, Poland
[c] Faculty of Physics, Astronomy and Informatics and Centre for Modern Interdisciplinary Technologies, Nicolaus Copernicus University, Toruń, Poland

Creativity has always been a topic difficult to study, partly due to the elusiveness of its definition and lack of specific tools and methods suitable for neuroimaging studies. The EEG approach described herein aimed to reveal neuronal correlates of divergent thinking, chosen as the best approximation of creative processes. 18 young adults were tested with acomputerized version of the Guilford's Alternative Uses Task (AUT), developed basing on previous work of Fink and colleagues (Fink 2009). Special timing measures were taken to eliminate speech artifacts from the EEG recordings. The participants announced each idea by pressing an 'idea button' and vocalized it thereafter. Creativity levels were assessed on four scales: fluency, originality, flexibility, elaboration. The EEG signal was analyzed in separate frequency bands and the resulting activations were compared to previous findings available in the literature. Additionally,

complexity analysis(including fractal and entropy measures) was applied to the EEG data, presenting a fairly new approach in the field of creativity studies.

82. Salivary MHPG as a marker of central noradrenergic activity in cognitive tasks and physiological arousal

Konrad Rudnicki[a], Aleksandra Rutkowska[a], Marek Wieczorek[b]

kjrudnicki@gmail.com

[a] Institute of Psychology, University of Lodz, Poland
[b] Department of Neurobiology, University of Lodz, Poland

It remains unclear whether salivary 3-methoxy-4-hydroxyphenyloglycol (sMHPG) is a marker of central noradrenaline turnover or peripheral activity accompanying arousal. Its levels are highly correlated with these found in the CSF. Hovewer it is also produced on the periphery with possibility for bidirectional permeation of blood-brain barrier. To investigate processes that elicit sMHPG excretion, 30 students participated in two experiments consisting of effortful, cognitive tasks, while 31 others were subjected to examinational stress. Saliva samples from the first group were taken before and 3 times after the experiments. From the second group samples were collected 15 minutes before the exam and on an ordinary day. HPLC-ED was used for quantification of sMHPG and noradrenaline. No differences in sMHPG during examinational stress were found, despite elevation of perceived arousal. However in both experiments involving cognitive effort, significant elevation in sMHPG was observed as well as positive correlation of sMHPG excretion with test performance. Except for one instance, sMHPG excretion appeared to be independent from noradrenaline levels. Results indicate that sMHPG is rather a marker of central noradrenergic activity in cognitive effort rather than physiologicalarousal. These data support past research that emphasizes relationship between cognitive functioning and MHPG.

83. Whole truth about lying: an fMRI study of neural correlates of deception as dependent on sex and perspective

Monika Riegel[a], Marcel Falkiewicz[b], Artur Marchewka[a], Iwona Szatkowska[b]

m.riegel@nencki.gov.pl

[a] Laboratory of Brain Imaging, Neurobiology Centre, Nencki Institute of Experimental Biology, Warsaw, Poland
[b] Laboratory of Psychophysiology, Department of Neurophysiology, Nencki Institute of Experimental Biology, Warsaw, Poland

Most of experimental studies concerning deception show that lying is a more demanding cognitive process than telling thetruth. However, we hypothesized that in real-life situations it depends on such factors as sex or perspective (lying as participants or witnesses). In order to investigate this issue, we developed a new urban-gaming paradigm provoking deception. 28 subjects (14 male) took part in an fMRI study. During scanning, subjects were asked questions concerning the details of the game. They were not instructed to lie, yet consequent and coherent lying was financially more profitable. The analysis of recation times showed their elongation for lying as compared to truth telling, and for lying in men as compared to women. Brain activations for lie vs. Truth contrast in the case of participant perspective were greater in medial frontal lobe (precentral gyrus, ACC) and parietal lobe (postcentral gyrus). Functional connectivity analysis revealed a neuonral network connected with lying consisted of 60 components. Depending on sex of subjects, different components play a key role in deception network functioning – insula for females and superior parietal lobule for males. These findings suggest that the neural correlates of deception in the ecologically valid paradigm depend on both sex participant/witness perspective.

84. The anatomy of the default mode network: insights from the high-quality 3T fMRI dataset

Mikołaj Buchwald[a], Jóźwiakowska Magdalena[a], Kaczor Mateusz[a], Maćkowiak Bartosz[a], Roch Sebastian[a], Biduła Szymon[b]

mikolaj.buchwald@gmail.com

[a] Cognitive Science Engineering Research Group (CovSERG), Poznan, Poland
[b] Cognition Laboratory, Institute of Psychology, Adam Mickiewicz University, Poznan, Poland

The default mode network (DMN) is a set of brain regions which commonly deactivate during performing variety of cognitive tasks. Recently, DMN attracted great attention because it was suggested that abnormalities in this network are related to a wide range of neurological disorders. However, current anatomical definitions of the DMN are inconsistent, thus hampering progress in clinical neurosciences. These discrepancies possibly result from susceptibility artifacts located in specific brain regions. To test this hypothesis, we examined the anatomy of the DMN using 3T fMRI high-quality dataset (HQD) from the OpenFMRI repository. In chosen database six participants were scanned while performing a one-back repetition detection task. Using Feat v6.0 we searched for regions which were

active during the resting state. Resulting network was compared to the metaanalysis of DMN conducted with the Neurosynth platform. We found both in the HQD and the metaanalysis engagement of core regions of the DMN (e.g., angular gyri and precunei). However, we dicovered also in the HQD signal increases in temporal poles, left insula, and right orbitofrontal cortex. As we expected, these undetected in the metaanalysis regions are prone to susceptibility artifacts. These results have substantial impact on the role of DMN in neurological disorders.

85. Unraveling default mode network: spontaneous activity of the brain or organized conceptual processing?

Sebastian Roch[a], Kaczor Mateusz[a], Jóźwiakowska Magdalena[a], Maćkowiak Bartosz[a], Buchwald Mikołaj[a], Biduła Szymon[b]

rochicz93@gmail.com

[a] Cognitive Science Engineering Research Group (CovSERG), Poznan, Poland
[b] Cognition Laboratory, Institute of Psychology, Adam Mickiewicz University, Poznan, Poland

The default mode network (DMN) is an intensively studied set of brain regions which are active during resting state. Some accounts indicate that this network is dominated by the unrestricted spontaneous activity of the brain. Other studies, however, suggest that DMN is related to adaptive processes, like planning or problem solving. If the latter is the case, then spatial activity patterns of DMN should be predictable, i.e., across time similar pattern of signal changes should occur in particular parts of DMN. We tested this hypothesis with the dataset from the OpenFMRI repository. Six individuals, in chosen database, were scanned using fMRI 12 times while performing a one-back repetition detection task. After finding with Feat v6.0 brainregions exhibiting significant activity during resting state, we tested whether or not spatial activity patterns during even runs could predict patterns of signal changes in odd runs. We found that neuronal responses of DMN remarkably differ between runs. However, when studied network was divided into anterior, posterior and lateral regions of interests (ROI), we discovered that in the posterior ROI spatial activitypatterns could be predicted. These results suggest that neuronal processing in DMN is a combination of spontaneousactivity and organized conceptual processing.

POSTER SESSION III

April 19, 2015 (Saturday)
12.15 – 13.45

NEURODEGENERATION

1. Serum levels of sRAGE in patients with multiple sclerosis

Daniel Cierny[a], Hányšová, S.[a], Michalik, J.[b], Kantorová, E.[b], Kurča, E.[b], Škereňová, M.[c], Dobrota, D.[a], Lehotský, J.[a]

[a] Department of Medical Biochemistry, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, Slovakia
[b] Department of Neurology, Jessenius Faculty of Medicine in Martin and Martin University Hospital, Comenius University in Bratislava, Slovakia
[c] Department of Clinical Biochemistry, Jessenius Faculty of Medicine in Martin and Martin University Hospital, Comenius University in Bratislava, Slovakia

Background: Receptor for advanced glycation end products (RAGE) is a transmembrane glycoprotein involved in inflammatory pathways. Circulating soluble isoform - sRAGE captures RAGE ligands thus blocking its activity. Decreased level of sRAGE was found in plasma and cerebrospinal fluid (CSF) of patients with multiple sclerosis (MS). The 7,39 pg/ml of sRAGE in CSF was found to be able to distinguish MS patients from controls in early stages of SM. In spite of that, some studies did not detect any differences in sRAGE levels.
Methods: In our study we examined serum level of sRAGE in 44 MS patients (16 men, 28 women) and in 32 controls by ELISA analysis. The average disease duration was 12,9 ± 6,6 years, EDSS score 3,7 ± 2,1, MSSS score 4,43 ± 2,98. 70,5 % of patients had relapsing-remitting MS and 29,5 % had secondary-progressive MS.
Results: Serum level of sRAGE was significantly higher in the group of MS patients as compared to the control group

(1071 ± 519 pg/ml vs. 798 ± 461 pg/ml; p = 0.003).
Conclusions: Results of our study suggest for the role of sRAGE in the pathogenesis of MS as a biomarker with potential clinical application.
The study was supported by the grants VEGA 213/12 from the Ministry of Education of the Slovak Republic, 2012/30-UKMA-7: Biological and molecular markers of multiple sclerosis from Ministry of Health of the Slovak Republic.

2. Epigenetic involvement in the ischemic/reperfusion injury in hyperhomocysteinemic rats

Barbara Tóthová[a], Mária Kovalská[b], Zuzana Tatarková[a], Ján Lehotský[a]

tothova@jfmed.uniba.sk

[a] Department of Medical Biochemistry, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, Slovakia
[b] Department of Histology and Embryology, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, Slovakia

Stroke represents the second most common cause of death worldwide and it is the leading cause of long-term and permanent disability. The involvement of epigenetic regulation in transcriptional activation or repression in development and functional recovery of brain disorders is nowadays highly examined but only a few papers about epigenetics during hyperhomocysteinemia (hHcy) in stroke are available. hHcy, or elevated level of homocysteine, a thiol-containing amino acid formed during the metabolism of methionine, is considered as a risk factor for cerebrovascular and other neurological disorders promoting neuronal cell death. Global brain ischemia was induced by 4-vessels occlusion with 15 min ischemia and reperfusion periods of 72h and 7 days. Animals were treated with methionine (2 mg Met/kg of weight) perorally for 1 month to induce the hHcy. We examined the protein levels of MeCP2, HDAC1 and SIRT1 by western blot analysis. The most apparent alterations we observed in appa
rent decrease of protein levels after 7 days of reperfusion in Met group. FluoroJade C analysis revealed a significant increase of apoptotic neurons in cortex and hippocampal CA1 pyramidal neurons in both Met treated IR groups. These results indicate for possible involvement of epigenetic regulation in hHcy rats during ischemic/reperfusion insult.

3. **Drosophila melanogaster** *as a model of neurodegenerative Gaucher disease*

Joanna Strzęp[a], N. Ishida[b c], E. Pyza[a]

joanna.strzep@gmail.com

[a] Department of Cell Biology and Imaging, Institute of Zoology, Jagiellonian University, Kraków, Poland
[b] National Institute of Advanced Industrial Science and Technology, Tsukuba, Ibaraki, Japan
[c] Graduate School of Life and Environmental Sciences, University of Tsukuba, Ibaraki, Japan

Gaucher disease (GD) is a lysosomal storage disorder, caused by defects in the GBA gene encoding glucocerebrosidase. In our experiments we expressed human glucocerebrosidase gene with R120W (mild neurodegeneration) or RecNciI (acute abnormalities) mutations in the retina photoreceptors of D. melanogaster. As a control we used wild type strains and flies with the expression of non-mutated human GBA gene.
The aim of our study was to investigate whether the mutations of this gene affects the eye morphology and behaviour of Drosophila melanogaster. We used climbing assay to measure the negative geotaxis of flies. Moreover, we examined the rhythm of locomotor activity.
The obtained results showed that the ability of climbing was disrupted in flies with GBA mutation comparing with controls. It means that degenerations only in the photoreceptors affect behaviour of animals. The morphology of the eye was changed only in flies with the acute mutation RecNciI. In addition the period of the locomotor activity rhythm was shorten in both mutations. This suggests that they affects the circadian system. In conclusion, the observed changes are similar to those observed in humans with GD. It confirms that D. melanogaster is a good model to study mechanisms of neurodegenerative diseases in humans.

4. Could induced hyperhomocysteinemia lead to neurodegeneration with Alzheimer's disease (AD)-like pathological features?

Maria Kovalska[a], Libusa Kovalska[b], Martina Furjelova[a], Barbara Tothova[c], Oliver Koprda[a], Marian Adamkov[a], Jan Lehotsky[c]

kovalska@jfmed.uniba.sk

[a] Department of Histology and Embryology, Jessenius Faculty of Medicine, Comenius University in Bratislava, Slovakia
[b] Clinic of Stomatology and Maxillofacial Surgery, University Hospital in Martin, Slovakia
[c] Department of Medical Biochemistry, Jessenius Faculty of Medicine, Comenius University in Bratislava, Slovakia

The number of studies investigating neurodegenerations with Alzheimer's disease-like pathological features increase.

Recent studies showed hyperhomocysteinemia to be a strong risk factor for dementia and AD. The molecular mechanisms underlying these mechanisms are not fully understood. Therefore, we investigated the effect of ischemia-reperfusion injury (IRI) in combination with hHcy on neurodegeneration in rat brains. We have studied neurodegeneration as well as post-translation changes in MAPK (mitogen-activated protein kinase) pathways after global IRI in rat hippocampus and forebrain cortex in association with hHcy and possible unfolding of AD. Global forebrain ischemia was induced by 4-vessels occlusion. In the concrete, 15 min of ischemia followed with reperfusion period of 72h and 7 days. hHcy was induced by methionin diet (0.2g/kg) in duration of 28 days. We demonstrated neurodegeneration of vulnerable neurons after induced IR as well as after hHcy. Western blot study and imunohistochemical analysis suggested that IRI and also hHcy down-regulates the p-ERK protein and up-regulates p-p38 protein what is associated with neuronal death. These findings suggest that IRI after induced hHcy could have a neurodegenerative role on global brain ischemia in rats. Our results also indicate that this model of combined insults could lead to progression of AD-like pathological features.

5. Effect of homocysteine on the energetic metabolism in human glial cells

Milan Klačanský, Silvia Mahmood, Radovan Murín

milan.kl@hotmail.com

Department of Medical Biochemistry, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, Slovakia

The neurotoxic effect of homocysteine (Hcy) is linked with the etiopathogenesis of several neurodegenerative diseases. Hcy is an intermediate of the S-adenosylmethionine cycle, which sustains methylation reactions in cells. The methylation of proteins and nucleic acids is crucial for the regulation of enzymatic activities and the epigenetic regulation of gene expression.
To investigate the impact of Hcy on the energy metabolism of glial cells we used cultured human astrocytes as study model. The cells, grown to 70% confluence, were incubated in minimal medium supplemented with Hcy (100 and 500 μM) for 21 hours. The concentrations of glucose and lactate in media were estimated by enzymatic assays. Cell lysates were used to determine the protein content and the specific glucose uptake and lactate release were calculated.
Hcy affected negatively the glucose uptake by glial cells and stimulated the lactate release. Increased lactate-to-glucose ratios point to the suppression of oxidative phosphorylation.
Our results indicate that Hcy might alter the energy metabolism of human glial cells, which may limit the neuron-glia cooperation.
This work was supported by the projects VEGA 1/0242/13, and "Competence center for research and development in diagnosis and therapy" code: 26220220153 co-financed from EU sources and European Regional Development Fund.

6. Micro RNAs and mutations in Trp53 in PS/APP transgenic mouse

Michał Prendecki[a], Anna Oczkowska[a], Izabela Postrach[a], Mateusz Dezor[a], Wojciech Kozubski[b], Jolanta Dorszewska[a]

mprendecki@ump.edu.pl

[a] Laboratory of Neurobiology, Department of Neurology, Poznan University of Medical Sciences, Poznan, Poland
[b] Chair and Department of Neurology, Poznan University of Medical Sciences, Poznan, Poland

The PS/APP transgenic mice accumulate β-amyloid similarly to Alzheimer's disease (AD) patients. Dysregulation of p53 induced by mutations or miRNA may lead to excessive oxidative damage, cellular death by apoptosis and neurodegeneration. The aim of the study was expression analysis of mmu-miR-138-5p, mmu-miR-185-5p and mutations profiling in exon 7 of Trp53 in PS/APP and control mice. The study was performed on 9 PS/APP and 14 control mice. The Trp53 was sequenced and miRNAs were investigated by RT-PCR in gray matter (GM), white matter (WM) and cerebellum (C). In young adult control mice the mutation T854G was associated with decreased expression of miR-138 and miR-185 in C and GM. Subsequently, in old controls the mutation G859A was associated with increase of miR-138 expression: 7-fold in GM and 4-fold in WM and C ($p<0,05$). The expression of miR-185 was increased 6- and 2-fold in GM and WM, respectively, and in C remained at constant level. Moreover, in PS/APP mice the mutations A929T and A857G were accompanied by decreased expression of miR-138 and -185 in all analyzed brain structures, except GM for miR-185. It seems that the dysregulation of miR-138 in particular may be associated with p53 dysfunction in neurodegeneration model.

7. The effect of hyperhomocysteinemia on long-lasting periods of reperfusion after induced ischemia-reperfusion injury and ischemic preconditioning

Martin Petras [a], Mária Kovalská[b], Barbara Tóthová[a], Sandra Hányšová[a], Zuzana Tatarková[a], Ján Lehotský[a], Anna Drgová[a]

petras@jfmed.uniba.sk

[a] Department of Medical Biochemistry, Jessenius Faculty of Medicine, Comenius University in Bratislava, Slovak Republic
[b] Department of Histology and Embryology, Jessenius Faculty of Medicine, Comenius University in Bratislava, Slovak Republic

The hyperhomocysteinemia (hHcy) is one of conventional risk factors for ischemic stroke and can worse also an ischemia-reperfusion (IR) injury of the brain due to pleiotropic activity of homocysteine (Hcy) and acceleration of atherosclerotic changes. However, the ischemic preconditioning (IPC) can help to improve neuronal survival after ischemia. The male Wistar rats divided into four groups (control group, hyperhomocysteinemic group, IR and IPC group with hHcy) were used in our experiments. Homogenized cortex and mitochondria were used for biochemical and histological analysis. Our results showed the increased oxidation of lipids (4-hydroxynonenal) and proteins (dityrosine) after induced hHcy and decreased level of these markers of oxidative stress after IPC compared to IR groups after long-lasting reperfusions. Moreover, quantification of FluroJade B+ cells showed significant neurodegeneration after 72 hours of reperfusion in IR group compared to IPC group induced by hHcy.
These results indicate the toxic and prooxidative effect of hHcy on the ROS formation and possible protective effect of induced IPC after long-lasting periods of reperfusion (24 and 72 hours), which can help to improve neuronal survival after temporary critical ischemia. (Supported by VEGA 1/0213/12 and project „Identification of Novel Markers in Diagnostic Panel of Neurological Diseases“, code:26220220114).

8. Examination of effects of cerebral venous outflow blockage on neurological status and brain image in rats.

Bartosz Kapustka, Mariusz Łączyński, Paula Ziomek, Halina Jędrzejowska-Szypułka, Joanna Lewin-Kowalik

kapustka.bartosz@gmail.com

Medical University of Silesia, Katowice, Poland

Introduction: Chronic Cerebrospinal Venous Insufficiency(CCVI) is one of postulated factors in ethiopathogenesis of CNS diseases.We've decided to test how the impairment of cerebral venous outflow would influence the neurological status as well as brain image in rats.
Material: Adult female WistarC rats were used – 24 experimental (groups n, A=9,B=8,C=7) and 1 control. In the group: A- both internal carotid veins were ligated, in group B-left jugular vein was ligated, in group C- both jugular veins were constricted, in all groups for 12-week-follow-up. Once a week, all animals were examined neurologically. After 12weeks, all rats underwent 4,7T MRI.. Then, animals were euthanized and their brains were collected for further histochemical analysis.
Results: Results of Neurological Deficit Scale were increased during perioperative period and became normal after 2-3weeks. All rats properly gain weight post-operatively. MR neuroimaging showed no changes typical for inflammation and demyelination. These findings were confirmed by histochemical analysis, which didn't revile presence of inflammatory cells or myelin destruction.
Conclusion: The results of neurological and MRI showed no differences between rats with impaired cerebral venous outflow and the control. Our findings do not show cause-effect relationship between evoked by internal jugular veins stenosis - CCVI - and CNS diseases.

9. Aβ production in brains of Familial Alzheimer disease patients

Maria Szaruga[a], Sarah Veugelen[b], Sam Lismont[b], Bart De Strooper[b c] and Lucía Chávez-Gutiérrez[b]

maria.szaruga@cme.vib-kuleuven.be

[a] VIB Center for the Biology of Disease, VIB-University of Leuven, Leuven, Belgium
[b] Center for Human Genetics/VIB Center for the Biology of Disease, VIB-University of Leuven, Leuven, Belgium
[c] UCL Institute of Neurology, University College London, Queen Square, London, United Kingdom

Alzheimer disease (AD) is a neurodegenerative disease associated with extracellular aggregation and deposition of β-amyloid peptides in the brain. Early-onset Familial Alzheimer disease (FAD) is inherited in an autosomal dominant manner and caused by mutations in presenilin (PSEN) or amyloid precursor protein (APP) genes. Aβ peptides are

generated by sequential intramembrane cleavages of APP by the γ-secretase complex, an aspartyl protease containing presenilin as a catalytic subunit.
We have recently reported that FAD-PSEN mutations consistently reduce the efficiency of the 4th turnover of the enzyme and demonstrated that loss of overall γ-secretase activity is not necessarily observed in FAD.
In order to investigate whether additional mechanisms occur in human brain in which wild-type and mutant γ-secretases are co-expressed, we have expanded our study by measuring de novo Aβ production in brains of FAD PSEN1 mutations carriers (postmortem material).
Our studies indicate that Aβ production is not increased in FAD, which stands against the general belief that higher load of Aβ peptides causes disease. Production of Aβ42, which has been pointed out as the pathogenic peptide, remained unchanged in majority of the investigated FAD brains. Our data supports a certain pathogenic mechanism that relies on qualitative, rather than quantitative changes in Aβ production in FAD.

10. Sciatic nerve injury of rats in condition of metabolic disorder

Lilit Avetisyan[a], Karen Simonyan[a], Vergine Chavushyan[b]

lilitavetisyan23@mail.ru

[a] Orbeli Institute of Physiology, Yerevan, Armenia
[b] Head of laboratory of Neuroendocrine Relationships, Orbeli Institute of Physiology, Yerevan, Armenia

Excess fructose consumption causes metabolic syndrome associated with changes in functioning of the central and peripheral nervous systems. Hyperglycemia, insulin resistance and hyperlipidemia are integral components of diabetes and important risk factors for developing peripheral neuropathies. In this study in rat model of fructose-induced metabolic syndrome 30 days after sciatic nerve crush-injury electrophysiological study of evoked synaptic activity of ipsilateral single motoneurons of lumbar part of the spinal cord was carried out. Parameters of abnormal activity have been found by the presence of areactive units and weak expression of components of responses to high-frequency stimulation as well as by disbalance of types of responses in the form of relatively even ratio of inhibitory/excitatory responses during stimulation of distal part of a damaged sciatic nerve. Test reflex abduction indices revealed a significant increase in sensitivity threshold of injured lower extremities (1-18 days) and a tendency of sensitivity equalization of healthy and injured lower extremities (21-28 days) in rats with fructose-induced metabolic syndrome under electrical stimulation of the sole of posterior lower extremities after sciatic nerve crush.

11. Non-contused area from the same brain may be a sufficient control for the analysis of changes in the neurofilament architecture following brain contusion

Rafał Skowronek[a], Mariusz Kobek[a], Zbigniew Jankowski[b], Janusz Szala[c], Artur Pałasz[d]

rafal-skowronek@wp.pl

[a] Department of Forensic Medicine and Forensic Toxicology, Medical University of Silesia, Katowice, Poland
[b] Department of Forensic Medicine, Medical University of Gdańsk, Gdańsk, Poland
[c] Institute of Materials Science, Silesian University of Technology, Katowice, Poland
[d] Department of Histology, Medical University of Silesia, Katowice, Poland

Last year we presented our initial study dealing with the morphometric analysis of neurofilaments at the site of brain contusion after traumatic brain injury (TBI) as a method for time-of-injury determination. We showed that this kind of structural quantitative assessment may be a promising method which could be used in forensic pathology. Some authors argue that in such studies, controls made up of postmortem brains of deceased individuals with no evidence of head trauma should be performed. Among them distant sites from the same brain do not control for global neurofilament changes that may occur as a result of diffuse TBI (secondary effects due to combinations of hypoxia, ischemia and mass effect). We decided to evaluate the impact of both – distant site (non-contused) from the same brain and specimen taken from organs of individuals with no evidence of head trauma. The test results for the two means (Student\'s t-test) showed no statistically significant differences between these two kinds of controls, both for the average of the neurofilaments area fraction ($p=0.185$), as well as to neurofilaments number ($p=0.517$). It seems that non-contused area from the same brain may be a sufficient control for the analysis of changes in the neurofilament architecture following brain contusion. One can not exclude that this microanatomical viewpoint may help to establish a novel and more reliable method in the contemporary forensic procedures.

NEURODEVELOPMENT

12. The role of DmMANF in the glial cells of Drosophila melanogaster

Lucyna Walkowicz, Kijak E., Krzeptowski W., Pyza E.

lucyna.walkowicz@doctoral.uj.edu.pl

Department of Cell Biology and Imaging, Institute of Zoology, Jagiellonian University, Kraków, Poland

Mesencephalic astrocyte-derived neurotrophic factor (MANF) is a secreted protein that is present in vertebrates. The same peptide, called DmMANF, has been found in Drosophila melanogaster. Like in mammals it is responsible for the protection of dopaminergic neurons. DmMANF is also important in development, since knock down its gene leads to death of embryo.
The aim of our work was to investigate distribution and functions of DmMANF in the brain of D. melanogaster and its possible involvement in regulating behavior. We found the expression of DmMANF in glial cells, particularly in the epithelial glial cells of the visual system. Moreover its inhibition by RNAi technique induced neurodegenerative changes in the first optic neuropil (lamina). The immunohistochemical analysis also showed a decrease of DmMANF level in the lamina of 50 days old males in comparing with young 7 days old individuals. On the other hand, the period of locomotor activity of flies with silenced or enhanced expression of DmMANF in glial cells showed no statistically significant differences.
Our results show that DmMANF plays an important role in survival of neurons in the visual system of D. melanogaster. However, this protein seems to be not important for circadian clock functioning.

13. Calbindin, calretinin and parvalbumin immunoreactivity in the septum of the guinea pig in fetal and postnatal stages of development

Beata Hermanowicz, Anna Robak

hermanowiczb@gmail.com

Department of Comparative Anatomy, Faculty of Biology and Biotechnology, University of Warmia and Mazury in Olsztyn, Poland

Calcium ions are universal second messengers controlling a wide range of different fundamental processes in the function of neurons during development. Calcium signalling is used to monitoring e.g. cellular growth and death, neurotransmitter release or changes in gene expression. Calcium-binding proteins (CaBPs), including calbindin (CB), calretinin (CR) and parvalbumin (PV) are implicated in regulation of Ca2+ homeostasis. Therefore, the aim of this study was to evaluate developmental changes in the distribution of these CaBPs in the septum, which is a nodal point of the limbic system, associated with memory, emotions and learning processes. The study was conducted on the guinea pig embryonic (E40, E50, E60) and postnatal (P5, P40, P100) brains. The tissue blocks containing the septum were processed for immunoenzymatic and immunofluorescence staining, using solution of antibodies raised against CB, CR and PV. The present study indicates that the distribution pattern of CB and CR, in contrast to PV in the septum, does not change significantly depending on the developmental stage. All examined proteins appear in the studied brain region already at 40th embryonic day. Among examined proteins, CB is the most and PV is the least expressed calcium-binding protein both in fetal and postnatal stages of development.

14. Aryl hydrocarbon receptor is essential for PNS myelination

Nirmal Kumar Sampathkumar, Ghjuvan'Ghjacumu Shackleford, Mehdi Hichor, Julien Grenier, Delphine Meffre, Stephanie Eid, Xavier Coumoul, Charbel Massaad

nirmalkumar1007@gmail.com

Université Paris Descartes, France

The Aryl hydrocarbon receptor (AhR) is a transcription factor, which is well known as regulator of xenobiotic metabolizing enzymes expression. However, AhR is well studied in the field of toxicology. But very recently studies start to reveal that it still has other endogenous functions. For example, AhR null mice exhibit defects in liver, thymus, fertility, perinatal growth, cardiac problem etc. Nevertheless, it is so elusive about the role AhR in peripheral myelination. In this project, we highlighted the role of AhR in peripheral myelination. For this study, we have shown that the constitutive knockout of AhR in C57BL/6 mice which caused disorganized myelin structure. In addition, MPZ and PMP22 protein levels are also altered age dependently. To further elucidate the mechanism of action of AhR on myelin genes' expression we used various approaches (siRNA, plasmids, pharmacological compounds) in a Schwann cell line (MSC80). Finally, in vitro data of ChIP-qPCR displayed the binding of AhR to MPZ and PMP22 at their promoter regions. Hence, we identified for the first time that, AhR has a major role for proper peripheral myelination.
Keywords: AhR, myelination, MPZ (Myelin zero protein), PMP22 (Peripheral myelin protein 22), ChIP.

15. NCAM expression in neurodevelopmental model of schizophrenia

Aleksandra Radaszkiewicz, Patrycja Mordalska, Joachim Latusz, Ewelina Bator, Krzysztof Wędzony, Marzena Maćkowiak

szybin@if-pan.krakow.pl

Laboratory of Pharmacology and Brain Biostructure, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

The neural cell adhesion molecule (NCAM), is a fundamental regulator of the synaptic plasticity. In the present study, NCAM expression was determined in the neurodevelopmental model of schizophrenia based on postnatal injections of CGP 37849, a competitive antagonist of NMDAR (1,25 mg/kg on days 1, 3, 6, 9; 2,5 mg/kg on days 12, 15, 18; 5,0 mg/kg on day 21). NCAM mRNA and protein levels were analyzed in the medial prefrontal cortex (mPFC) of adult rats using qPCR and Western Blot method. Furthermore, the involvement of NCAM in memory formation was investigated in trace and delay fear conditioning tasks (TFC or DFC, respectively). Postnatal CGP injection did not affect the level of NCAM mRNA, but decreased NCAM140 and NCAM180 protein levels. In contrast, NCAM140 protein level was increased in the mPFC in CGP-treated group, both after memory acquisition and retrieval in TFC task. However, postnatal CGP administration did not alter either NCAM 180 or NCAM mRNA level in both TFC and DFC tasks. The obtained results indicate that postnatal blockade of NMDA receptors evoked the changes in NCAM expression in mPFC, which might be involved in impairment of memory formation associated with the pathology of schizophrenia.

NEUROPHYSIOLOGY

16. The influence of selective, induced knock-out of NMDA receptors on bursting activity of midbrain dopaminergic neurons- in vivo electrophysiological studies

Magdalena Walczak[a], Jan Rodriguez Parkitna[b], Tomasz Błasiak[a]

magda.walczak@student.uj.edu.pl

[a] Institute of Zoology, Jagiellonian University, Krakow, Poland
[b] Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland

Expression of NMDA receptors has been suggested to be crucial for generation of bursting activity by midbrain dopaminergic (DA) neurons. It has been shown that constitutive knock-out of NMDA receptors in DA neurons abolishes bursting activity. In the present study we have used a genetically modified mouse model with inducible inactivation of NMDA receptors specific to dopaminergic neurons. We have obtained extracellular recordings from DA neurons of ventral tegmental area (VTA) and substantia nigra pars compacta (SNc), combined with iontophoretic application of NMDA. We have observed no response to NMDA application in NR1 subunit knock-out mice, whereas NMDA evoked robust bursting activity of DA neurons in control animals. During the separate series of experiments we have applied non-specific cholinergic receptors' agonist – carbachol (CCH) to verify if cholinergic innervation of VTA/SNc region can induce bursting activity of DA neurons lacking the NMDA receptor. Majority of examined DA neurons have responded to application of CCH by increasing the firing rate and in some cases development of bursting activity was observed. Our results suggest that NMDA dependent mechanism is dominant, but not the only one responsible for the induction of bursting activity of midbrain DA neurons. Supported by: Statutory Funds of the Institute of Pharmacology of the PAS.

17. The role of NMDA-receptor dependent phasic activity of dopamine neurons in motivation and effort discounting

Kamila Łopata[a], Przemysław Cieślaka[a], Łukasz Szumiec[a], Mateusz Turbasa[a], Magdalena Walczak[b], Tomasz Błasiak[b], Jan Rodriguez Parkitna[a]

lopata@if-pan.krakow.pl

Institute of Pharmacology of the Polish Academy of Sciences, Krakow, Poland
Institute of Zoology, Jagiellonian University, Krakow, Poland

A major role of dopamine neurons is energizing behavior. It was proposed that the lack of motivation and decreased ability to exert effort observed in depression is caused by a dysfunction of the dopamine system. Here we investigate a transgenic mouse model with disrupted NMDA receptor-dependent activity of dopamine neurons. Dopaminergic neurons from mutant mice were insensitive to NMDA and lacked burst activity while retaining normal tonic activity. Mutant mice responded similar to controls in food self-administration test, as well as under progressive ratio and variable interval schedules. However, mutants did not acquire instrumental responding for audio-visual stimuli.

Moreover, mutant mice showed no preference for a saccharine solution in an IntelliCage under fixed ratio 3 schedule, although when the number of nose pokes required to access to sweet solution was increased gradually, the difference was minor. In line with a potential depressive-like phenotype, mutants spen t more time immobile in the forced swim test, which might indicate lower motivation to escape from an aversive situation and demonstrated lower level of social interactions. Thus, the loss of NMDA receptors in DA neurons caused decreased motivation to obtain some types of rewards and increased probability of a behavior similar to learned helplessness.

18. Evaluation of the mechanisms underlying the anticonvulsant effect of sildenafil in the 6 Hz psychomotor seizure threshold test in mice

Katarzyna Socała, Nieoczym Dorota, Pieróg Mateusz, Wlaź Piotr

ksocala@op.pl

Department of Animal Physiology, Institute of Biology and Biochemistry, Maria Curie-Skłodowska University, Lublin, Poland

Sildenafil, a selective phosphodiesterase type 5 inhibitor (Viagra), has recently been reported to have anticonvulsant effect in the psychomotor seizure test in mice that is considered a model of therapy-resistant limbic seizures. The mechanism(s) underlying this effect remains, however, unclear. Therefore, the aim of the present study was to investigate the role of some neurotransmitter systems as well as the nitric oxide/ guanosine 3´,5´-monophosphate (NO/cGMP) pathway in the anti-seizure activity of sildenafil in the 6 Hz seizure threshold test in mice. Our results showed that co-administration of an ineffective dose of sildenafil with an ineffective dose of CGP 37849 (a competitive NMDA receptor antagonist) or diazepam (a GABA receptor agonist) significantly raised the threshold for psychomotor seizures. Pre-treatment with DPCPX (a selective adenosine A1 receptor antagonist), but not with KW-6002 (a selective adenosine A2A receptor antagonist) abolished the anticonvulsant action of sildenafil. Likewise, 7-nitrindazole (a selective neuronal NO synthase inhibitor) and methylene blue (a non-selective inhibitor of guanylate cyclase and NO synthase) reversed the anticonvulsant effect of sildenafil. In conclusion, it seems that the anticonvulsant effect of sildenafil in 6 Hz seizure test is mediated via different neurotransmitter systems. Further studies are required to explore the anticonvulsant mechanism of sildenafil.

19. The influence of motor imagery on the learning of a motor skill

Kinga Gzieło-Jurek[a], Zuzanna Setkowicz[a], Michał Kiełbiński[a], Jakub Płoszaj[a], Wioletta Tarasek[a], Anna Chrzanowska[a], Krzysztof Janeczko[a], Stefan Gaździński[b]

kinga.gzielo@gmail.com

[a] Department of Neuroanatomy, Jagiellonian University, Krakow, Poland
[b] Military Institute of Aviation Medicine, Warsaw, Poland

Obesity increases the risk of cardiovascular, metabolic and neurological disease, especially in the elderly. It is associated with oxidative stress, blood-brain barrier dysfunction and chronic inflammation.
Here, rats were maintained on a high-fat diet (HFSD), consisting of 40% fat, 40% sugar and 10% fiber for 12 months. We then studied the morphology of GFAP-positive astrocytes and Iba1-positive microglia in HFSD-fed rats and controls.
Methods: Male Wistar rats were kept in single cages for 12 months, fed either HFSD or standard laboratory chow. Immunohistochemistry for GFAP and Iba1 was performed. Images were obtained from the hippocampal Ammon's horn (CA) and dentate gyrus (DG). Semi-automated Sholl analysis was performed, the resulting measurements of cell morphology (the number of intersections, an indirect measure of cell process branching) were analyzed using 2-way (treatment and structure) ANOVA.
Results: Astrocyte branching was significantly reduced after HFSD. Conversely, microglial cells had more processes in HFSD-fed brains. Here, the effect of structure was also significant, with DG glia having a less-branched morphology in comparison to CA. These observations are consistent with a slight reduction, rather than increase, in glial activation after HFSD. Supported by NCN grant 2012/05/N/NZ2/00641

20. Anti-epileptogenic Effects of Ethosuximide on Anxiety, Depression and Problem solving in a Genetic Absence Model

Lieke Bakker, Renée Raaijmakers, Valerio D'Amore, Gilles van Luijtelaar

lieke.bakker@student.ru.nl

Donders Centre for Cognition, Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen, The Netherlands

The antiabsence drug Ethosuximide (ETX) has antiepileptogenic properties in man and absence models and prevents

depressive like-phenotype after 4 months treatment. Many antiepileptic drugs have negative effects on problem solving tasks. Here the development of anxiety, depressive-like phenotype, and problem solving were investigated. Half of the WAG/Rij rats were treated for 4 month with ETX, the others were controls. The rat's behavior was measured at 1 and 4 months after treatment, and one week after the discontinuation of ETX.
There were no differences in various anxiety tests (elevated plus and open field) during treatment, moreover, depression-like behavior as measured in the forced swim test was not prevented. 1 and 4 month treated rats were more motivated to run in the Y-maze, showed an increased appetite for sucrose pallets and learned to discriminate post-treatment between the cued and non-cued arm of the Y-maze.
It can be concluded that early and chronic ETX treatment has positive motivational effects in a problem solving task, does not affect anxiety, while repeated testing might have falsified the validity of the forced swim task. Whether the favorable outcomes on motivation is due to the effects of ETX perse, or to antiepiletogenese remains to be established.

21. Kindled behavior disturbances are suppressed by cerebellar stimulations

Valeriya Chubach, Muratova Tatyana, Godlevsky Leonid

godlevsky@odmu.edu.ua

Odesa National Medical University, Odesa, Ukraine

Anxiety and depression are component of interictal behavioral deteriorations that occur as a consequence of kindling, a procedure to induce chronic epilepsy. The aim of this study was to evaluate the possible effects of electrical stimulation (ES) of paleocerebellar cortex on anxiety and depressive-like behavior in a PTZ kindled epilepsy model. Kindling was induced via pentylenetetrazol (PTZ) (25.0 mg/kg i.p. daily) during three weeks. Locomotion in open field, elevated plus-maze (EPM) and Porsolt forced swimming test have been used for the assessment of anxiety and depression-like behavior. ES (100 Hz) has been delivered to V-VII lobules of vermal cortex of kindled rats. ES of paleocerebellum reversed kindling-induced reduction of crossings of central squares, increased rearings, and decreased the number of defecations in open field. The duration that kindled animals spent in the open arms of the EPM increased in post- ES period, and the number of enterings into the closed arms of the EPM decreased. The duration of the immobility response in the swimming test in kindled rats was reduced after ESs of paleocerebellum. In all: ES of paleocerebellar structures suppressed anxious and depressive-like behavior in PTZ-kindled rats.

22. Loss of NMDA receptors in noradrenergic neurons increases tonic activity of the locus coeruleus and facilitates behavioral flexibility in mice

Przemysław Eligiusz Cieślak[a], Nerea Llamosas[b], Tomasz Kos[c], Luisa Ugedo[b], Maria Torrecilla[b], Jan Rodriguez Parkitna[a]

cieslak@if-pan.krakow.pl

[a] Laboratory of Transgenic Models, Department of Molecular Neuropharmacology, Institute of Pharmacology Polish Academy of Sciences, Krakow, Poland
[b] Department of Pharmacology, Faculty of Medicine and Dentistry, University of the Basque Country, Leioa, Spain
[c] Department of Behavioral Neuroscience & Drug Development, Institute of Pharmacology Polish Academy of Sciences, Krakow, Poland

The tonic and phasic activity of noradrenergic neurons of the locus coeruleus (LC) corresponds to the scanning and focused modes of attention and also governs the balance between flexible versus focused behavioral performance.
Here, by using transgenic mice (NR1DBHCre) we study the effects of a selective inactivation of NMDA receptors in noradrenergic neurons.
We found that the mutation caused an increase in tonic activity of noradrenergic cells in LC, without appreciably affecting their phasic (bursting) activity. The change in activity was accompanied by altered behavior in tasks measuring attention and behavioral flexibility, the Go/No-Go and the Attentional Set Shifting Task (ASST). In the Go/No-Go mutant mice showed deficits in focused attention, observed as increased distractibility and a greater tendency to respond to non-target stimuli during No-Go trials. Conversely, the mutation enhanced behavioral flexibility in ASST, as evidenced by facilitation of attentional shifting during the extra-dimensional shift phase of the task, while leaving reversal learning and other aspects of discrimination learning unaffected.
These observations confirm the relation between tonic mode of LC activity and behavioral flexibility, as proposed by the adaptive gain theory and also reveal a role of NMDA receptors in limiting tonic activity of noradrenergic neurons.

23. Influence of selected antiepileptic drugs on seizure activity induced by pentylenetetrazole in the adult Zebrafish model

Mateusz Pieróg, Leszek Guz, Piotr Wlaź

mateusz.pierog@poczta.umcs.lublin.pl

Department of Animal Physiology, Institute of Biology, Maria Curie-Skłodowska University, Lublin, Poland

The aim of the experiment was to investigate the effect of antiepileptic drugs (AEDs) given intraperitoneally (i.p.) on seizure activity in PTZ-induced model by immersion. The evaluation system involves the determination of seizures behavioral: Stage I - hyperlocomotion, myoclonic-like seizures, Stage II - clonic-like swimming, Stage III - tonic-like swimming. Popular technique of drug administration is to immerse the fish in a tank with the dissolved substance for certain time that enables absorption into the bloodstream through the gills. An alternative is i.p. administration in the adults Zebrafish. This method is preferable for applications of small volumes of drugs or substances sparingly soluble in water (e.g., oily substance). The study tested two groups of AEDs, which are assigned to block sodium channels (valproate, phenytoin, carbamazepine) and inhibition of glutamate transport using NMDA receptor antagonists (levetiracetam, felbamate). Statistical analysis of the results showed the effectiveness of AEDs on phases SI-SIII. Substances - valproate, phenytoin, carbamazepine have raised the seizure threshold for all phases of seizures. Similarly, levetiracetam has increased the seizure threshold. In the case of felbamate increase seizure threshold was recorded only during the SI. The results prove the effectiveness of the method used, and encourage continuing research on Zebrafish.

24. Combined Method for Effective Allocation and Extraction of Oscillatory Patters in Epileptic EEG signals

Vadim Grubov

vvgrubov@gmail.com

Saratov State University, Saratov State Technical University, Saratov, Russia

It is well known that there is a strong correlation between characteristic oscillatory patterns on EEG signals and functional state of living organism. So, the investigation of oscillatory patterns in characteristic frequency ranges is an important problem that includes neurophysiology and signal processing, because analysis of complex signals and oscillatory patterns traditionally refers to applied mathematics, nonlinear dynamics and theory of oscillation.
The main problem in analysis of EEG signals is complex experimental nature of EEG. The EEG signal has some particular features like strong non-stationarity and noise component which make most wide-spread signal analysis methods (like Fourier analysis) ineffective for analysis of EEG signal. Thus, the problem of development of new effective methods for EEG analysis is very important.
In this Report we suggested new original method for time-frequency analysis and extraction of characteristic oscillatory patterns in the epileptic EEG signals, based on continuous wavelet transform and empirical mode decomposition. These method was applied to experimental EEG signals and results were compared to analysis of expert-neurophysiologist. The effectiveness of proposed methods in EEG signal analysis was shown.
The study was supported by RFBR (14-02-31235) and Ministry of Education and Science of Russian Federation.

25. Maternal separation attenuates long-term potentiation in the rat hippocampus and lateral amygdala

Aleksandra Trenk[a], Joanna Danielewicz[a], Grzegorz Hess[a b]

aleksandra.trenk@gmail.com

[a] Department of Neurophysiology and Chronobiology, Institute of Zoology, Jagiellonian University, Krakow, Poland
[b] Department of Physiology, Institute of Pharmacology PAS, Krakow, Poland

Early life stress exerts a detrimental influence on the functions of the organism in the adulthood. The maternal separation (MS) is a widely used animal model to study the impact of early adversity. Here we sought to determine the effects of MS on long-term potentiation (LTP) in the rat hippocampus and lateral amygdala (LA).
Rat pups were subjected to MS for 3 hours per day on postnatal days (PND) 1-21. They were weaned at PND 28 and the ex vivo electrophysiological experiments were conducted between PNDs 35-49. The animals were anesthetized and coronal brain slices containing both structures were cut. Field potentials (FPs) were evoked in the thalamic and cortical inputs to the LA and in the CA1 area of the hippocampus. LTP was induced using theta-burst stimulation in the LA and high-frequency stimulation in the CA1 area.
The results of the present study demonstrate that MS results in an impairment of LTP in the hippocampus. Moreover, a reduction of the LTP magnitude was observed in both the cortical and thalamic inputs to the lateral amygdala in slices obtained from MS-subjected animals. Thus, MS impairs the potential for synaptic plasticity in both structures.
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26. Retinal deactivation abolishes infra slow oscillatory pattern but not the neuronal activity in the intergeniculate leaflet and ventrolateral geniculate nucleus of WAG/Rij rats

Łukasz Chrobok, Katarzyna Palus, Patrycja Orlowska-Feuer, Marian Henryk Lewandowski

lukasz.chrobok@uj.edu.pl

Department of Neurophysiology and Chronobiology, Institute of Zoology, Jagiellonian University, Krakow, Poland

The intergeniculate leaflet (IGL) and ventrolateral geniculate nucleus (VLG) are two interrelated retinorecipient nuclei of the lateral geniculate complex, involved in biological rhythms and visuomotor functions regulation, respectively. A subpopulation of IGL/VLG neurons generates action potentials in an infra-slow oscillatory (ISO) manner with a period of multiseconds. Previous studies have shown that ISO activity in the IGL of Wistar rats depends on retinal activity, as it is exclusively present under photopic conditions and is completely abolished by the contralateral intraocular injection of tetrodotoxin (TTX). We set out to verify a retinal origin of ISO activity in WAG/Rij rats, which are an animal model of absence epilepsy. Surprisingly, our in vivo electrophysiological studies showed that ISO activity in the IGL/VLG does not depend on lightening conditions, however its oscillatory features are modulated by irradiance. Moreover, contralateral intraocular TTX injections diminished rhythmic firing, though not the neuronal activity as in the case of Wistar rats. In agreement with our patch-clamp studies, these results suggest that the IGL/VLG network is strongly disinhibited, compared to Wistar rats. As absence epilepsy is associated with retinal and sleep-wake cycle abnormalities, investigation of the visual thalamus constitutes an important research area. Supported by Polish MSHE grant: 0001/DIA/2014/43

27. Dysregulation of hyperpolarization-activated inward cation current (Ih) affects the Thalamocortical oscillations: the role of auxiliary subunit TRIP8b on HCN channel function in thalamic and cortical neurons

Mehrnoush Zobeiri[a], Annika Lütjohann[a], Paric Mueth[b], Dane M. Chetkovich[c], Hans-Christian Pape[a], Gilles van Luijtelaar[d], Thomas Budde[a]

zobeiri@uni-muenster.de

[a] Institute für Physiologie I, Westfälische Wilhelms-Universität, Münster, Germany
[b] Department of Neurology, Universitätklinikum Münster, Germany
[c] Davee Department of Neurology and Clinical Neurosciences and Department of Physiology, Northwestern University, Chicago, USA
[d] Donders Centre for Cognition, Radboud University Nijmegen, Nijmegen, The Netherlands

The aim of the present study was to determine how dysregulation of hyperpolarization-activated cyclic nucleotide-gated cation (HCN) channels due to the lack of expression of auxiliary subunit TRIP8b, alters the basic properties of hyperpolarization-activated current(Ih) in thalamic and cortical neurons and consequently affects the thalamocortical oscillations. Ih was measured in whole cell patch clamp recordings from thalamocortical (TC) neurons of different thalamic nuclei, as well as pyramidal neurons in layer V and VI of the somatosensory cortex of TRIP8b-deficient (TRIP8b-/-) and control (C57Bl/6J) mice (p15 – p30). Effects of Ih dysregulation on thalamocortical oscillations was monitored by local field potential (LFP) recordings (p 90 – p120). In all investigated brain regions, Ih amplitude was significantly lower in TRIP8b-/- as compared with control mice. Analysis of the half-maximal activation of Ih revealed a significant shift in steady states activation curves towards more hyperpolarized values in TRIP8b-/- . TC neurons in TRIP8b-/- mice showed a higher sensitivity for cAMP. In addition, reduction of Ih increased the probability of burst activity in TC neurons and altered the cortical neuronal oscillations towards more slow activities. Alterations in Ih properties due to the lack of TRIP8b auxiliary subunit may contribute to the generation of abnormal thalamocortical oscillations.

28. Sleep-wake states across 24 h are differently coupled in epileptic and control rats

Magdalena Smyk[a], Gilles van Luijtelaar[b], Wilhelmus H. Drinkenburg[c],

magdalena.smyk@gmail.com

[a] Dep. of Neurophysiology and Chronobiology, Chair of Animal Physiology, Institute of Zoology, Jagiellonian University in Krakow, Poland
[b] Donders Centre for Cognition, Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen, the Netherlands
[c] Dep. of Neuroscience, Janssen Research & Development, a Division of Janssen Pharmaceutica NV, Beerse, Belgium

The distribution of sleep-wake states across 24 h is non-uniform and behavior-dependent. In nocturnal rodents, motor activity predominates during the dark phase, while the light phase is occupied by sleep. Absence seizures in WAG/Rij rats, a well validated animal model of childhood absence epilepsy, occur more frequently during the dark phase and have a significant impact upon the sleep-wake cycle of this strain. The main goal of the study was to investigate phase-dependent temporal relationship between sleep-wake states in WAG/Rij rats and non-epileptic control.
20 h EEG/EMG recordings were made in 12 adult, male WAG/Rij and 12 aged-matched male Sprague Dawley rats in order to investigate temporal relationship between 5 sleep-wake states: active and passive wakefulness, light and deep slow-wave sleep, REM sleep. Cross-correlation function was applied on 10 h data (resolution: 30 sec) recorded in both phases of the 12:12 light-dark cycle in standard laboratory conditions.
Temporal relationship between sleep-wake states was found to be decreased by the epileptic phenotype of the WAG/Rij rats. Different sleep-wake coupling with respect to the phase of the light-dark cycle seems to be a general phenomenon of sleep in rats. However, the presence of absence seizures might influence some aspects of this relationship.

29. Both δ and μ opioid receptors are involved in hyperpolarizing effect of the met-enkephalin in the rat intergeniculate leaflet of the thalamus

Katarzyna Palus, Chrobok L., Lewandowski MH

k.palus@uj.edu.pl

Jagiellonian University, Krakow, Poland

The intergeniculate leaflet (IGL) of the thalamus is a small but important structure of the mammalian biological clock. The well-known function of the IGL is integration of photic and non-photic stimuli and sending this information to the master biological clock – suprachiasmatic nuclei. The network of the IGL consist of GABA-ergic neurons which coexpress opioid neurotransmitter enkephalin (ENK) and neuropeptide Y (NPY). These two groups of IGL neurons differ between their function. Neurons expressing NPY connect IGL with the suprachiasmatic nuclei and enkephalinergic cells connect contralateral IGLs by geniculo-geniculate pathway. ENK neurons are known to generate infra-slow oscillation which can be observed during in vivo experiments. The aim of our patch-clamp study was to verify if ENK directly affects IGL neurons and what type of opioid receptor is involved. Our preliminary data indicated postsynaptic hyperpolarization effects after met-ENK (30μM) application. Surprisingly, naltrindole – δ opioid receptor antagonist – caused only partial inhibition of met-ENK postsynaptic effect. However, in case when we used a mix of both opioid receptor antagonists – the hyperpolarization caused by met-ENK was totally disappeared. To the best of our knowledge this is the first time when the met-ENK effect via two different opioid receptors is described in the IGL.

30. Expression of the heavy-chain neurofilament proteins in the lateral geniculate nucleus of the cat

Aleksander Mikhalkin, Nina Nikitina, Aleksander Veschitskiy, Natalia Merkulyeva

michalkin@mail.ru

Pavlov Institute of Physiology, Russian Academy of Sciences, St. Petersburg, Russia

In the visual system a population of the neurons with high level of the heavy-chain neurofilaments (H-NF) is distinguished. These cells are considered to be similar to the cells of Y pathway – one of three main visual processing pathways of mammals – by a number of parameters. To identify the nonphosphorylated H-NF the SMI-32 antibody is applied. It makes visible the soma and the proximal dendrites of labelled neurons. We assessed the soma area (SA) and the relative brightness (RB) of the neurons in the lateral geniculate nucleus (LGN) of the cat. We compared these parameters through the layers and in different parts of the representation of the visual field on the LGN. It helps to understand the contribution of the SMI-32 positive cells in the Y pathway. We observed correlation of RB and SA ($r=0,52$, $p=0,001$), that demonstrates the relation between expression level of the nonphosphorylated H-NF (indirectly reflected by the RB) and the size of the cells. SA and RB values decrease from layer Cm to layer A and from center to peripheral representation. It's noteworthy, because Y-cells have larger receptive fields in the representation of the periphery visual field than in its center.

31. Investigation of the role of GABAerg inhibition in epileptic and non-epileptic human neocortex, in vitro

Ágnes Kandrács[a b], Kinga Tóth[a d], Katharina T. Hofer[a b], Csilla Szabó[a b], Attila Bagó[c], Loránd Erőss[c], László Entz[c], István Ulbert[a b], Lucia Wittner[a c]

[a] Institute of Cognitive Neuroscience and Psychology, Research Centre for Natural Sciences, Hungarian Academy of Sciences, Budapest, Hungary
[b] Faculty of Information Technology, Pázmány Péter Catholic University, Budapest, Hungary
[c] National Clinical Neuroscience Institute, Budapest, Hungary
[d] Institute of Experimental Medicine, Hungarian Academy of Sciences, Budapest, Hungary

Resection surgery is considered a treatment alternative for drug resistant epileptic patients. Using human neocortical tissue resected from patients with focal epilepsy or patients with tumour but without epilepsy, we investigated the effect of the blockade of GABAerg inhibition using bicuculline, a competitive GABAA receptor antagonist. Local field potential gradient (LFPg) recordings were obtained from neocortical tissue slices with a 24 channel laminar multielectrode. Current source density (CSD) and multiple unit activity (MUA) were calculated. Furthermore, time-frequency analysis was performed in order to investigate high-frequency oscillations (HFO).
During bicuculline application, we could detect population activity events in 67% of tissue slices from epileptic and in 42% of tissue slices from tumour patients with an average occurrence frequency of 0,12±0,15 Hz and 0,09±0,11 Hz, respectively. These events show a high-amplitude LFPg peak with a duration of 348±73,28 ms in epileptic and 326±95,55 ms in tumour patients. MUA and HFO, including both ripples and fast-ripples, have been observed during this activity in all cases.
Our results show that there are striking similarities in the features of bicuculline events in epileptic and non-epileptic patients. However, further investigations are needed to clarify the role of GABAerg inhibition in epileptic processes.

32. Light-induced neuronal responses of the dorsal lateral geniculate nucleus in the pigmented rat - in vivo study

Jagoda Jęczmień, Orlowska-Feuer Patrycja, Lewandowski Marian Henryk

jagoda.jeczmien@gmail.com

Department of Neurophysiology and Chronobiology, Jagiellonian University, Krakow, Poland

The dorsal lateral geniculate nucleus (dLGN) of the thalamus is a retinocipient brain area responsible for processing visual information. It receives retinal input from all photoreceptors: rods, cones and melanopsin cells, which project to distinct area of the nucleus. Previous electrophysiological studies have shown three types of light-induced responses (transient ON, OFF and sustained) within the mice dLGN, where only 'sustained' cells have coded light intensity. The purpose of the present study was to verify, if similar types of light-induced responses occur in the rat dLGN and whether neurons generating infra-slow oscillatory activity are sensitive to light. We addressed these questions by performing in vivo extracellular recordings combined with different light stimulations. In accordance with previous reports, we observed excitation or suppression of dLGN neuronal activity upon eye illumination and the most common response (46%) was transient ON. Moreover, all recorded oscillatory neurons were sensitive to light and all three types of responses were observed. As in the case of mice, only 'sustained' neurons were able to track changes in light intensity. Our results confirm that the dLGN neurons in pigmented rats, exhibit similar light-induced activity as were observed in mice, independently of their firing pattern (oscillatory and non-oscillatory). This study was supported by grant 2013/08/W/N23/00700.

33. Relaxin-3/RXFP3 signalling in the paraventricular nucleus of hypothalamus (PVN) of rats – insights into the sexual differences in stress-related food intake

Alan Kania[a], Gundlach A.L.[b], Lewandowski M.H.[a], Hess G. [a], Blasiak A.[a]

alan.kania@uj.edu.pl

Department of Neurophysiology and Chronobiology, Jagiellonian University, Krakow, Poland
The Florey Institute of Neuroscience and Mental Health, The University of Melbourne, Melbourne, Australia

Relaxin-3 (RLN3), the ancestral neuropeptide highly expressed in the brain, is involved in feeding control and stress response. Strong orexigenic effect of RLN3 and responsiveness of RLN3 synthetising neurons to stress, made the relaxin-3 system a target of research aimed at understanding the reciprocal connections between stress and feeding. Notably, recent evidence suggest that the relaxin-3 contribution to appetite control is sexually differentiated. Binge eating female rats, exhibiting overeating in response to intermittent food restriction and chronic stress, show increased expression of relaxin-3 in nucleus incertus and reduced c-fos expression in PVN. Therefore, to characterise cellular effect of relaxin-3 cognate receptor (RXFP3) activation on PVN neurons we conducted the whole cell patch clamp experiments on brain slices from female Sprague Dawley rats. RXFP3 agonist (RXFP3-A2 600 nM) exerted strong inhibitory effect on majority of recorded neurons, which persisted in the presence of tetrodotoxin (0,5 uM), indicating postsynaptic effect. Our data support hypothesis that relaxin-3 is associated with feeding control in female rats, and planned further studies will characterise possible differences in cellular response to RXFP3 activation in PVN in male rats, that would explain sexual dimorphism in feeding and stress-related behaviours. Supported by: MSHE Poland 0020/DIA/2014/43 and NCN Poland DEC-2012/05D/NZ4/02984.

34. Melanin concentrating hormone innervation of the nucleus incertus – unravelling the feeding control network in the brain

Agnieszka Grabowiecka[a], Hess G.[a], Lewandowski M.H.[a], Gundlach A.L.[b], Blasiak A.[a];

agnieszka.grabowiecka@uj.edu.pl

[a] Department of Neurophysiology and Chronobiology, Jagiellonian University, Krakow, Poland
[b] The Florey Institute of Neuroscience and Mental Health, The University of Melbourne, Melbourne, Australia

Nucleus incertus (NI), a brainstem structure located in the floor of the fourth ventricle, is a main source of the relaxin-3 (RLN3) – a member of the relaxin peptide family. It was found that RLN3 is an important player in the regulation of food intake and stress response in rodents.
Melanin concentrating hormone (MCH) is a neuropeptide, synthetized in lateral hypothalamus and zona incerta in the mammalian brain. MCH controls sleep/wake cycle, modulates locomotor activity and exerts strong orexigenic actions in mammals. MCH innervation was confirmed in many brain structures, including brainstem area.
The aim of our study was to identify and precisely describe the anatomical location of the source of MCH fibres in the NI area. Performed tract-tracing and immunohistochemical staining experiments revealed that area of the nucleus incertus is innervated by MCH-positive fibers and MCH-synthetizing neurons filled with retrograde tracer collected from the NI, were present in lateral hypothalamic and zona incerta area.
Strong orexigenic action of the MCH and confirmed anatomical link between MCH and RLN3 systems allow us to hypothesise that MCH play important role in regulation of food intake by modulation of the main source of the RLN3 in the rat brain.

35. Effects of chronic manipulation of the endocannabinoid system in WAG/Rij rats during adolescence

Fleur Kilwinger[a b], Clementina M. van Rijn[a], Gilles van Luijtelaar[a], Martin F.J. Perescis[a b]

c. a.: m.perescis@donders.ru.nl

[a] Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen, The Netherlands
[b] HAS Den Bosch University of Applied Sciences, 's Hertogenbosch, The Netherlands

The cannabinoid 1 receptor (CB1) is the most abundant G-protein coupled receptor in the central nervous system (CNS). Activation of the CB1 receptor inhibits neurotransmitter release. The endocannabinoid system also plays a role in the development of the CNS. There is evidence for the involvement of the endocannabinoid system in absence epilepsy. Absence epilepsy is a non-convulsive type of epilepsy that normally occurs during childhood and is characterized by Spike Wave Discharges. Activation of the CB1 receptor by the synthetic cannabinoid R(+)WIN55-212,2 decreases the number of spike wave discharges. In this study we present that chronic exposure to R(+)WIN55-212,2 during adolescence decreases the number of SWDs in adulthood. This suggests that there were permanent changes in the brain caused by chronic injections with R(+)WIN55-212,2. Chronic exposure to R(+)WIN55-212,2 could have changed the CB1 receptor density or the connectivity between brain structures. Next to the effects of R(+)WIN55-212,2 an effect of the stress of the injection was noticed. Environmental changes are found to have an effect on SWD expression.

36. A pinealectomy lowers the amount of epileptic seizures. Effect of a pinealectomy on spike and wave discharges in WAG/Rij rats

Michelle Huismans[a b c], J. Tchekalarova[b d], R.T. Ngomba[b], M.F.J. Perescis[a c], A. De Fusco[b], S.G.Moyanova[b]

michellehuismans@hotmail.com

[a] HAS Den Bosch University of Applied Sciences, 's Hertogenbosch, The Netherlands
[b] IRCCS Istituto Neurologico Mediterraneo Neuromed, Pozzilli, Molise, Italy
[c] Donders Institute for brain, Cognition and Behaviour, Radboud University Nijmegen, The Netherlands
[d] Institute of Neurobiology Bulgarian Academy of Sciences, Sofia, Bulgaria

Melatonin is a hormone that regulates and resets the circadian rhythm, all the biological and endogenous processes in the body that repeat every 24 hours. It is produced in the pineal gland during dark periods. A link between epilepsy and the circadian rhythm has been found in patients that had seizures only during the night or day.
To research this link, 31 WAG/Rij rats, known for their absence epilepsy, had a pinealectomy. Approximately 54 days later a 24 hours lasting EEG was done. 13 rats had a similar treatment and surgery, but their pineal gland was not

removed (SHAM). WAG/Rij rats normally have a significantly higher amount of spike and wave discharges (SWDs) during the dark phase (06:00 p.m. – 06:00 a.m.) than during the light phase. This was found in the SHAM rats. The pinealectomy rats showed no difference in amount of SWDs during dark or light phase. This leads to the conclusion that our data has shown that the effect of a pinealectomy, is a decrease of spike and wave discharges during the dark period. This means that their circadian rhythm is disturbed, which causes the amount of spike and wave discharges to even out.

37. Study of the activity of hippocampal neurons in rat model of type 2 diabetes

Karen Simonyan[a], Armine Isoyan PhD[a], Vergine Chavushyan PhD, DSc[b]

karensimonyan86@gmail.com

[a] Orbeli Institute of Physiology, Yerevan, Armenia
[b] Head of laboratory of Neuroendocrine Relationships, Orbeli Institute of Physiology, Yerevan, Armenia

Fructose consumption has largely increased over the past decades and is explained by its potential as a dietary sugar substitute. High fructose consumption induces insulin resistance and increases the risk of type 2 diabetes. In 10 rats preliminary mean plasma glucose level was 85,800 ± 4,305 mg/dl, and 6 weeks after 20% fructose drinking the increase in glucose concentration reached 155,600 ± 5,958 mg/dL (P <0,0001). High density of insulin receptors in the central nervous system defines the key role of insulin in neuronal synaptic plasticity. Electrophysiological study of evoked activity of hippocampal neurons during high-frequency stimulation of entorhinal cortex in experimental rat model of type 2 diabetes, caused by the consumption of 20% fructose, showed significantly lower level of prestimulus and poststimulus spike activity of recorded neurons compared with the control. At the same time, the expression of excitatory responses during high frequency stimulation in fructose group exceeded those in the control, possibly due to activation of "silent" synapses in hippocampus. The existing balance of types of recorded responses in control group underwent an insignificant redistribution in fructose group. According to the data obtained in these pathological conditions the plasticity and survival of neurons appears by modulation by excitatory inputs of information processing in entorhinal cortex – hippocampus network.

38. Recording of theta-related cells discharges from posterior hypothalamic area in anesthetized rats: methodological problems

Paulina Kłos-Wojtczak, Bartosz Caban, Renata Bocian, Paulina Kaźmierska, Tomasz Kowalczyk, Jan Konopacki

paulina.klos@gmail.com

University of Lodz, Poland

Theta rhythm is known as the best synchronized rhytmical activity generated from the mammalian brain. The main structure from which theta rhythm is registered is hippocampal formation (HP). Previous study showed that posterior hypothalamic (PH) nucleus and supramammillary nucleus are the structures, which are also capable of generation local theta rhythm independently from HP theta. However, PH rhythm is characterized by lower stability and amplitude. What is more, epochs of theta are shorter, and appear in EEG rarely. The present study was aimed to established the standard conditions of producing theta in anesthetized rats to be able to record theta-related local cell discharges. Firstly, anesthetized rats were subjected to local injection of 0.75ug/0.5ul carbenoxolone. After this injection only well synchronized theta rhythm was observed. In the next step rats were subjected with 0.5ug/0.5ul kainic acid. Unfortunately kainic acid caused only epileptic activity. Afterwards the mixture of carbenoxolone and kainic acid was applied. However that injections have never produced theta rhythm. Finally various doses of carbachol were also tested. The lowest doses of carbachol were not capable of induce theta rhythm, and injection of the highest doses of carbachol induce only epileptic activity. Ultimately, concentration of 0.2ug/0.5ul carbachol was accepted; it induced well synchronized epochs of theta rhytm and large irregular activity.

39. Treatment with the 5-HT7 receptor antagonist SB 269970 impairs the effects of activation of 5-HT7 receptors in the rat hippocampus

Joanna Sowa[a], Magdalena Kusek[a], Krzysztof Tokarski[a], Grzegorz Hess[a b]

jgsowa@gmail.com

[a] Department of Physiology, Institute of Pharmacology, Polish Academy of Sciences, Krakow, Poland
[b] Department of Neurophysiology and Chronobiology, Institute of Zoology, Jagiellonian University, Krakow, Poland

Introduction: Serotonin (5-HT) modulates the activity of the hippocampal neuronal circuitry via several receptor subtypes. The 5-HT7 receptor raises the excitability of pyramidal neurons of the CA1 and CA3 areas. The aim of this study was to establish the effects of treatment with the 5-HT7 receptor antagonist SB 269970 on the reactivity of CA1 and CA3 pyramidal neurons to 5-HT7 receptor activation.
Methods: Wistar male rats received i.p. injections of 0.9% NaCl or SB 269970 once daily for 14 days. 48h after the last injection, whole cell recordings from CA1 and CA3 pyramidal neurons were carried out. To activate the 5-HT7 receptor, 200 nM 5-CT was added to ACSF in the presence of 2 μM WAY100635, a 5-HT1A antagonist.
Results: In the slices obtained from control animals, 5-HT7 receptor activation resulted in a small depolarization and an increase in the input resistance as well as increased the spiking activity of CA1 and CA3 pyramidal cells. Those effects were absent from neurons obtained from SB 269970-treated rats.
Conclusions: The results of the present study indicate that treatment of rats with the 5-HT7 receptor antagonist SB 269970 abolishes the effects of 5-HT7 receptor activation on the intrinsic excitability of hippocampal pyramidal neurons.

PAIN & SOMATOSENSORY PROCESSING

40. The effect of chronic Pain on Empathy: A study of the electroencephalographic changes related to emotional processing in patients with chronic pain

Kelly Woudsma[a], M. Ferdek[a,b] ,M. van Aken[c], N. Peeters[a], J. Oostermann[a], I. Brazil[a], A. Peeters[d], G. Ruigt[a], A. Nap[c], M.L.A. Jongsma[e], CM van Rijn[a]

[a] Donders Centre for Cognition, Radboud University Nijmegen, The Netherlands
[b] Jagiellonian University, Krakow, Poland
[c] Gynaecology, Rijnstate Hospital, Arnhem, The Netherlands
[d] Department of Anatomy, Radboud University Nijmegen, The Netherlands
[e] Behavioural Science Institute, Radboud University Nijmegen, The Netherlands

Focusing on patients with endometriosis related chronic pain, this study aims to determine the effect of this chronic pain on emotional processing using EEG. Primarily, we are investigating the effect of chronic pain on mu rhythms localized over the sensorimotor cortex. These rhythms are associated with motor tasks and mirror neuron processing. In addition the LPP (late positive potential), a measure of degree of emotional content, is being determined. We are measuring patients suffering from endometriosis that are non-cyclic, due to hormonal therapy ($n \approx 40$). The patients will be compared with matched controls. The measurements are: passive viewing of emotionally salient stimuli, a standardized pain measurement scale (QST), and a variety of questionnaires. As chronic pain has been previously seen to negatively affect emotional decision-making and other higher difficulty cognitive tasks, we expect to find significant differentiation between pain patients and controls on the level of EEG, especially a desynchronization of the mu rhythm and a less pronounced LPP. This study is meant to serve as a basis to understanding the effect of chronic pain on socialization and empathy, and as a way-point on the road to understanding both chronic pain and empathy in isolation. Preliminary data will be presented at the conference.

41. Evidence for two distinct attentional bias patterns for pain-related information

Casper van Heck, R.P.C. Kessels, C.M. van Rijn, J.M. Oosterman

caspervanheck@gmail.com

Donders Centre for Cognition, Radboud University Nijmegen, the Netherlands

Little is known regarding inter-individual differences in attentional biases for pain-related information; more knowledge is crucial, since these biases may have significant effects on pain processing. The present study investigated attentional bias patterns for pain-related information, with specific focus on avoidance- and hypervigilance/failure-to-

disengage-like behaviour. Forty-one subjects, aged 21 (SD=2.67, 25 female), were recruited from the local student population. Subjects performed a dot-probe task, where neutral and pain-related words were used to create neutral, congruent, and incongruent trials. Included were self-report measures regarding depression, personality, somatosensory amplification (SAS), and pain perception. After making a distinction between participants based on the bias index, effects commonly associated with known bias patterns (avoidance and hypervigilance/failure-to-disengage) surfaced. Several outcomes correlated with behavioural performance, but not for both groups; an increase in SAS-scores was associated with an increase in avoidance-like behaviour in the avoider-group, whereas an increase in pain-related scores was associated with an increase in failure-to-disengage/hypervigilance in the other group. We state that the general population is likely to be made up of two or more groups, which differ significantly on their behaviour and performance, and differ in terms of risk for specific disorders. We believe separating these groups can benefit many studies.

42. Influence of hand position and cueing on P250-350 component elicited by tactile and pain electrical stimuli

Karolina Świder[a], Eligiusz Wronka[a], Tineke van Rijn[b]

karolina.swider@uj.edu.pl

[a] Jagiellonian University, Krakow, Poland
[b] Radboud University, the Netherlands

Evoked potentials in response to painful stimuli have been studied as objective measures of pain. The aim of the study was to determine if crossing hand position decreases the amplitude of P250-350 elicit by electrical tactile and pain stimuli in the condition of their predictability and unpredictability (cueing). Crossing hands over the body's midline impairs the ability to localize stimuli and decreases tactile and pain sensations (Galace at all, 2011). Participants (23 females) were informed about the insensitivity of the stimuli (painful or non-painful) delivered to the left/right hand and about hands position (crossed or uncrossed) at the beginning of each of the 16 blocks of the experiment. Each stimulus was preceded by an arrow pointing right or left (80% correct and 20% incorrect cuing). EEG activity was recorded from 64 electrodes. Participants were to rate their sensation after receiving each of 200 tactile and 200 pain stimuli using NRS scale. Results revealed that crossing hand position has not decreased tactile nor pain P250-350 amplitudes. P250-350 amplitudes were increased in painful condition and when stimuli were preceded by incorrect cues. Finally, substantial statistical significant differences in P250-350 amplitude were found comparing correct and incorrect cue only for uncrossed hand position.

43. Neuromatrix theory and facial feedback hypothesis: can we apply them to reduce pain intensity?

Wacław Adamczyk[a], Michał Rżany[b] Andrzej Małecki[c,a]

adamczykfizjo@gmail.com

[a] Department of Physical Education, The Jerzy Kukuczka Academy of Physical Education, Katowice, Poland
[b] Medical University of Silesia, Katowice, Poland
[c] Department of Physiotherapy in Neurological and Musculoskeletal Disorders

The neuromatrix theory (NT) and facial feedback hypothesis (FFH) may be considered in the context of pain science. The first one assumes that many brain areas activate during pain perception, while the other, states that facial movement may influence emotional experience. What kind of effect on pain may occur if positive facial expressions like Duchenne (DS) or non-Duchenne (nDS) smiles would be inducted? This study was designed as a short-term, double-blind control trial. Fifty-five participants were randomly assigned to either the DS group (genuine smile activation), nDS group (faked smile) or control group in which neutral expression was maintained. Pressure pain threshold (PPT) was measured three times in three series in a manner that only during second series DS or nDS were inducted. Participants activated or deactivated selected muscles by holding the chopsticks in their mouth. To enhance validity of the study, sEMG biofeedback from desired muscles was applied. Statistical analysis revealed significant elevation of PPT during induction of DS or nDS (P < 0.05). However, this effect was temporary. In control group PPTs were similar among three series of measurements (P > 0.05). That results support the NT and FFH. The induction of DS and nDS significantly increased PPT.

44. Probing the involvement of the primary somatosensory cortex in pain perception using high-definition transcranial direct current stimulation (HD-tDCS) combined with the recording of nociceptive and non-nociceptive somatosensory-evoked potentials

Cédric Lenoir[a], S. Hatem[b], A. Mouraux[a]

cedric.lenoir@uclouvain.be

[a] Institute of Neurosciences (IONS), Université catholique de Louvain, Brussels, Belgium
[b] Brugmann University Hospital, Brussels, Belgium

Investigators have suggested that innocuous somatosensory input is processed serially from the thalamus to the primary somatosensory cortex (S1) and then to other brain regions; whereas nociceptive input would project in parallel from the thalamus to S1 and other brain regions. Here, we test this hypothesis by assessing the effect of High-definition transcranial direct current stimulation (HD-tDCS) applied to the left S1 on the perception and event-related potentials (ERPs) elicited by nociceptive and non-nociceptive stimuli delivered to the ipsilateral and contralateral hand. HD-tDCS was achieved using a cathode surrounded by four anodes (20 minutes; 1 mA). Nociceptive stimuli were pulses of radiant heat delivered to the hand dorsum. Non-nociceptive stimuli were short-lasting vibrations delivered to the index. Nociceptive and non-nociceptive ERPs were recorded immediately before and after HD-tDCS. After each stimulus, participants rated intensity of perception. Because HD-tDCS was expected to reduce the excitability of the left S1, we expected that the responses to non-nociceptive stimulation of the contralateral hand would be reduced as compared to the ipsilateral hand. Furthermore, we predicted that the responses to nociceptive stimulation of the contralateral hand would show a similar reduction if and only if S1 constitutes an obligatory relay for nociceptive input.

45. Cross-modal spatial attention between nociception and vision

Roxane De Keyser[a], Anaëlle Valemberg[b], Valéry Legrain[a]

roxane.dekeyser@uclouvain.be

[a] Insitute of Neuroscience, Université catholique de Louvain, Brussels, Belgium
[b] Faculty of Psychology, Université catholique de Louvain, Brussels, Belgium

Adequately reacting to a harmful stimulus requires to locate which part of the body is actually hurt and where this stimulus is in the environment. A cross-modal link between sensory modalities is thus necessary to coordinate spatial attention across the different dimensions in space. The aim of this study is to investigate, using event-related potentials (ERPs), how nociceptive stimuli applied to one hand are able to direct attention in external space and prioritize the processing of visual stimuli occurring close to the stimulated hand. Nociceptive stimuli were applied to either hand, and were shortly followed by a visual stimulus close to either the same hand (congruent) or the opposite hand (incongruent). The spatial congruency between the nociceptive and visual stimuli was not predictable. Participants were asked to detect rare targets in the series of visual stimuli. Results showed that reaction times to visual targets were not affected by the cross-modal spatial congruency. Conversely, preliminary analyses revealed that spatially congruent visual stimuli elicited ERPs with an enhanced negativity in the 220-380 time window, as compared to ERPs elicited by incongruent visual stimuli. This negativity could reflect cortical mechanisms to link spatial attention between one particular body limb and its peripersonal space.

46. Characterizing the time-dependent and limb-specific interactions between nociception and the motor system

Maxime Algoet[a], J. Duqué[a], G. D. Iannetti[b], A. Mouraux[a]

maxime.algoet@uclouvain.be

[a] Institute of Neurosciences (IONS), Université catholique de Louvain, BE
[b] Department of Neuroscience, Physiology and Pharmacology, University College London, UK

Our aim was to characterize the temporal dynamics and specificity of the interactions between nociceptive and motor systems in humans. We hypothesized that the occurrence of a nociceptive stimulus should elicit an urge to move, which would translate into a specific and time-dependent modulation of motor excitability involving muscles related to withdrawal movements. Methods: We characterized the effect of nociceptive laser stimuli delivered to the left/right hand on the motor-evoked potentials (MEPs) elicited by concomitant transcranial magnetic stimulation of the left and right primary motor cortices, delivered 50-2000 ms after the nociceptive stimulus, and recorded from left and right flexor and extensor muscles of the hand and arm. Results and discussion: Nociceptive stimuli induced (1) an early-latency (100 ms) enhancement of MEPs in ipsilateral hand flexor muscles. This can be attributed to nociceptive-motor interactions at spinal level because, at this latency, the nociceptive input has not yet reached the cortex. This was

followed by (2) a suppression of MEPs in all ipsilateral hand muscles (150-400 ms), and (3) a long-lasting enhancement of MEPs in all contralateral hand muscles (600-2000 ms). These later effects could be related to nociceptive-motor interactions at spinal and/or cortical level.

47. Pinprick-evoked brain potentials to study mechanical nociception in humans

Julien Lambert, Emanuel van den Broeke, Andre Mouraux

julien.lambert@uclouvain.be

Institute of Neuroscience, Université Catholique de Louvain, Brussels, Belgium

Studies using microneurography have suggested that preferential activation of mechanosensitive nociceptors can be achieved by mechanical stimulation of the skin using small-surface pinprick probes. This approach is of particular interest to study the phenomenon of mechanical hyperalgesia, a frequent sign in patients with inflammatory and/or neuropathic pain. Using a novel device to deliver time-locked pinprick stimuli with a constant 64 mN force and a surface area of $ mm2, the aim of the study was to characterize the effects of changing the speed and duration of the skin indentation on different waves of pinprick event-related brain potentials (PEPs). Considering the different response properties of nociceptive and non-nociceptive mechanoreceptors, we hypothesized that changing speed and duration could lead to the preferential activation of different categories of mechanoreceptors. Regardless of speed and duration, pinprick stimulation delivered to the forearm elicited a clear complex whose latency (120-250 ms) is compatible with the conduction velocity of A-beta and/or A-delta myelinated afferents. At slow velocities, an additional peak appeared approximately 500 ms after stimulus onset, possibly related to the activation of slowly-adapting and/or slowly-conducting mechanoreceptors. Our results suggest that PEPs could be used as a mean to better characterize sensitization of mechanical nociceptive pathways.

48. The central nervous system does not contribute to vibrotactile adaptation

Anne Klöcker, David Gueorguiev, André Mouraux

anne.klocker@uclouvain.be

Institute of Neuroscience, Université catholique de Louvain, Brussels, Belgium

Long lasting mechanical vibrations applied to the skin induce a reversible decrease in the perception of vibration at the stimulated skin site. This phenomenon of vibrotactile adaptation has been studied extensively. Yet, there is still no clear consensus on the mechanisms leading to vibrotactile adaptation. In particular, the respective contribution of (i) changes affecting mechanical skin impedance, (ii) peripheral processes, and (iii) central processes is largely unknown. Here, we used direct electrical stimulation of nerve fibers to bypass mechanical transduction processes and, thereby, explore the possible contribution of central processes to vibrotactile adaptation. Twelve subjects took part in two experiments. In the first, adaptation was induced using mechanical vibration of the fingertip (51 or 251 Hz vibration delivered for 8 minutes, at 40x the detection threshold). In the second, we attempted to induce adaptation using transcutaneous electrical stimulation of the median nerve (51 or 251 Hz constant-current pulses delivered for 8 minutes, at 1.5x the detection threshold). Vibrotactile detection thresholds were measured before and after adaptation. Mechanical stimulation induced a clear increase of vibrotactile detection thresholds. In contrast, thresholds were unaffected by electrical stimulation. This indicates that vibrotactile adaptation is predominantly the consequence of peripheral processes and/or changes in biomechanical properties of the skin.

49. The effect of heterotopic nociceptive conditioning stimulation on Aδ, C, and Aβ-fiber brain responses

Diana Torta[a], M. Churyukanov[b], L. Plaghki[a], André Mouraux[a]

diana.torta@uclouvain.be

[a] Université catholique de Louvain, Brussels, Belgium
[b] Department of Nervous Diseases, The I.M. Sechenov First Moscow State Medical University, Russia

Human studies have shown that noxious conditioning stimuli applied to a given body location reduce the percept and brain responses elicited by test stimuli delivered at a remote location (heterotopic noxious conditioning modulation, HNCS). It remains unclear to what extent the effects rely only on the spino-bulbar loop mediating diffuse noxious inhibitory control (DNIC) effects in animals or are modulated by supraspinal mechanisms. Moreover, no study have explored the effects of HNCS on C and A-beta inputs. In this study we measured the intensity of perception and event related potentials (ERPs) to selective A-delta, C and A-beta inputs. We observed that: i) the perceived intensity of nociceptive A-delta and C stimuli was reduced during HNCS; ii) ERPs in response to A-delta, C and A-beta stimuli were also reduced during HNCS. Importantly, A-beta ERPs are related to primary afferents that ascend directly through the dorsal columns and do not relay at the spinal cord level. Therefore, a modulation of these responses cannot be under

the influence of descending spinal modulatory mechanisms. These results show that, in humans, HNCS operates also via supraspinal mechanisms.

50. Somatosensory steady-state evoked potentials (SS-EPs) to characterize the effects of TMS delivered over the primary somatosensory cortex on somatosensory processing

Gan Huang, Cédric Lenoir, Maxime Algoet, André Mouraux

huanggan1982@gmail.com

Université catholique de Louvain, Brussels, Belgium

Transcranial magnetic stimulation (TMS) is widely used in research to modulate the function of a cortical structure and probe its function. Here, we present a novel approach combining TMS with the recording of somatosensory steady-state evoked potentials (SS-EPs) to explore the time-course of the effects of TMS delivered over the primary somatosensory cortex (S1) on somatosensory processing. Vibrotactile stimulation was delivered simultaneously to the left and right hand (10 s 255 Hz vibration, amplitude-modulated at 21 Hz on one hand and 27 Hz on the other hand). This elicited two distinct peaks in the EEG frequency spectrum, tagging the cortical processing of somatosensory input originating from the left and right hand, respectively. TMS was delivered over the hand area of the left S1, 2 seconds after the beginning of the vibrotactile stimulus (single pulse or short 20 Hz trains of 13 pulses). A canonical correlation analysis (CCA) was used to assess the time-course of SS-EP amplitude after TMS. TMS consistently inhibited the SS-EPs elicited by stimulation of the contralateral hand, up to 2.17 s after short trains of TMS and 0.66 s after single pulses of TMS. There was no effect on the SS-EPs to ipsilateral somatosensory input.

51. Electrophysiological evidence for the effect of visual reminders of death during threatening somatosensory stimulation

Valentina Nicolardi, Aglioti Salvatore Maria, Valentini Elia

valentinanicolardi@gmail.com

Department of Psychology, Santa Lucia Foundation, Sapienza University of Rome, Italy

Negative emotional states and anxiety influence the representation of threatening events in the brain. These states are electively induced by the awareness of the ultimate threat: death. Its awareness induces negative self-focused states and dreadful anxiety in human beings. Yet, only few studies identified a preferential effect of death reminders on brain activity. Here we investigated if observation of visual death vs. threat cues modulates perception of pain as well as brain activity evoked by visual and nociceptive stimuli. In a conditioning phase participants received high and low painful laser stimuli while observing death vs. threat images. In a subsequent testing phase, observation of the same stimuli was associated with a moderately painful stimulus. Results show that amplitude of nociceptive laser evoked potentials was larger when observing death pictures. Moreover, greater visual evoked potentials and oscillatory alpha desynchronization were found for death pictures and for pictures previously conditioned to high-painful stimuli. Thus, visual reminders of death exerted a top-down modulation of the brain activity associated with the nociceptive and visual stimuli. This finding suggests that visual reminders of death-related vs. other negative valence cues significantly enhances cortical activity associated with both death cues and co-occurring bodily threatening stimuli.

PSYCHOPATHOLOGY

52. Electrophysiological correlates of attentional functions in teenagers with ADHD and healthy controls

Katarzyna Anna Giertuga[a], M.Z. Zakrzewska[b,c], M. Magnuski[b], M. Bielecki[b], M. Kossut[a,b], A. Cybulska-Klosowicz[a]

k.giertuga@nencki.gov.pl

[a] Nencki Institute of Experimental Biology, Warsaw, Poland
[b] University of Social Sciences and Humanities, Warsaw, Poland
[c] Stockholm University, Stockholm, Sweden

Attention deficit hyperactivity disorder (ADHD) is a common behavioral diagnosis based on the presence of developmentally inappropriate levels of inattentiveness, overactivity and impulsivity. The prevalence for ADHD among children is estimated at about 3-10%, affecting boys 5 times more often than girls. The aim of the study was to investigate the patterns of attentional functions and brain activity in teenagers diagnosed with ADHD. Electroencephalography (EEG) data was collected from clinical group aged 11-16 and compared with healthy, age-

and sex- matched controls. EEG signal was recorded while the participants performed the Posners Attention Network Test (ANT). This test combines cue detection (Posner, 1980) with a flanker-type paradigm (Eriksen and Eriksen, 1974) and allows for the behavioral assessment of effectiveness of attentional functions: alerting, orienting, and executive. The results obtained on behavioral level showed significantly disrupted executive component of attention in ADHD group. Accordingly we explored Event Related Spectral Perturbations (ERSPs) corresponding to this effect. To this end we used robust regression to estimate the amount of variance in Reaction Times (RT) explained by ERSPs. The obtained results are discussed within the context of existing theories of ADHD-related deficits. Supported by the National Science Centre Grant 4958.

53. The effectiveness of augmented reality training on cognitive functioning in patients with schizophrenia

Anna Schudy[a], Łukasz Okruszek[a], Michał Jarkiewicz[b], Mateusz Kruszyński[a], Magdalena Linke[b], Marek Jarema[b], Emilia Łojek[a], Adam Wichniak[b]

schudy.anna@gmail.com

[a] University of Warsaw, Poland
[b] Institute of Psychiatry and Neurology

Background: Recent studies suggest that psychomotor slowing in schizophrenia may be primary to other cognitive deficits in this disease. However, most of the cognitive remediation (CR) therapies are not designed to put emphasis on this domain of cognitive functioning. Therefore, a therapy which enables simultaneous training of psychomotor speed and other cognitive functions may be more beneficial than standard CR rehabilitation. The aim of our research program is to analyze the impact of training with new generation augmented reality (AR) software on cognitive functioning in schizophrenia. Method: Five patients diagnosed with schizophrenia completed 12 one-hour AR-training sessions. Patients underwent a neuropsychological examination with MATRICS Consensus Cognitive Battery (MCCB), before and upon the completion of the training. Results: Test-retest differences were observed in measures of psychomotor speed and verbal learning. Moreover, a trend toward differences in verbal working memory task emerged. A trend toward improvement of MCCB Composite Score was also observed, however it did not reach the statistical significance. Conclusion: This results shows that AR training improve both psychomotor speed and other cognitive domains in patients with schizophrenia, however further studies are needed to elucidate this effect.

54. Neural correlates of psychopathy: an fMRI study of fearless dominance and reaction to arousing movie clips

Jacek Matuszewski[a], Jarosław Michałowski[a], Dawid Droździel[a], Wojciech Koziejowska[a], Katarzyna Jednoróg[b], Artur Marchewka[b]

jacekmatuszewski91@gmail.com

[a] University of Warsaw, Poland
[b] Nencki Institute of Experimental Biology, Warsaw, Poland

Psychopathy is a personality disorder generally associated with shallow affect, lack of empathy or close relationships and impaired fear conditioning. Previous neuroimaging studies found lesser activation of regions involved in emotion processing and regulation, such as prefrontal cortex, amygdala and cingulate cortex in high psychopathic individuals. However, most of these studies involved general "high psychopathic" subjects and psychopathy is nowadays considered as multi-dimensional construct. One of its factors, Fearless Dominance involves boldness, emotional resilience and venturesomeness. Little is known about neural correlates of that dimension. In our study we examined 27 healthy students (15 females) divided on High and Low Fearless Dominance group based on the scores of the Psychopathic Personality Inventory-Revised. We used fMRI to investigate brain activation patterns during viewing of 30s movies from different arousing categories: threat (e.g. human violence), sensation seeking (e.g. extreme sports) and social exposure (e.g. wedding ceremony). We found decreased activation in prefrontal regions and amygdala in High FD group while observing violence and social exposure but no significant differences in sensation seeking condition. Our results show that High FD subjects with smaller emotional response may not perceive threatening situations as dangerous. Those finding may have clinical or sub-clinical implications for future.

NEUROLOGY

55. Exploring the benefits of action observation mirror neurons priming for post-stroke hemiparesis rehabilitations

Charlotte Verfaille, Vandermeeren, Y., Legrain, V., Edwards, M.G.

charlotte.verfaille@uclouvain.be

University of Louvain, Belgium

What if simply watching a video could improve motor performance for post-stroke hemiparetic patients? Hemiparesis is an unheralded motor impairment characterized by a lack of control and sensitivity in the contralateral limb to the brain lesion, which greatly impairs patients' quality of life. Research shows that the Mirror Neuron System (MNS) is implied in motor function and activates similarly both when observing someone performing an action, and when executing action. In the present study, we focused on improving hemiparesis rehabilitation using MNS action observation priming. We compared motor performance of eight upper limb hemiparetic patients before and after an action (video) observation which was either a therapeutic or a control intervention. The results revealed that the therapeutic action observation priming resulted in smoother gestures without motor jerks relative to the pre-observation and control conditions, but there were no effects to motor movement speed. These findings show a new form of rehabilitation material that could provide advances towards the use of more enthralling rehabilitation material for patients, and more ecological and specific ways to provide rehabilitation and assess patients with personalized tests and exercises based on everyday life gestures and activities

56. Neural correlates of command following in patients with disorders of consciousness – initial results

Marek Binder[a], Anna Jurasińska[a], Urszula Górska[a], Marcin Koculak[a], Marta Brocka[b]

marek.binder@uj.edu.pl

[a] Jagiellonian University, Krakow Poland
[b] Leibniz-Institute for Neurobiology, Magdeburg, Germany

Following verbal commands is a strong proof of retained awareness in patients with disorders of consciousness (DOC). Unfortunately motor deficits can impair an accurate estimation of this function in this clinical group. Direct detection of EEG patterns associated with movement intention to verbal command can potentially overcome this obstacle. In this study we replicated Cruse et al. (2012) command-following paradigm in a group of healthy controls and DOC patients.

The control group consisted of 18 volunteers and DOC patient group included 25 patients (9 were examined twice, amounting to 34 measurements). During experimental session all subjects were required to follow repeated verbal commands issued through headphones "Try to move your left hand", "Try to move your right hand", "And now, relax". EEG signals were acquired using 64-channel ActiveTwo system. Five-seconds fragments of EEG from two bipolar and two Hjorth channels were analyzed using single-trial classification method, and thresholded using family-wise randomization test.

In the control group, in 89% subjects distinctive EEG patterns related to motor intention were found. In the patient group this result was found in 21% measurements. This procedure can be used in patient population to assess command-following ability, yet it presents a certain risk of false negatives.

57. Neuronal firing during patterns of synchronous population activity in the neocortex of patients with epilepsy or tumor, in vitro

Katharina T. Hofer [a b], Kinga Tóth[a d], Ágnes Kandrács[a b], Csilla Szabó[a b], Attila Bagó[c], Loránd Erőss[c], László Entz[c], István Ulbert[a b], Lucia Wittner[a c]

hofer.katharina@ttk.mta.hu

[a] Institute of Cognitive Neuroscience and Psychology, Research Centre for Natural Sciences, Hungarian Academy of Sciences, Budapest, Hungary
[b] Faculty of Information Technology, Pázmány Péter Catholic University, Budapest, Hungary
[c] National Clinical Neuroscience Institute, Budapest, Hungary
[d] Institute of Experimental Medicine, Hungarian Academy of Sciences, Budapest, Hungary

Epilepsy is a disorder associated with neuronal hyperactivity. When pharmacological treatment is ineffective, surgical tissue removal is considered as an alternative. Spontaneous population activity (SPA) observed in this kind of tissue has previously been attributed to epileptic processes.
In this study, epileptic neocortical tissue obtained this way was compared to non-epileptic neocortical tissue obtained during brain tumor surgery, which also generated SPA in vitro. The firing patterns of different types of neurons during the SPA were investigated.
The local field potential gradient was recorded from brain tissue slices obtained from epileptic and non-epileptic patients using a laminar multielectrode. Both SPA and single neuron activity were detected and analysed using crosscorrelations. While some neurons increased, some decreased and some did not change their firing during SPA. The extent to which neurons changed their firing significantly differed between epileptic tissue and non-epileptic tissue. Moreover, principal cells and interneurons also showed significant differences in their cell firing. The involvement of a neuron also depended on its location relative to the site of the SPA.
Importantly, slices from both epileptic and non-epileptic tissue generated SPA. Thus, SPA cannot directly be related to epileptic processes. However, the involvement of different groups of neurons differed significantly.

58. Neurocognitive functioning in individuals living with HIV

Mateusz Choiński[a], Anna Rita Ambroziak[a], Jakob Czarnecki[a], Emilia Łojek[a], Marta Sobańska[a], Natalia Gawron[a] , Agnieszka Pluta[a b], Daniel Borek[a b], Bogna Szymańska[c], Andrzej Horban[c], Ewa Firląg-Burkacka[c] Przemysław Bieńkowski[d], Halina Jarosz[d], Anna Ścińska[d], Tomasz Wolak[b], Mateusz Rusiniak[b], Robert Bornstein[e], Stephen Rao[f]

mateuszchoinski@student.uw.edu.pl

[a] Faculty of Psychology, University of Warsaw, Poland
[b] World Hearing Center, Kajetany, Poland
[c] Wojewodzki Szpital Zakazny, Warsaw, Poland
[d] Instytut Psychiatrii i Neurologii, Warsaw, Poland
[e] The Ohio State University, Columbus, Ohio, United States
[f] Cleveland Clinic, Cleveland, Ohio, United States

Background of the study: It is increasingly recognized that Human Immunodeficiency Virus (HIV) infection results in significant alterations in the cognitive functioning. Previous research has shown several patterns of HIV Associated Neurocognitive Disorder (HAND).
Methods: Preliminary results were obtained from 70 participants (47 HIV+ patients and 23 seronegative controls). Groups were comparable (p>0.05) in age, education, depression level and general medical status. General cognitive status (MMSE) was lower for individuals living with HIV (p=0.044; d=0.46). Comprehensive neurocognitive assessment evaluated verbal and visuo-spatial memory, verbal and nonverbal fluency, executive functions, psychomotor speed, dexterity, and attention.
Results: HIV individuals showed decreased visuo-spatial memory (p=0.007; d=0.69), nonverbal fluency (p<0.001; d=0.8), executive functions (p<0.01; d=0.69), attention (p<0.001; d=0.82) and language (p=0.01; d=0.65). No significant differences (p>0.05) were observed in the measures of psychomotor speed, verbal fluency, verbal memory and learning.
Conclusions: The initial findings seem consistent with previous studies. Observed impairments indicated the “Various Neurocognitive Deficits” pattern of neuropsychological classification of deficit in HIV infection proposed by Lojek and Bornstein (2005). Further studies should examine whether other neurocognitive patterns, found by Lojek and Bornstein (2005) in US population, can also be identified in Polish HIV+ population.

59. Acute post – stroke depression and lesion location

Katarzyna Kowalska[a], Paweł Moskal[b], Elżbieta Klimiec[a], Agnieszka Słowik[a], Aleksandra Klimkowicz-Mrowiec[a]

katarzyna.olga.kowalska@gmail.com

[a] Department of Neurology, University Hospital, Krakow, Poland
[b] University Hospital, Kraków, Poland

Post–stroke depression (PSD) is commonly complication of stroke and it is associated with worse outcomes and lower quality of life after the stroke. Several studies have evaluated association between the lesion location and the occurrence of depression, however the results are equivocal. The aim of the study was to evaluate association of stroke location and PSD severity. The consecutive patients admitted to the Stroke Unit, Department of Neurology, University Hospital, Krakow, with supratentorial stroke or TIA were included in the study. Depression was assessed 7-10 days

after admission with Patient Health Questionnaire-9 (PHQ-9). Severity of depression was defined according to PHQ-9 score: minor 5-9 points and major depression ≥10 points. We analyzed the occurrence of depression among 233 patients with different clinical subtypes of stroke (The Oxfordshire Stroke Project classification), left vs. right sided lesions and superficial vs. deep infarcts. Depression occurred in 60,5% (n=141) of patients. Among depressed patients 49,6% (n=70) had minor and 50,4 % (n=71) major depression. There was no significant difference in presence of depression or its severity between different stroke subtypes, left and right sided lesions and superficial or deep infracts. In conclusion, acute PSD is not related to location of the stroke lesion.

60. Prevalence of „Phantom Vibration Syndrome" amongst polish medical staff

Wilhelm Masarczyk, Aleksandra Stawecka, Adam Rutkiewicz, Katarzyna Pyrkosz, Norbert Chudy, Jarosław Sobiś

wil.m@poczta.fm

Dept. of Psychiatry in Tarnowskie Góry, Medical University of Silesia, Katowice, Poland

Background: The use of mobile phones being a key element of modern society raises question about its influence on our well being. One of such effects of using a cellphone is the so called „Phantom Vibration Syndrome" (PVS) A common experience about which little is known. The aim of our study was to evaluate PVS occurrence among polish medical staff and to examine the influence of selected factors on experiencing phantom vibrations or ringtones. Methods: The study was conducted using a two part questionnaire among over 200 medical staff, including medical faculty students, nurses and doctors. First part asking how someone uses their phone and the second being the State Trait Anxiety Inventory. Results: The prevalence of PVS surpassess 60% but neither the occurence nor frequency is related to anxiety levels. A small percentage has very bothersome PVS. Women experience PVS more often. There are corelations between the localization of the phone and PVS occurrence.
Conclusions: Results show PVS is not a totally random phenomenon although it being related to anxiety does not seem to be the case. The fact there is a small group experiencing PVS as very bothersome requires investigation if they need any medical attention.

61. Psychotic episode as a rare manifestation of SLE-induced depression

Adam Gałczyński, Elżbieta Julia Borys, Katarzyna Stefania Ochyra

adam.galczynski@uj.edu.pl

Jagiellonian University Medical College, Krakow, Poland

Introduction: Systemic lupus erythematosus is a chronic autoimmune disease affecting multiple organ systems including the CNS. It is known to cause neuropsychiatric syndromes including depression. We present the medical history of a patient with depression whose symptoms have increased since the diagnosis of SLE-like syndrome and have manifested themselves as a psychotic episode.
Case description: A 55-year-old female patient, HM, was admitted to the psychiatric ward on January 27th, 2015 due to depressed mood and anhedonia (F33.1). The patient has been hospitalized 11 times for depression since 1999. Her response to pharmacological and psychotherapeutic treatment was always satisfactory but short-lived due to her family situation. In 2010, the patient was diagnosed with SLE-like syndrome. Neuroimaging showed cortical atrophy. Chronic fatigue and arthralgia worsened her depression. Cognitive function impairment has developed gradually. HM reported reduced effectiveness of therapy. The last hospitalization revealed visual and auditory hallucinations.
Conclusions: HM presents psychotic symptoms in the course of SLE-enhanced depression, which is unusual for this group of patients. The mechanism of this abnormality is unknown. It may be caused by microangiopathic changes in the CNS induced by SLE-like syndrome over the years. Discovering mechanisms of depression in patients with SLE requires further study.

62. A high premorbid intellectual potential as the good prognostic of recovery in a depressive patient with multifocal vascular brain damage

Weronika Janeczko, Bogusława Bober-Płonka

weronika.zuzanna.janeczko@gmail.com

Institute of Applied Psychology, Jagiellonian University, Krakow, Poland

Background. A forty-year-old depressive woman with multifocal vascular brain damage following liver cirrhosis, both toxic and viral (HBV and HCV), resulting from drug abuse from 18 to 26 years of age. Epileptic seizures following the liver transplantation. Similar symptoms in her twin sister: depression, epilepsy, drug addiction.
Methods. Psychological interview and observation. Tests of personality and intelligence. Neuropsychological examinations over several years.
Results. Status after liver transplantation: Encephalopathy, depression, intellectual degradation (organic pathology). Visual disorders - hemianopia, tunnel vision or temporary palinopsia. Total working disability. Mood and cognitive organic-based impairments. Current status: normal orientation, cooperation with increased susceptibility to fatigue and emotional viscosity. Difficulties in memory, spatial orientation and vision. Despite the problems, strong motivation to restore previous mental and physical abilities. Medication: cyclosporin, depakine. Improvement after liver transplantation: Mood stability, Beck's Scale 9, NEO-FFI (Neuroticism 34; Extraversion 24; Openness to experience 34; Agreeableness 42; Conscientiousness 17).
Conclusions: Simultaneous psychiatric disorders and somatic complaints had mutually reinforcing negative effects. The patient's high premorbid intellectual efficiency, the right posttransplantory treatment (cessation of seizures) and social environment with good personal awareness of the disease are promising predictors for cognitive recovery which, in turn, can potentiate effects of the whole ongoing rehabilitation process.

63. Meningioma manifesting as transient ischemic attack

Aleksandra Gałwa, Sławomir Michalak, Przemysław Kapała

aleksandra.galwa@gmail.com

Medical University in Poznan, Poland

Background. Meningioma is the most common extra-axial benign brain tumor in adults. Frequently it has suprasellar, frontal, temporal, sphenoid wing and petroclival localizations. If the tumor with such a localization involves intracranial segment of internal carotid artery, it may cause cerebral circulation disturbances.
Methods. Standard radiological procedures in patients with symptoms suggesting cerebral ischemia include computerized tomography (CT), magnetic resonance imaging (MRI) and carotid arteries ultrasound. Brain neuroimaging enable differential diagnosis of transient ischemic attacks (TIA) and stroke.
Results. Sixty one years old woman with history of hypertension experienced 30 – minutes aphasia with right-sided paresthesias. At the admission to neurological clinic she do not manifested neurological deficit. Doppler examination of carotid and vertebral arteries showed no abnormalities. Brain MRI revealed brain tumor located in basal fronto-temporal region with contrast enhancement. The tumor with radiological features of meningioma involved cavernous segment of left internal carotid artery. Only few cases of such atypical meningioma presentation were reported. In the clinical study on meningioma cerebral circulation disturbances were reported in 0.19% cases.
Conclusion.Tumors involving cavernous portion of internal carotid artery should be taken into consideration in the diagnosis of TIA or stroke etiology, particularly in cases without identified causes.

64. Lethal catatonia – a case report

Michał Rosa, Katarzyna Pejka, Adam Bełda, Adrian Chrobak, Marcin Siwek, Dominika Dudek

michalros1991@wp.pl

Students' Scientific Association of Adult Psychiatry, Jagiellonian University Medical College, Krakow, Poland

Lethal catatonia (LC) is an extremely rare life-threatening condition. Due to secondary disturbances in electrolytes and thermoregulation, circulatory and respiratory failure, LC nearly always leads to death. Difficulties in clinical diagnosis and its similarity to malignant neuroleptic syndrome appear to be the reason of underestimation of the prevalence of LC. It is most often found as a component of schizophrenia, but can also be associated with cerebrovascular diseases, brain tumours and traumatic head injuries. However, the exact etiology of LC remains unclear.
The authors would like to present a case of 23 y.o woman with awareness disturbances, elevated muscular tension of extrapyramidal character, tremor in upper and lower limbs and fever 38.5°C. Laboratory tests - creatine kinase (CK) 92450 U/L, CK muscle/brain type (CK-MB) 1896 U/L, aspartate aminotransferase (AspAT) 1317 U/L, alanine aminotransferase (AlAT) 544 U/L, lactate dehydrogenase (LDH) 1620 U/L – showed massive rhabdomyolysis (condition in which damaged skeletal muscle tissue breaks down). Intoxication of psychoactive drugs was excluded. Negative results of antineuronal antibodies (anti-AMPA1, anti-CASPR2, anti-NMDA, anti-GABARB1, anti-AMPA2, anti-LGI1) allowed to exclude other disorders as i.a limbic encephalitis. On these grounds, a diagnosis of LC in the course of

undifferentiated schizophrenia, was made.

65. Cerebral arteritis is associated with both neurological and psychiatric symptoms, including psychotic disorders

Szymon Jeziorko[a], Natalia Stawowska[b], Aleksandra Sobocińska[b], Robert Stępnicki[b], dr Marcin Siwek[c], Prof. dr hab. Dominika Dudek[c]

szymon.jeziorko@gmail.com

[a] Disorders Students' Association, Jagiellonian University Medical College, Krakow, Poland
[b] Adult Psychiatry Students' Association, Jagiellonian University Medical College, Krakow, Poland
[c] Department of Psychiatry, Jagiellonian University Medical College, Krakow, Poland

Case presentation: A female 37-year-old patient was admitted to the Psychiatric Ward with the preliminiary diagnosis of cerebral arteritis, not elsewhere classified (I67.7) to modify previous treatment which caused hiperprolactinemia and to observe mental state because of psychotic disorders in past history. The patient has been undergoing treatment for demyelinating disease of central nervous system, unspecified (G37.9) for 1,5 years and epilepsy for half a year. She was prescribed lamotrygine, clonazepam, valproic acid, metoprolol, potassium, pantoprazole, risperidone, prednisone. The level of valproic acid was highly increased, so its dose was decreased by 300 mg. After dictontinuation of risperidone treatment, prolatic level in the blood was normalised. During hospitalization grand mal seizure occured, it was treated by 1 ampoule of clonazepam. The patient was discharged with a diagnosis of other specified mental disorders due to known physiological condition (F06.8).
Conclusion: Cerebral arteritis requires both neurological and psychiatric treatment. It is important to verify drug doses as well as its side effects.

66. Broca's anomic aphasia in middle stage – a case study

Wojciech Sak[a b], Joanna Dreszer-Drogorób, Ph.D[a], Monika Lewandowska, Ph.D[a b c], Natalia Pawlaczyk[a b], Maria Czarnecka[a b]

wojciech.r.sak@gmail.com

[a] Institute of Philosophy, Humanistic Faculty, Nicolaus Copernicus University in Torun, Poland
[b] Centre for Modern Interdisciplinary Technologies in Torun, Poland
[c] World Hearing Center in Kajetany, Poland

There are a number of ways to classify aphasia, such as those developed by T.H. Weisenburg, K.E. McBride or based on Wernicke-Lichtheim model, just to mention the most popular. With these diversity comes multitude of definitions because aphasia is a multidimensional concept, depending on what perspective we take: neurological, neurolinguistic or cognitive. Albeit those considerations, it is possible to say that most researchers would agree that aphasia (1) is a language-level problem, (2) including receptive and expressive components, (3) of multimodal nature, and (4) is caused by a central nervous system dysfunction (N. Martin et al. 2008). Only a case study allows to show a clear picture of patients real experience of aphasia on detailed level, reflecting the nature of the decomposition of language skills due to the disease. Here patient P.S. (age 40) in 2011 suffered from ischemic stroke of left hemisphere which caused hemiparesis in right side of the body and Broca's anomic aphasia, currently in middle stage. Case study includes results of neuropsychological assessment of such comprehensions as expressive speech, speech understanding, writing, reading, counting, praxis, discrimination and reminding of rhythmic structures, body schema, spatial orientation, stereognosis, higher visual functions, memory and executive functions.

67. The case of frontotemporal dementia in affective disorder

Anna Tereszko, Adrian Andrzej Chrobak, Dr Marcin Siwek, Prof. dr hab. Dominika Dudek

tereszka@gmail.com

Students Scientific Association of Affective Disorders, Jagiellonian University Medical College, Krakow, Poland

Frontotemporal dementia is a neurodegenerative disorder associated with significant changes in social and personal behavior. Despite its common signs and symptoms this disease may mimic or co-occur with mental illness.
Authors would like to present case of 51 y.o female patients admitted to psychiatric hospital due to the recurrence of

depressive symptoms. Despite venlafaxine and mianserin treatment patients' state deteriorated. She became more isolated, started to listening loud music and stopped to deal with domestic chores.
During admission, patient revealed blunted affect, indifferent mood, anergia, abulia, and psychomotor retardation. During hospitalization patient presented episode of uncontrolled laughter, hiperoralism, and eating disorders.
MRI imaging revealed small white matter hiperintensities in the left frontal lobe, and marked features of cortical and subcortical atrophy in the area of frontal and temporal lobe. Also ventricles were enlarged. Neurological consultation revealed occurrence of primitive reflexes – palmar grasp reflex and deliberative reflexes (Marinesco-Radovici). Neuropsychological examination revealed moderate dementia
Due to the results of above mentioned results diagnosis of frontotemporal dementia was made. Depressive symptoms has been classified as secondary to the underlying neurodegenerative disease.

68. Plethora of psychiatric symptoms in unusual presentation of bipolar disorder: case study

Grzegorz Siwek, Adrian Chrobak, MD Marcin Siwek, prof. Dominika Dudek

gkewis@gmail.com

Student Scientific Association of Affective Disorders, Jagiellonian University Medical College, Krakow, Poland

35 year old male patient was admitted to the clinic with the initial diagnosis of excacerbation of paranoid schizophrenia. During the examination patient presented symptoms of depressed mood, restricted affect, thought blocking, psychomotor retardation, mental disorganization as well as resignation and suicidal thoughts. Patient has been treated for 2 years for depression and was hospitalized 3 months earlier because of exacerbation of depressive symptoms. After introduction of antipsychotic treatment, psychotic symptoms retracted yet patient presented spectacular mood swings – varying from depressed mood, apathy and anhedonia to hypomania symptoms: psychomotor agitation, jocular attitude and disihibition. In 6th day after the admission, patient started to develop catastrophic and paranoid delusions. MRI was conducted – enlargement of ventricular system, with marked subcortical atrophy was found. In neuropsychological assessment patient presented signs of severe cognitive and behavioral disorders providing the evidence of fronto-temporal dysfunction, that might be of neurodegenerative origin. Treatment with lorazepam and mood stabilizers was introduced to achieve remission of the symptoms. Patients was released from the hospital in euthymic state, no further episodes of delusions were observed.

69. Case report of 23-year female patient with acute psychotic episode of unknown origin with depressive disorder in the background

Marta Wrońska[a], Marcin Siwek MD PhD[b], Prof. Dominika Dudek MD PhD[b], Magdalena Gawron[a], Karolina Cisło[a]

mawronska@gmail.com

[a] Student Scientific Association of Affective Disorders, Jagiellonian Univerisity, Medical College, Krakow, Poland
[b] Departament of Affective Disorders Jagiellonian University Medical College, Krakow, Poland

Introduction: Demyelinating process might be associated with mental disorders. The extensive loss of the myelin sheath causes deficiency in cognition, sensation and movement. Demyelinating diseases are caused by genetics, infections, autoimmune reactions and some by unknown factors. Hereby we present the case of 23 year old female with severe psychotic episodes with moderate depressive disorder which might be related to demyelination changes in brain well-observed in MRI. The principal diagnosis is still unknown.
Case presentation: 23 year old female was admitted to psychiatric ward with psychotic episode after initial treatment of moderate depressive disorder with venlafaxine. Patient presented the history of 5-months-lasting depressive episode associated with anxiety disorder, somatization, recurring suicidal thoughts, insomnia and food avoidance. Fluctuations of mental and emotional state along with recurring auditory, visual, tactile and olfactory hallucinations, persecution mania were observed. Olanzapine was introduced to reduce symptoms. MRI showed demyelination changes nearby corpus callosum in the right occipital lobe. Psychological tests may emphasize the organic merit of disease.
Conclusion: There is no evident cause of psychotic episode in above case. However the most probable reason is demyelination changes in brain.

70. Evaluation of the effects of neurological rehabilitation in a patient after traumatic brain injury (TBI) - a case report

Dorota Ratuszek-Sadowska[a], Kamila Woźniak[b], Wojciech Hagner[a]

dorota_ratuszek@o2.pl

[a] Chair and Department of Rehabilitation Medicine, Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Toruń, Poland
[b] Department of Neurosurgery, Neurotraumatology Pediatric Neurosurgery Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Toruń, Poland

Traumatic brain injury (TBI) is one of the causes of permanent disability. Consequences of TBI are motor disorders and neuropsychological changes. Patients after intracranial injury can face effects lasting a few days to disabilities which may last the rest of their lives. Neurological rehabilitation greatly influences health condition of persons after TBI.
Aim of this study is presentation and analysis of the effects of 4 weeks neurological rehabilitation in a patient after traumatic brain injury, based on the case report of a 35 – years old man with tetraparesis resulting from TBI with contusion of the frontal lobes and brainstem. Comprehensive rehabilitation was tailored to patient's needs and abilities.
Activity limitation was rated before and after treatment using the following instruments: the Barthel Index (BI), the Functional Independence Measure (FIM), the Timed Up and Go (TUG) Test and Functional Reach Test. After the rehabilitation patient improved results in all evaluated tests. The most important achievement is the ability to independently use the toilet, a significant improvement in walking speed and improve the balance in high positions.
This case present a compelling need for neurological rehabilitation with focus on achieve patient's independence in daily living activities and improve their quality of life.

71. Case report of a 34-year-old female suffering from Creutzfeldt-Jakob disease

Marcin Polak, Agnieszka Sobuś, Adam Socha, Marcin Siwek, Dominika Dudek

Collegium Medicum, Jagiellonian University, Krakow, Poland

One of the most demanding challenges in psychiatry, neurology and neurobiology are prion diseases, including Creutzfeld-Jakob disease (CJD). Discovered nearly one hundred years ago still remains fatal and makes scientists search for the cure. Caused by proteins called prions which accumulation in the central nervous system leads to neurodegenerative process with non-characteristic symptoms such as rapidly progressive dementia, depression, obsessive-compulsive symptoms, anxiety, ataxia, mutism and psychosis. Sporadic CJD can lead to patient's death months or even weeks after occurrence of the first signs of the disease.
Our focus is a case of a 34-year-old patient who was admitted to the hospital with such symptoms as blurred vision, diplopia and gait impairment. The patient suffered from sleep disorders and cognitive impairment as well and was primarily diagnosed with conversion disorder. Deterioration of the patient's state indicated neurodegenerative process. Further tests including lumbar puncture, EEG and MRI scan revealed changes leading to suspicion of Creutzfeld-Jakob disease.

72. Neurolues - almost forgotten but still dangerous

Michał Hajdo[a], Aleksandra Rybus[a], Jakub Słowik[a], Dominika Dudek[b], Marcin Siwek[b]

michal.hajdo@gmail.com

[a] Students Scientific Association of Affective Disorders, Jagiellonian University Medical College, Krakow, Poland
[b] Department of Affective Disorders, Jagiellonian University Medical College, Krakow, Poland

Neurolues is a late form of syphilis which affects central nervous system. Neurolues may occur as syphilitic meningitis, meningovascular syphilis, general paresis or tabes dorsalis.
Here we present a case of 39-years old patient was admitted to a mental hospital with preliminary diagnosis of organic mood disorder, caused by long-term heroin addiction. Despite the treatment, patient's condition deteriorated. Neurological symptoms also occurred, as follows:
Since March 2012 patient has shown symptoms of depression, suicidal tendencies and anxiety. Citalopram and

perazine has been prescribed.
Since October 2012 patient has had balance disorders, dizziness, micrography, anhedonia, fatigue and sleep disorders. In neurological examination hypomimia and dizziness have been found. His treatment has been changed to venlafaxine and zopiclone.
In 2013, during the hospitalization in neurological ward, laboratory tests and imaging studies have been conducted. MRI of the head and EMG showed no abnormalities. Anti-treponemal antigen and FTA-Abs was positive indicating diagnosis of neurolues. Thus ceftriakson was prescribed. However,
a significant improvement in the patient's condition has not been achieved. Dermatological treatment has been commissioned.
Neurolues should be taken into account, when patient shows atypical neurological and mental illness symptoms.

73. Place of treatment of neurosurgery compression fractures in geriatric patients

Kamila Woźniak, Zygmunt Siedlecki, Dorota Ratuszek- Sadowska, Maciej Śniegocki

Department of Neurosurgery, University Hospital and Neurotraumatology No. 1 in Bydgoszcz, Poland

Background of the study: Osteoporotic fracture origin are among the most common causes of chronic back pain in the elderly. It is estimated that every year in Poland there is approx. 3,000 new vertebral fractures. The consequence of vertebral fractures are chronic back pain, loss of height and depth thoracic kyphosis. Osteoporotic fractures are fractures stable and do not threaten to damage the spinal cord, but because of the accompanying chronic pain significantly affect the quality of life of geriatric patients. One of the treatments for vertebral compression fractures is vertebroplasty.
Methods: In the years 2012- 2014 in the Department of Neurosurgery, Neurotraumatology and Pediatric Neurosurgery University Hospital No. 1 in Bydgoszcz was made 132 vertebroplasty spine fractured vertebral osteoporosis. The procedure was performed in the operating room, under local anesthesia, under the control of the X-ray machine.
Results: Partial or complete relief of pain followed in the case of vertebroplasty in nearly 95% of patients within the first 24 hours after the surgery.
Conclusion: Vertebroplasty is a modern, minimally invasive treatment for vertebral compression fractures of the spine and pain in the course of osteoporosis in the elderly.

74. Does the ABCD score show the real risk of stroke for patients with transient ischemic attack?

Maciej Fijałkowski, Piotr Bąk, Monika Gołąb-Janowska, Przemysław Nowacki

maciej.fijalkowski1@gmail.com

Department and Clinic of Neurology, Pomeranian Medical University, Szczecin, Poland

Background: Ischemic stroke (IS) is sometimes preceded by transient ischemic attack (TIA). Identification of patients with TIA and high risk proceeding ischemic stroke is possible thankfully ABCD score. The aim of this study was an assessment if the ABCD score is valuable in predicting the IS during first 90 days for TIA episode.
Methods: There were 120 patients included to this study. They were hospitalized in Department of Neurology of PUM in years 2012-2013 with diagnosis of TIA.
Results: Once and for all 94 patients were evaluated. 5,3% of patients have suffered IS (group 1) during 90 days for TIA's appearance. 60% out of them were classified in ABCD score as high- risk patients (5 and 6 points). 40% out of them got equally 4 points in ABCD score. The scores for patients who didn't suffer the IS (group 2) were 48,3 and 51,7%. These results weren't substantially different comparing to group 1 (p=0,4796). Frequency of IS in our study (patients hospitalized) was twice lower than in Braye and associates' study, who were evaluating the risk of IS after TIA episode for patients who were not hospitalized. Patients suffering the IS had substantially often an AF (p=0.0255). There were no other substantial differences between groups evaluated with ABCD score's help.
Conclusion: 1) All patients with or after TIA episode should be hospitalized because it decreases the risk of IS. Last but not least the IS can occur ever if the ABCD score is low and patient is classified in low-risk group. 2) AF should be taken under consideration in transformation from TIA to IS risk evaluation because of being an important vascular incident risk factor.

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