Université catholique de Louvain
Secteur des Sciences de la Santé

UCL Université catholique de Louvain

8th IoNS PhD Student Day

Program and Abstracts

INSTITUTE OF NEUROSCIENCE

November 9, 2016
Auditorium Maisin
UCL – Brussels

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Université catholique de Louvain

Institute of Neuroscience

8th IoNS PhD Student Day

PROGRAM
&
ABSTRACTS

November 9, 2016

UCL, Brussels

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Program

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9h15 – 11h10	**First session of oral presentations** **Anna Doshina** – Modulation of GABAergic Neurotransmission by the Amyloid Precursor Protein of Alzheimer's Disease. **Serena Stanga** – Control of GDNF expression by AD-related proteins and implications in neurodegenerative and neuromuscular diseases. **Julie Lecoq** – Presentation of the Louvain Learning Lab. **Sophie Lepannetier** – Role of TRPC1 ion channel in hippocampal neurons. **Alexia Cossard** – RhoA GTPase and embryonic apical neural stem cells in the mammalian cerebral cortex.
11h10 – 11h25	**Short presentations of posters**
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15h00 – 15h30	**Coffee break**
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17h00	**Awards and closing drink**

ORAL PRESENTATIONS

CEMO

Modulation of GABAergic Neurotransmission by the Amyloid Precursor Protein of Alzheimer's Disease.

Anna Doshina[1], Florian Gourgue[1], Michiho Onizuka[1], Remi Opsomer[1], Peng Wang[1], Kunie Roussel-Ando[2], Bernadette Tasiaux[1], Ilse Dewachter[1], Pascal Kienlen-Campard[1], Jean-Pierre Brion[2], Philippe Gailly[1], Jean-Noël Octave[1] and Nathalie Pierrot[1]

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Alzheimer disease (AD) is the most frequent neurodegenerative disease characterized by a cognitive decline. An imbalance between excitatory and inhibitory neurotransmission results in altered networks synchronization that could contribute to the cognitive deficits observed in AD patients. Moreover, recent data indicate that changes in GABAergic neurotransmission could be involved in the pathophysiology of the disease. In the adult central nervous system, gamma-amino-butyric acid (GABA) is the main inhibitory neurotransmitter. The nature of GABAergic transmission, excitatory versus inhibitory, is essentially determined by the electrochemical Cl- gradient, which depends on intracellular Cl- concentration [Cl-]i. In the central nervous system, neuronal [Cl-]i is essentially controlled by expression levels of the Na+-K+-2Cl- cotransporter 1 (NKCC1, a Cl- importer) and the K+-Cl- cotransporter 2 (KCC2, a neuronal Cl- extruder). We have previously shown that the Amyloid Precursor Protein (APP), a key player involved in AD, modulates neuronal activity of cortical networks. The aim of this project is to study whether APP can affect inhibitory neurotransmission. Our results show that KCC2 is downregulated in cortical networks expressing human APP (hAPP). Furthermore this downregulation is associated with less hyperpolarizing and less inhibitory GABA signaling. Moreover a downregulation of KCC2 expression is observed in the brains of AD patients.

CEMO

Control of GDNF expression by AD-related proteins and implications in neurodegenerative and neuromuscular diseases

Serena Stanga

CEMO-Alzheimer Dementia, Institute of Neuroscience, Université catholique de Louvain, Brussels, Belgium

The physiological function of the Amyloid Precursor Protein (APP) remains poorly understood. APP has been extensively studied for its involvement in Alzheimer's disease (AD) since its amyloidogenic processing leads to the formation of beta-amyloid peptide (Aβ), the major constituent of senile plaques that are typical AD lesions. We contributed to a more comprehensive picture of APP regulatory network and physiological function by showing that APP-dependent regulation of the Glial cell line-Derived Neutrophic Factor (GDNF) drives the process of neuronal and muscular maturation involved in neuromuscular junctions (NMJs) formation (1). APP function is likely to rely in important part mainly to the regulation of APP target genes expression. So far, the identity of genes regulated by APP is intense matter of debate and, in addition, these genes are often difficult to relate to the phenotype observed in APP-deficient mice. APP-dependent GDNF transcription appears as critical for the muscular phenotype observed in APP null transgenic mice (APP-/-). Interestingly, our recent experiments indicated that Presenilins (PS) are also involved in the regulation of GDNF transcription. Presenilins-dependent γ-secretase activity generates the Aβ peptide and releases the APP intracellular domain (AICD), which was shown to be the transcriptionally active APP fragment. It is therefore of particular interest to understand the molecular mechanisms recruited by APP/PS to control the expression of GDNF, a neurotrophic factor fundamental for both central and peripheral nervous system (CNS, PNS), neuron survival and, importantly, altered in AD and amyotrophic lateral sclerosis (ALS). The goal of this study is to identify cross-disease pathways and evaluate the relevance of therapeutic approaches targeting the APP/PS/GDNF pathway.

1) Stanga S, Zanou N, Audouard E, Tasiaux B, Contino S, Vandermeulen G, René F, Loeffler JP, Clotman F, Gailly P, Dewachter I, Octave JN, Kienlen-Campard P: 'APP-dependent glial cell line-derived neurotrophic factor gene expression drives neuromuscular junction formation.' FASEB J. 2016 May; 30(5):1696-711. doi: 10.1096/fj.15-278739. Epub 2015 Dec 30.

CEMO

Role of TRPC1 ion channel in hippocampal neurons

Sophie Lepannetier, Olivier Schakman, Sabrina Tempesta, François Seghers, Philippe Gailly

Université catholique de Louvain

Transient receptor potential-canonical 1 (TRPC1) is a non selective cation channel (PCa/PNa 1). It is involved in store-operated Ca2+ entry in cooperation with Orai1 channel and activated by STIM1, a sensor of Ca2+ contents in the endoplasmic reticulum. However, several evidences suggest that TRPC1 can be activated independently of store depletion in response to agonists. Using a LacZ reporter mouse, we found that TRPC1 is abundantly expressed in neurons from the CA1-CA3 and from the dentate gyrus regions of the hippocampus. We compared cellular culture of hippocampal neurons from TRPC1 knockout mice to WT mice. Interestingly, stimulation with dihydroxyphenylglycine (DHPG), an agonist of group I metabotropic glutamate receptors (consisting of mGluR1 and mGluR5) induced a store-independent entry of Ca2+ that was very much reduced in hippocampal neurons from TRPC1-/- mice. Studying brains slices, we observed that LTP in Schaffer collaterals-CA1 synapses was diminished in TRPC1-/- mice when induced with a mild stimulus (theta burst consisting of 4 stimuli at 100 Hz repeated at 5 Hz during 1s). Cognition tests such as Y-shape modified maze and contextual fear-conditioning, realized on 4-8 months old mice revealed a deficit of memory. Moreover, we noted that the specific hippocampal over-expression of the immediate early gene zif268 related to new environment learning was blunted in TRPC1-/- mice. We conclude that TRPC1 channels are activated by mGluR stimulation and play a role in neuronal plasticity.

CEMO

RhoA GTPase and embryonic apical neural stem cells in the mammalian cerebral cortex

Alexia Cossard

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The mammalian cerebral cortex plays key roles in cognition, emotions, sensory and motor functions. These tasks rely on adequate activities of neural circuitries. This connectivity is the end-point of a long process of embryonic and postnatal cortical development which depends on the ability of neural stem cells (NSCs) to produce an array of neurons and glia that carry out specialized functions in mature neural networks. Excitatory neurons, the major type in the cortex, are produced by NSCs located within the cortex in a region called the ventricular zone (VZ). Initially NSCs mainly self-renew, resulting in an expansion of the pool of NSCs. Then they progressively switch into another types of apical NSCs (aNSCs) also called radial glia cells and start producing neurons but also astrocytes or oligodendrocytes at a later developmental stage. Our objective is to increase our understanding of the mechanisms that regulate the development of the cerebral cortex and their involvement in the pathological adult brain. This will be done using the mouse as a model and focusing on the role of the small GTPase RhoA in the regulation of adhesion, self-renewal and differentiation of apical neural stem cells in the developing cerebral cortex. RhoA has been implicated in a host of cellular processes in cell culture systems, but its physiological functions in the developing brain remain elusive. We are more specifically investigating its functions in the apical neural stem cells during the late neurogenic phase of development.

COSY

The Good, The Bayes and The Ugly An insight into statistical advances in neuroscience

Vincent Moens, Alexandre Zénon

Institute of Neuroscience (IoNS), Université catholique de Louvain, Brussels, Belgium.

We propose to explore the great advantages of using Bayesian statistics to make inference about data acquired in neuroscience, with a focus on Variational Bayes. We will compare Variational Inference with more traditional statistical models as well as other Bayesian methods. We will use our implementation of the Full Drift Diffusion Model as a example in order to emphasise the usefulness of VB. We hope to encourage the audience, which uses statistical models on a daily basis, to use Bayesian methods in order to assess model accuracy and the significance of an effect.

COSY

Changes in motor function following sustained nociceptive input generating central sensitization

Maxime Algoet, Gan Huang, André Mouraux

Institute of Neuroscience (IoNS), Université catholique de Louvain, Brussels, Belgium.

Following a lesion, pain-related changes in motor behavior can protect from further injury and promote recovery. Our aim was to characterize changes in motor function induced by a sustained nociceptive stimulus generating a central sensitization. To assess changes in motor system excitability, single pulses of transcranial magnetic stimulation (TMS) were applied at different points to the scalp to generate a map of the left and right primary motor cortex. Motor-evoked potentials (MEPs) were recorded from first dorsal interosseous (FDI). Next we applied high frequency electrical stimulation (HFS), a validated procedure to induce both central and peripheral sensitization at the area of stimulation, to the forearm, 10 cm distal to the fossa cubita. The left and right TMS-mapped representations of the FDI, FCR and ECR muscles were quantified before HFS (T0), 20 minutes after HFS (T1) and 45 minutes after HFS (T2). The following measures were obtained from each map: the size of the map and the MEP amplitude at the hot-spot. Finally, to identify possible changes in the cortical distribution, we assessed the center of gravity (CoG) of the maps. The results suggest that the intense activation of nociceptors does not only induces central sensitization of the nociceptive system but also induces sustained changes outside the nociceptive system, here the motor system. Indeed, the motor maps measured at the different time points showed differences, both at T1 and T2. Moreover, these changes seem to be specific for the sensitized limb.

COSY

cTBS disruption of the Supplementary Motor Area perturbs sequence representation but not performance

Oleg Solopchuk, Andrea Alamia, Laurence Dricot, Julie Duque, Alexandre Zénon

Institute of Neuroscience (IoNS), Université catholique de Louvain, Brussels, Belgium.

As shown in an influential recent study (Wiestler & Diedrichsen 2013), skill acquisition leads to a decrease in fronto-parietal cortical activations and concurrent sharpening of sequence representation, particularly in the pre- and supplementary motor area (SMA). However, the causal implication of these changes in the formation of the learned motor skill remains unclear. Here, we aimed to test the role of the SMA in motor skill learning by combining interferential and neuroimaging techniques. We found that SMA disruption with transcranial magnetic stimulation had detrimental effect on cortical sequence representation, consistent with the findings of Wiestler and Diedrichsen, but failed to show any impact on behavioral performance. Our findings suggest that SMA is not causally involved in the performance of elementary motor sequences, in spite of the enhanced neural representation of trained sequences in this area.

COSY

Walking and aging: the weight transfer challenge

Guillaume M. Meurisse[1], Guillaume J. Bastien[1,2], Bénédicte Schepens[1]

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An important cause of falls in elderly people is the weight transfer during walking. Therefore, we investigated the evolution of the body weight shift from the back leg to the front leg during gait, by comparing young and old adults walking at matched speed. Methods: Eight young and seventeen elderly healthy subjects without history of falling were asked to walk on an instrumented treadmill at 5 different speeds from 0.56 to 1.67 m.s-1. An algorithm was used to determine the vertical ground reaction forces (GRFv) acting upon each limb during the weight transfer phase (WT). In order to characterize the dynamics around the WT, we measured the stride and WT durations, the maximum GRFv exerted by the back leg (maxBACK) and by the front leg (maxFRONT), and the vertical velocity of the center of mass (Vv). Results: At high speeds, elderly subjects show shorter stride and WT durations, smaller maxBACK, greater maxFRONT and a minimum of the Vv delayed, in comparison to young subjects. These observations on non-falling subjects indicate that WT is modified with age with a supporting force on the back leg that doesn't increase with speed. Therefore, at fast speed, the downward Vv continues to increase until the front foot contact. As a result more impact force needs to be exerted by the front leg to redirect upwards the center of mass. These observations together with the kinematic modifications can be useful to detect risk of falling.

COSY

Validation of a Double-Coil TMS Method to Assess Corticospinal Excitability

Julien Grandjean, Gerard Derosiere, Pierre Vassiliadis, Louise Quemener, Ysaline de Wilde, Julie Duque

Institute of Neuroscience (IoNS), Université catholique de Louvain, Brussels, Belgium.

Transcranial magnetic stimulation (TMS) applied over the primary motor cortex (M1) elicits motor-evoked potentials (MEPs) which provide a temporally precise and muscle-specific readout of state-changes in the motor output system. Many studies have used TMS over M1 to investigate corticospinal excitability changes occurring when choosing which hand to use for an action. So far, these studies have used single-pulse TMS eliciting MEPs in one hand when this hand is either selected or non-selected. However, an important limitation of this "Single-Coil" method is that MEPs are measured in selected and non-selected conditions during separate trials and even more importantly, they are computed in relation to the movement of different hands. The purpose of the present study was to evaluate a "Double-Coil" TMS method by which MEPs are elicited in both hands at once. We compared the amplitude of left and right hand MEPs elicited at rest (at 100, 115, 130, 145 or 160% of the resting motor threshold, rMT) using a Double-Coil method with those obtained using Single-Coil TMS over the right or left M1, respectively. Because the Double-Coil TMS pulses were applied with a 1 ms inter-pulse interval (to avoid direct interference between the two pulses), TMS was either applied over the left M1 first or the right M1 first, in separate trials. As expected, MEPs increased with the intensity of stimulation, reaching the highest amplitude at 160% of rMT. Besides that, MEPs were comparable whether they were elicited in the left or right hand using a Single- or Double-Coil method, regardless of the pulse order. These results suggest that Double-Coil TMS may be used to assess corticospinal excitability in both hands at a near-simultaneous time.

COSY

Mind your grip: cognitive-motor interaction in dual-tasks

Erwan Guillery, Valéry Legrain, André Mouraux, Jean Louis Thonnard

Institute of Neuroscience (IoNS), Université catholique de Louvain, Brussels, Belgium.

We live in a multitasking world. Simultaneous execution of cognitive and sensorimotor tasks is critical in daily life. Therefore we designed experimental settings to investigate the contribution of cognitive resources in grip-lift control using a dual-task paradigm. We asked participants to perform two tasks simultaneously, a grip-lift task and unrelated cognitive tasks. If the performances in one and/or both tasks are lower when done simultaneously, as compared to do separately, then these two tasks are assumed to share the same processing resources. In a first study we show that when they are perturbed by a cognitive task, healthy participants took more time to conform their finger on the apparatus and applied more force to hold it. Thus even if precision-grip seems to be a highly automatic behaviour, it still requires high-level cognitive controls. In a second study using a more control paradigm on a larger sample of participants, we reproduced the same result and even more we showed that the alterations were scaled with the difficulty of the tasks and that there was no interaction with age and sex. For you who read until there thank you. Grasping an object between the thumb and index finger requires precise coordination between grip force and tangential load force. This coordination is not mature in young children and is impaired in several diseases such as in adult stroke patients. That is why we investigate the requirement of cognitive resources in activities involving the manipulation of objects in neurological patients in a third study using the same paradigm.

COSY

Grasp control in children with unilateral cerebral palsy during a brisk change in lower extremity dynamics

Daniela Ebner-Karestinos[1], Benoît Flament[2], Carlyne Arnauld[2], Jean-Louis Thonnard[1,3], Yannick Bleyenheuft[1]

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[2] Physical and Occupational Therapy Department, Haute Ecole Louvain en Hainaut, Charleroi, Belgium
[3] Physical and Rehabilitation Medicine Department, Cliniques Universitaires Saint-Luc, Brussels, Belgium

Background. During object manipulation, to avoid slips and early fatigue, a good coordination between grip force (GF) and load force (LF) is required. In children with unilateral cerebral palsy (UCP), this coordination has never been studied in a daily/functional activity such as descending a step while carrying an object. Aim. To compare the GF-LF coupling during a stepdown task while carrying an object in children with UCP and typically developing children (TDC). Method. Participants were 27 children with UCP and 27 age-matched TDC. Standing on a step and holding a grip-lift manipulandum, children were instructed to descend the step spontaneously and maintain subsequently a static position. We analyzed dynamic and temporal variables for LF and GF. Results. A modulation of the LF and GF maxima was observed with higher values on both hands for children with UCP. This adaptation provided a GF/LF ratio that was similar to controls in the non-paretic hand, but not in the paretic one. In addition, the paretic hand demonstrated a lower maximal voluntary contraction (MVC) when compared to the non-paretic hand and both hands of controls, leading to the use of a higher percentage of MVC during the whole task in the paretic hand. Conclusions. Children with UCP showed impairments on dynamics in both hands. The grip/lift coupling was altered in their paretic hand and preserved in the non-paretic. These findings highlight a motor planning deficit in both upper extremities and impairment in sensori-motor integration solely focused in the paretic hand during this intersegmental task.

POSTERS

CEMO

Role of presenilin in mitochondrial function

Sabrina Contino[1], Serena Stanga [1], Paolo Porporato [2], Matthew Bird [3], Claudia Marinangeli [4], Rémi Opsomer [1], Françoise Bontemps [5], Pascal Kienlen-Campard [1]

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Mitochondrial dysfunction plays a pivotal role in the progression of Alzheimer disease (AD), and yet, drivers of this dysfunction remain elusive. Most commonly in familial cases of AD, mutations appear in the genes encoding for Presenilin 1 (PS1) and Presenilin 2 (PS2), the catalytic component of the APP-cleaving gamma secretase complex. The amyloidogenic cleavage of APP results in production of Aβ that accumulates in the extracellular space around neurons and forms one of the two lesion types present in AD patients: amyloid plaques. Beside the generation of Aβ though, evidence indicate additional roles for Presenilin (PS) in the cell. Notably, it has been shown that PS are involved in calcium homeostasis, synaptic plasticity and memory. Herein, we aim at investigating the bioenergetic functions of PS. To this, we initially examined mitochondrial function in vitro in Mouse Embryonic Fibroblast (MEF) cell lines expressing or not (knock-out, KO) presenilin isoform: Wild type (+/+), PS1 KO, PS2KO and PS double KO (PS -/-). Preliminary data indicate that the mitochondrial membrane potential ($\Delta\Phi$), ATP level, ROS production and mitochondrial oxidative phosphorylation complexes appear unchanged in all the cell types. By comparison, an important decrease in the respiratory capacity in PS -/- and PS2KO MEFs were found. Moreover, these cell types show an increase in glucose consumption and lactate production which enables them to compensate their energy requirement. These deficits are restored when the presenilin 2 is reexpressed in the PS2KO MEFS cells. We plan to confirm these data in vivo in the central nervous system (CNS) of different mouse model (+/+ ; -/- ; PS1KO ; PS2KO).

CEMO

Exercise Performed in a Fed State Activates Mitophagy in Human Skeletal Muscle

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Purpose: To determine whether mitophagy is activated by acute endurance exercise in a fission-dependent manner in human skeletal muscle and to investigate if this activation is dependent upon the nutritional state. Methods: Trained athletes (n = 7) cycled 2 h at 70% VO2 peak in a fed or fasted state. Vastus lateralis muscle biopsies were obtained at baseline, before, immediately after and 1 h after exercise. Proteic and genetic markers of mitophagy, mitochondrial biogenesis, fission and fusion were analyzed using Western blot and qRT-PCR. Results: Acute endurance exercise in the fed state increased the expression of genes involved in fission and mitophagy regulation (Drp1, Bnip3, and Bnip3L, $P < 0.01$) as well as the presence in the mitochondrial fraction, of the fission-regulatory protein Fis1 ($P < 0.05$). The mitophagy-regulatory protein BNIP3 was two-fold higher just after exercise in the fed compared to the fasted state ($P < 0.05$). In the fasted state, mitophagy did not seem to be activated. Mitophagy activation was paralleled to an increase in HSP60 mRNA ($P < 0.001$) a gene implicated in the mitochondrial protein folding, whereas PGC1α mRNA ($P < 0.001$) seemed to increase independently. Conclusion: In conclusion, the present study provides the very first evidences that fission-dependent mitophagy is increased in the fed state in parallel to mitochondrial biogenesis after endurance exercise in human skeletal muscle.

COSY

Phonic and global learning methods of reading : a comparative study of their cortical impact in beginning readers

Alice van de Walle de Ghelcke, Aliette Lochy, Bruno Rossion

Psychological Sciences Research Institute, Louvain-la-Neuve, Belgium
Institute of Neuroscience (IoNS), Université catholique de Louvain, Brussels, Belgium.

Reading, an essential prerequisite to academic achievement, is a complex skill acquired after formal instruction, and a variety of learning methods are still used at school. The phonic method (conversion of letters into sounds) insures a more robust word representation (1, 2) than the global one (visual memorization of whole words), but little is known about their cortical impact in children. One adults' training study with artificial script (3) revealed that phonic learning, and not global learning, induced the left hemispheric lateralization thought to reflect connections between posterior visual and anterior language regions (4). In the present study, we tested 33 children in grade 1 both behaviorally and with EEG using Fast Periodic Visual Stimulation. Oddball items are inserted periodically in fast streams of base stimuli. This approach recently revealed that words are discriminated from pseudowords in the left VOT in adults (5). In the present study, base stimuli (at 6Hz) consisted of pseudofont, and oddball stimuli (every five items) were either words learned globally at school (logographs), matched unknown words, or pseudowords. In 120 seconds of stimulation per condition, a clear left-lateralized discrimination response appears at 1.2Hz and harmonics for words and pseudo-words, while a bilateral response appears for logographs. These results suggests that learning to read by a global approach at an early stage involves specific neural representation, as the right hemisphere is involved in holistic processing and object recognition. Therefore, it might impede the quality of word representation in young children, as left hemisphere specialization is the signature of expert reading.

(1) Perfetti, 1991 (2) Share and Stanovich, 1995 (3) Yoncheva et al., 2012 (4) Maurer and McCandliss, 2007 (5) Lochy et al., 2015

COSY

Characterizing cold evoked potentials in healthy volunteers

Roxane De Keyser[1], Emanuel van den Broeke[1], André Dufour[2], Valéry Legrain[1], André Mouraux[1]

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Whereas heat-evoked brain potentials such as laser-evoked potentials have been well characterized, few studies have described the event-related brain potentials elicited by transient cooling of the skin. The main reason is that devices able to generate steep cooling ramps were not readily available. However, changes in cold perception (for example cold allodynia) is a frequently observed phenomenon in clinical pain conditions. Furthermore, measuring brain responses to cold stimulation could constitute an interesting method to assess the function of small myelinated afferents. In this study, we used a novel device based on micro Peltier elements to generate brief cold stimuli having a very steep $300 \deg C/s$ cooling ramp to record cool- and cold-evoked brain potentials in healthy human volunteers (TCS; Prof. André Dufour, Univesity of Strasbourg). Two different stimulation surface areas ($42mm^2$ and $125mm^2$) and four different target cooling temperatures (20, 15, 10 and $5 \deg C$) were used. Twenty stimuli lasting 100 ms were delivered at the volar forearm in each condition. The stimuli were delivered in an intermingled fashion on both arms separately. The elicited event-related potentials were characterized by a biphasic complex consisting of a negative and positive wave maximal at the vertex (Cz) and peaking 160-390 ms after stimulus onset. The amplitude of the cold-evoked potentials was modulated by intensity. The latencies of the observed cold-evoked potentials are compatible with the myelinated Aδ-fibers. No responses were observed at later latencies compatible with the conduction velocity of C-fibers.

COSY

The brain reward circuitry before and after mental fatigue: an fMRI study

Monika Gergelyfi, Oleg Solopchuk, Laurence Dricot, Alexandre Zénon

Institute of Neuroscience (IoNS), Université catholique de Louvain, Brussels, Belgium.

Increased subjective feeling of mental fatigue (MF) and performance decrement often occur following prolonged cognitive activity. This phenomenon is sometimes viewed as a disruption of motivational processes. However, in our previous study we did not find any causal relationship between MF and motivation. The aim of the present study was to further investigate this finding at the neural level. We predicted that, if MF really does consist in a progressive loss of motivation, brain regions involved in reward processing and motivation should be specifically disrupted by MF. Healthy (25) subjects underwent a fatigue and a control session. In the fatigue session, MF was induced by performing a modified version of the Stroop task (90 minutes), whereas in the control session, the participants were asked to read magazines for 90 minutes prior to the fMRI scan. The neural effects of MF were measured by means of fMRI during a Working memory task with block-wise variations in reward. The fatigue session was successful in inducing both subjective and objective fatigue. Crucially, we found that subjective MF, but not its behavioural consequences, was associated with the depression of the task-related network whereas reward-related regions were not specifically affected. In addition, subjective fatigue correlated with a global increase in functional connectivity, especially in the default mode network, consistently with the findings related to the stage of sleep onset. These results indicate that subjective fatigue is associated with depressed task-specific BOLD responses and cannot be reduced to an alteration of motivational processes. The lack of correlation between decreased task-responses and impaired behavioural performance might suggest the existence of compensatory mechanisms which are not observable with fMRI.

COSY

Measuring the effect of short-term limb immobilization on motor imagery

Charlotte Verfaille, Xavier Libouton, Valéry Legrain

Institute of Neuroscience (IoNS), Université catholique de Louvain, Brussels, Belgium.

What happens in the brain following short-term limb immobilization? During the past decade, this question has been broadly investigated from evidence detailing cortical sensorimotor reorganisation [1] to motor performance changes [2]. More specifically, a set of experiments has focused on the influence of upper-limb immobilization on body representation changes concluding on a modification of the hand cognitive representation and its hand motor simulation [3]. This current research is directly in line with the previous results presented above and has for aim to determine the consequence of a short-term upper-limb immobilization on long term hand cognitive representation. In order to answer this question, we immobilized the left hand of 13 participants with a plaster cast during 72 hours and compared their performance at the Hand Laterality Task to a non-immobilized group. This task is specifically used in order to trigger motor imagery processes and evaluate the body representation. It consisted in the presentation of 16 different hands in term of Hand (Right vs. Left), Orientation (40deg, 80deg, 120deg and 160deg) and Rotation (Radial vs. Ulnar). Participants were tested at the beginning of the immobilization and just before removing the cast as well as 72 hours after cast removal. Reaction time results revealed no difference between the immobilized and the control group. Therefore, these outcomes do not support that sensorimotor deprivation following a brief period of immobilization can modify the cortical representation of hand movements.

[1] Huber et al. (2006). Arm immobilization causes cortical plastic changes and locally decreases sleep slow wave activity. Nat Neurosci 9: 1169-1176.

[2] Moisello et al. (2008). Short-term limb immobilization affects motor performance. JMot Bahav 40(2): 165-176.

[3] Toussaint & Meugnot (2013). Short-term limb immobilization affects cognitive motor processes. J Exp Psychol Learn 39(2): 623-632.

Organizing Committee

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Acknowledgements

The organizing committee is very grateful to Ms. Cathy Friand for her help in the organization of the day.

Sponsors

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