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Program and Abstracts

6th annual meeting of the

Clinical Neuroscience Bern

November 29th 2010

Conference location:

University Hospital of Psychiatry,

Bolligenstrasse 111, Bern

http://www.kas.unibe.ch/neuro10

Dear participants,

It is a pleasure to welcome you to the 6th meeting of the Clinical Neuroscience Network in Bern, where we once more would like to give you the opportunity to exchange all the findings, interesting ideas and projects you are engaged in. Again, about 150 researchers from all different neuroscience-related disciplines, mainly from the University of Bern, will attend this year.

We are pleased to announce that Prof. Dr. Katharina Henke, University of Bern, Department of Psychology will present the key note lecture entitled “Memory Systems Based on Processing Modes”. Besides the main lecture, there will be six selected oral presentations in the morning. During the extended lunch break, an unguided postersession will take place. However, we would appreciate if one of the authors is available at the poster during the session. In the afternoon, four interesting parallel workshops are offered. This year again, due to a generous grant by the University Hospital of Neurology, we will be able to award three poster prices.

The meeting reflects the wide spectrum of research in clinical neuroscience in Bern and we hope it will further stimulate new joint research initiatives and provide an opportunity to have a fruitful and interesting discussion of ongoing projects. We have confidence that the continuation of the series of meetings will further strengthen the interfacultary clinical neuroscience network and provide an excellent occasion for a lively and interesting exchange of study results, experiences and knowledge as well as offer the basis for the development of new and interesting projects. Finally we would like to express our gratitude to Lilo Badertscher and Matthias Grieder for their important contributions in the organization of this year’s meeting.

We are looking forward to seeing you at the University Hospital of Psychiatry and wish you a stimulating and enriching meeting.

Prof. Dr. Thomas Dierks Prof. Dr. René Müri

Organization:
Lilo Badertscher (Dept. of Psychiatric Neurophysiology, University Hospital of Psychiatry, Bern)
Thomas Dierks (Dept. of Psychiatric Neurophysiology, University Hospital of Psychiatry, Bern)
Matthias Grieder (Dept. of Psychiatric Neurophysiology, University Hospital of Psychiatry, Bern)
René Müri (Dept. of Neurology, Inselspital Bern)

Sponsors:
University Hospital of Psychiatry, Bern
University Hospital of Neurology, Inselspital, Bern

Program 29.11.2010

08:00 – 09.00 **Poster attaching**

09:00 – 09:15 **Opening Addresses**

- Prof. Dr. Werner Strik, Director of the University Hospital of Psychiatry, Bern
- Prof. Dr. Peter Eggli, Dean of the Medical Faculty, University of Bern
- Prof. Dr. Christian W. Hess, Chairman of the Clinical Neuroscience Bern

09:15 – 10:00 **Key Note Lecture (Chair: Werner Strik)**

- *Prof. Dr. Katharina Henke*, Department of Psychology, University of Bern
  Memory systems based on processing modes

10:00 – 10:30 **Coffee Break**

10:30 – 12:00 **Short presentations (Chair: Christian W. Hess)**

- *Mathieu Schiess* (Dept. of Physiology, University of Bern), Robert Urbanczik, Walter Senn:
  Reinforcement learning in dendritic structures
- *Erin L. MacMillan* (Dept. of Clinical Research, University of Bern), Daniel G.Q. Chong, Wolfgang Dreher, Anke Henning, Chris Boesch, Roland Kreis:
  Proton exchange between water and metabolites in human brain observed in vivo by magnetic resonance spectroscopy. A tool to characterize brain tumor tissue?
- *Caroline Falconer* (Dept. of Psychology, University of Bern), Fred Mast:
  Vestibular induced facilitation of egocentric mental transformation
- *Barbara Studer-Luethi* (Dept. of Psychology, University of Bern), Susanne M. Jaeggi, Martin Buschkuehl, Walter J. Perrig:
  The effects of personality on working memory training outcome
- *Robert H. Andres* (Department of Neurosurgery, University of Bern, Inselspital, Bern), Guohua Sun, Erin MacMillan, Clive N. Svendsen, Hans R. Widmer, Andreas Raabe, Tonya M. Bliss, Gary K. Steinberg:
  Modulation of Neural Plasticity by Stem Cell Transplantation after Stroke
- *Tobias Bracht* (Dept. of Psychiatric Neurophysiology, University Hospital of Psychiatry, University of Bern), Susanne Schnell, Andrea Federspiel, Kay Jann, Helge Horn, Roland Wiest, Thomas Dierks, Werner Strik, Thomas Müller, Sebastian Walther:
  Altered fibre tract course within the motor system in schizophrenia

12:00 – 14:00 **Poster Session and Lunch**

14:00 – 16:30 **Workshops**

- Workshop 1: **Learning and Memory – From Synapses to Behavior**
  Chair: *Thomas Nevian*
- Workshop 2: **DTI and Perfusion – clinical and preclinical application**
  Chair: *Roland Wiest*
- Workshop 3: **PANSS – Introduction and first rater-training**
  Chair: *Daniel Müller*
- Workshop 4: **Awake Surgery – Safe eloquent tumor surgery**
  Chair: *Jürgen Beck*

16:30 – 17:00 **Poster Awards**

17:00 **End of the meeting**

Table of content

Key Note Lecture

Memory systems based on processing modes

Katharina Henke

University of Bern, Switzerland

Prominent models of human memory divide between memory systems based on consciousness. These models neither account for an unconscious form of episodic memory (=memory for personally experienced events) nor for a role of the hippocampus in any form of unconscious encoding or retrieval. Yet, evidence has been accumulating in favor of an unconscious form of episodic memory that is mediated by the hippocampus, as conscious episodic memory is. This evidence favors a new memory model that no longer divides between memory systems based on consciousness. Instead, the new model distinguishes between memory systems based on how and what information is being processed, independently of consciousness of encoding. My talk will provide the rational for the traditional view and present some of our work that paved the path to the new view of memory systems.

Abstracts by discipline

Methodology (MT)

MT-01

A systems perspective to peri-ictal iEEG dynamics of focal onset seizures

Christian Rummel[1], Heidemarie Gast[2], Kaspar Schindler[2]

[1]SCAN, Institute of Diagnostic and Interventional Neuroradiology, Inselspital, 3010 Bern, Switzerland, [2]qEEG group, Department of Neurology, Inselspital, 3010 Bern, Switzerland

Introduction: Epilepsy is the second most common neurological disorder. Only two thirds of epilepsy patients are rendered seizure-free by anticonvulsant drugs. The remaining pharmaco-resistant patients are potential candidates for epilepsy surgery. However, surgery is only possible, if the seizure onset zone (SOZ) may be clearly delineated and turns out to be localized in a part of the brain that may be removed without causing serious neurological deficits. Thus, to localize precisely the SOZ is of paramount importance and here we will discuss how a systems perspective to quantitative analysis of the intracranial electroencephalogram (iEEG) may support this process.
Methods: We retrospectively analyze peri-ictal iEEG recordings quantitatively on three spatial scales. Univariate analysis of the absolute signal slopes (Schindler et al., 2001) defines the epileptiform character of the signals on the smallest spatial scale accessible by iEEG. As multivariate quantities we study the eigenvectors and eigenvalues of correlation matrices (see e.g. Müller et al., 2005) calculated from the signal derivatives. Whereas the eigenvectors can be exploited to identify the iEEG channels' relative contribution to the correlation patterns on intermediate scales, the eigenvalues provide information about the total correlation on the largest spatial scale accessible by iEEG.
Results: The reduced fluctuation level of correlation matrices calculated from iEEG derivatives enables more reliable interpretation of the eigenvectors than for the iEEG signals directly. In application to multi-channel iEEG we find patient specific changes of the structure of the largest eigenvectors during epileptic focal onset seizures. Specifically, we find that at seizure onset the iEEG channels recording from the clinically defined SOZ significantly reduce their contribution to the largest eigenvector. This phenomenon helps to precisely localize the SOZ in space and time and may be interpreted as an ictal rearrangement of the collective neuronal activity.
Conclusions: Applying multivariate correlation analysis of iEEG derivatives helps to precisely localize the SOZ and thus provides clinically important information in the presurgical evaluation of pharmacorresistant epilepsy patients.

References:
Müller M, Baier G, Galka A, Stephani U, Muhle H (2005) Detection and characterization of changes of correlation structure in multivariate time series. Phys. Rev. E 71:046116.
Schindler K, Wiest R, Kollar M, Donati F (2001) Using simulated neuronal cell models for detection of epileptic seizures in foramen ovale and scalp EEG. Clin. Neurophysiol. 112:1006-1017.

methodology
epileptic focal onset seizures; quantitative EEG; pre-surgical evaluation; seizure onset zone

Poster

MT-02

Proton exchange between water and metabolites in human brain observed in vivo by magnetic resonance spectroscopy. A tool to characterize brain tumor tissue?

Erin L. MacMillan[1], Daniel G.Q. Chong[1], Wolfgang Dreher[2], Anke Henning[3], Chris Boesch[1], Roland Kreis[1]

[1]Dept. of Clinical Research, University of Bern, Bern, Switzerland, [2]Dept. of Chemistry, University of Bremen, Bremen, Germany, [3]Institute for Biomedical Engineering, University and ETH Zurich, Zurich, Switzerland

To aid in diagnosis and characterization of tumors, a type of magnetic resonance imaging (MRI) contrast has been published that is sensitive to the increase in small protein and peptide content in active regions of tumors, namely amide proton transfer (APT) [1]. While APT has shown promising initial results to characterize tumor tissue heterogeneity, it is unclear whether the change in contrast across a tumor arises from the change in protein content, water content, temperature, or pH. To gain a better understanding of the chemicals that exchange protons with water during an APT MRI measurement, we used magnetic resonance spectroscopy (MRS) to investigate the protons that are present in the region of the APT saturation.

Conventionally, MRS is performed with water suppression to remove the distortions caused by the 10,000 times difference in concentration between water and the metabolites of interest. However, water suppression diminishes the signal intensities of resonances that undergo proton exchange with water, precisely the resonances that are thought to originate from the proteins that give rise to the APT effect. Thus, to investigate these exchangeable resonances with MRS, it is necessary to utilize a technique that separates the water and metabolite resonances without suppressing the water resonance. One such technique involves inverting metabolite resonances in alternating acquisitions, enabling the sum of all spectra to contain the water resonance, and the difference to contain the metabolites of interest. To characterize the exchange rates of the exchangeable resonances, an inversion transfer experiment was performed on a large brain voxel in 11 healthy volunteers with a Siemens TRIO magnetic resonance system at 3 Tesla. **These measurements revealed 6 prominent exchangeable metabolite peaks, with exchange rates ranging from 0.5 to 8.9 Hz.**

These findings help determine assignments of the downfield resonances; suggested contributing metabolites include adenosine triphosphate, homocarnosine, phenylalanine, phosphocreatine, glutathione, and glutamine. **Furthermore, these results may lead to a better understanding of the sources of contrast in APT imaging, including whether tumor tissues show metabolites that are not observed in healthy brain or whether it is the exchange rates that are tumor-specific.**

[1] Zhou J, Payen JF, Wilson DA, Traystman RJ, and van Zijl PCM. Using the amide proton signals of intracellular proteins and peptides to detect pH effects in MRI. Nature Medicine 9:1085 (2003).

Supported by the Swiss National Science Foundation, project #320000-120324: “Magnetic Resonance Techniques to Investigate Human Brain Physiology: Novel Acquisition and Processing Methods to Extend the Scope and Robustness of Clinical Spectroscopy at High Magnetic Fields”

methodology, neuroradiology
magnetic resonance spectroscopy

Poster / Talk

MT-03

Calibrated fMRI using simultaneous EEG and fMRI: influence of hypercapnia on CMRO2

Kay Jann[1], Ariane Orosz[1], Jennifer Andreotti[1], Martinus Hauf[2], Roland Wiest[2], Claus Kiefer[2], JoingJoing Wang[3], Thomas Dierks[1], Andrea Federspiel[1]

[1]Department of Psychiatric Neurophysiology, University Hospital of Psychiatry and University of Bern, Switzerland, [2]Institute of Diagnostic and Interventional Neuroradiology, University of Bern, Switzerland, [3]Dept. of Neurology, UCLA, Ahmanson-Lovelace Brain Mapping Center, Los Angeles, USA

Introduction: Neuronal activity is coupled to cerebral blood flow (CBF), blood volume (CBV) and oxygenation (CMRO2). These changes can be measured via blood oxygenation level dependent (BOLD) mechanism. Unfortunately, the BOLD signal does not allow disentangling these entities: calibrating is therefore indispensable. Carbon dioxide (CO2) is used as a vasodilator to estimate changes in CMRO2 [1]. One basic assumption in this model is that under moderate hypercapnia CMRO2 is not altered. Recently, this assumption was explicitly tested [2, 3]. In the later work electroencephalography (EEG) was measured, not on the same calibrated acquisition setup however. An unambiguous consensus does still not exist about this basic assumption. Therefore we conducted to the following investigation within the same subject and the same recording setup.

Methods: One single female subject participated (age 27.4 years). The imaging session consisted of ASL- and BOLD scans: 1) hypercapnia (HC) scan with inhalation of 7% CO2 gas mixture (2 min room air, 3 min 7% CO2, 2 min room air) and 2) a block design functional scan with room air (NA) (2 min off, 6×(30 s on/30 s off), 2 min off). Simultaneous EEG recording inside the scanner was performed during these scans. Visual stimulation of a 2 Hz full-field flashing checkerboard pattern with a small white fixation cross in the center. fMRI scan gradient echo planar imaging TE/TR [ms]=30/3000,FA=90°,32 axial slices, slice thickness (ST)=4 mm, gap=0 mm, FOV=240 mm, matrix=64 x 64. Volumes 156/208 during NC/NA. ASL scan using pseudocontinuous ASL (pCASL) sequence [13, 14], FOV=220 mm, matrix=64 x 64, axial slices=5, ST=8 mm, gap=1.5 mm, TE/TR[ms]=17/3000, slice-selective gradient = 6 mT/m, tagging duration τ = 700 ms and postlabeling delay (w) = 1000 ms. Volumes 156/208 during HC/NA. EEG recording 92 channel (5 kHz sampling rate, 16.3mV input range, bandpass filter 0.1-250 Hz, impedance < 20 kΩ). EEG was recorded first outside- (6 min) and then inside the scanner for simultaneous EEG-fMRI acquisition.

Results: End-tidal CO2 increase of 6 mm Hg during HC. Whole brain resting perfusion CBF = 54.30 [ml/100g/min] increase to 60.69 [ml/100g/min] during HC. ROI extraction provided CO2 runs: BOLD (%): 0.71, CBF (%): 26.86. Calculation of M=5.02. Calculation of CMRO2 (Stimulus-induced runs: BOLD (%): 0.48, CBF (%): 13.57) yielded CMRO2=5.62. Alpha power decreased during HC. Visual evoked potentials showed latency of P100 peak at 116 ms. Current density during HC localized in the early visual cortex. During HC a reduced power in frequency bands theta and alpha 2 are observed.

Conclusions: The present pilot study measured CBF, M and CMRO2. The observed reduction in alpha power could indicate that CMRO2 under CO2 administration does not remain constant. A relation between changes in CMRO2 and frequency of a neuronal cluster was suggested earlier. The present findings are in line with previous observations tested [2], but at odds with other findings [3]. Only an extension of the present pilot study with more measurements can clarify whether the basic assumption of the method used in calibrated fMRI can hold.

References:
[1] Davis, T.L., et al., Proc Natl Acad Sci U S A, 1998. 95(4): p. 1834-9. [2] Chen, J.J. and G.B. Pike, J Cereb Blood Flow Metab, 2010. 30(6): p. 1094-9. [3] Xu, F., et al., J Cereb Blood Flow Metab, 2010.

methodology, physiology
fMRI; ASL; BOLD; CMRO2; sLORETA

Poster

MT-04

Accordance of ASL delay time and bolus arrival times in parenchyma

Kay Jann[1], Martinus Hauf[2], Frauke Kellner-Weldon[2], Marwan El-Koussy[2], Claus Kiefer[2], Andrea Federspiel[1], Gerhard Schroth[2]

[1]*Department of Psychiatric Neurophysiology, University Hospital of Psychiatry and University of Bern, Switzerland,*
[2]*University Institute of Diagnostic and Interventional Neuroradiology, Inselspital and University of Bern, Switzerland*

ASL has become a widely applied tool to non-invasively measure cerebral perfusion. The blood entering the brain through the carotid and the vertebral arteries is magnetically labelled in the tagging block during a given time period. For technical reasons there has to be a gap between the tagging block and the readout planes (inversion pulse artifacts). Furthermore, the blood needs several seconds to travel the distance between the tagging block to the cortical capillaries (parenchymal phase) where exchange with the tissue takes place [1]. To account for this, the readout begins after a specified delay. However, T1 relaxation causes a fast decay of signal from the labelled blood that limits the time-window of sufficient SNR for ASL acquisition to a few seconds [2]. In patients with steno-occlusive arterial disease (SOAD) above the labaling plane (intracranial stenosis) this time window might be too narrow due to delayed bolus arrival times (BAT) to the parenchyma.. Moreover, differences in BAT would cause signal acquisition from blood in distinct vascular compartments, thus complicating interpretation of ASL CBF maps.
The aim of the current ongoing investigation is to estimate to what extent BAT from labelling to the parenchymal phase of cerebral perfusion are delayed in patients with SOAD and from which vascular compartment the ASL signal origins at a given delay time.
Digital subtraction angiography (DSA; Siemens Axiom Artis zee) was performed in 10 patients with SOAD and the BAT from labeling block to different vascular compartments was defined for the healthy and the stenotic hemisphere by inspection of the DSA images. In addition a simulation of T1 decay was computed based on our standard ASL imaging parameters (pseudocontinous ASL[3]; TR 4000ms, label time 1.72s, post labelling delay 1.5 s, blood-brain-partition coefficient 0.9; T1 relaxation 3T: 1490ms) using Bloch's equation [4].
Average BAT from labelling plane to parenchyma was 3.3s±1.0s (mean ± standard deviation) on the healthy hemisphere and 3.8s±2.1s on the hemisphere, supplied by a upstream stenotic artery. Thus, no significant prolongation of transit times can be observed in the group mean (paired t-test p=0.31); however, there are substantial inter-individual differences. Standard ASL acquisition uses labelling and delay times of 1.6-1.72sec and 1-1.5sec, respectively. In this time-window a reasonable SNR can be achieved with 120 images as estimated by the simulation of T1 signal decay for the specified imaging parameters and flow velocities of 90ml/100g/min. However, in this time-window the ASL signal origins from small arteries and not the parenchyma. Prolonging the delay to match the BAT to the parenchyma (4s) reduces the SNR by 50%.
The ASL perfusion values seem to be acquired at a time point where the labelled blood is still in small arteries or arterioles but not yet in the parenchyma. Upstream stenoses from the labelling plane seem not to significantly prolong the BAT, thus a direct comparison of CBF values calculated from healthy and stenotic hemisphere is plausible. However, inter-indiviudual differences have to be considered when interpreting CBF maps from ASL especially in patient populations where blood flow is altered.

References:
1) Wang J. et al. (2003) Magn Reson Med 50: 599-607; 2) Detre JA, Wang J (2002) Clin Neurophysiol 113: 621-634; 3) Dai W. et al. (2008) Magn Reson Med 60: 1488-1497; 4) Wu WC. et al. (2007) Magn Reson Med 58: 1020-1027

methodology, neuroradiology, physiology
ASL

Poster

MT-05

Pathophysiological influences of steno-occlusive arterial disease on brain perfusion measurements using Arterial Spin Labeling (ASL)

F. Kellner-Weldon[1], K. Jann[2], C. Kiefer[1], M. Zbinden[1], O. Bill[3], M El-Koussy[1], P. Michel[3], J. Schmidli[4], H. Mattle[5], G. Schroth[1], A. Federspiel[2], M. Hauf[1]

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Background: ASL-based quantitative evaluation of cerebral blood flow (CBF) has been validated against the "gold standard" H2O15-PET imaging, however, only for healthy young subjects. In subjects with carotid artery disease (CAD) different confounding factors give rise to quantification errors of ASL.
We aimed at determining parameters influencing CBF values under physiological and pathological states, identifying sources of quantification errors in ASL in CAD, and evaluating the feasibility of CerebrovascularReserveCapacity (CRV) measurements using ASL.
Methods: Brain perfusion measurements were performed with pseudo continuous ASL (pCASL) (TR 4000ms, 14 slices, label time 1.72s, post labeling delay 1.5 s) on a 3 Tesla TRIO TIM MR (Siemens) at Inselspital, Berne and CHUV, Lausanne. CBF values of cortical territories of the middle cerebral artery (MCA) without upstream stenosis were extracted in 32 patients and 12 healthy controls (mean age 56, range 28-80 years) using MRIcroR.
Eighteen patients with occlusive CAD (14m/4f; mean age: 69; range 58-83 yrs) have been investigated with pCASL at rest and after a vasodilatatory stimulus with azetolamide 1g iv (15 pat) or CO2 7% (3 pat)). CBF values of the cortical MCA territories were extracted.
Endtidal CO2 (ETCO2), peripheral saturation of O2 (SO2), blood pressure (BP) and heart rate (HR) were recorded during the scans. If available, conventional angiography findings were compared to the ASL acquisition parameters and CBF values.
Results:
I - ASL quantification errors: In the current setting, the mean delay between labeling and image acquisition is 2.48 sec. Angiographic contrast bolus arrival takes on average 3- 4 sec from label plane to parenchyma perfusion in healthy subjects. The ASL image acquisition therefore delivers signals from small arteries and arterioles rather than from the capillaries of the parenchyma.
II- CBF values under physiological conditions: In 78 MCA territories with no upstream stenosis mean CBF values in the cortical MCA territory were 63.1 ml/100g/min (SD 13.5). CBF increases by 2.04 ml/100g/min per mmHg ETCO2 change. This correlation explains 36%of the variability of CBF in healthy brain parenchyma (R2:0.36).
III - CVR group effects show a reduction of CVR in function of the degree of stenosis. CVR for patients with stenosis >90% was 9.9 (SD 6.6), with 70-90% was 14.1 (SD 7.4) and with <50% stenosis was 19.4 ml /100g/min (SD 9.4). The variance reflects CVR dependency on stenosis grade and collateral flow.
Conclusion:
I- The ASL perfusion method seems to acquire signal from small arteries rather than the capillaries in the parenchyma (see also the poster by Jann et al.).
II- The CBF values at rest depend on the endogenous level of ETCO2 and these findings have to be considered in the interpretation of the data, particularly in bilateral steno-occlusive arterial disease.
III- Preliminary data show the feasibility of CVR measurements with ASL in steno-occlusive disease to provide non-invasively CBF and CVR values covering the whole brain parenchyma. CVR is reduced in patients with high grade carotid stenosis. The variance of the data reflects CVR dependency on stenosis grade as well as on collateral flow.

methodology
brain perfusion

Poster

MT-06

Different kinds of connectivity measures from a face binding task measured simultaneously with EEG and fMRI

Mara Kottlow[1], Kay Jann[1], Lester Melie-García[2], Thomas Koenig[1]

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[2]*Neuroinformatics Department, Cuban Neuroscience Center, Havana, Cuba*

In a previous study we had found that gamma phase synchronization, a marker for conscious visual binding, was enhanced during face integration compared with visual search. We identified two distinct networks of areas showing positive correlations of gamma phase synchronization (γ-GFS) and BOLD responses.
The goal of the present study was to compare this γ-GFS-BOLD correlates with sLORETA lagged nonlinear connectivity and with anatomical connectivity assessed with diffusion tensor imaging (DTI).
Subjects had been measured with combined EEG-fMRI while looking at different parts of a schematic face, randomly moving around in a square (NOFACE condition) and from time to time formed a facial gestalt (FACE condition). Overlapping areas from the fMRI analyses of FACE versus baseline and NOFACE versus baseline were taken as ROIs for the subsequent connectivity analyses. These areas were the bilateral superior temporal lobules, the right middle fusiform gyrus, the left fusiform gyrus, and the cuneus bilaterally.
Comparable to the γ-GFS-BOLD correlates, sLORETA lagged nonlinear connectivity showed increased coherence in frequencies from 40 to 42 Hz during the FACE condition.
DTI revealed that all ROIs except the left fusiform gyrus were directly or indirectly via other regions of the predefined ROIs connected through white matter tracts in at least one subject. The left fusiform gyrus may be connected to the other ROIs via further regions, since it showed connectivity with the superior parietal lobule in the sLORETA analysis. The γ-GFS-BOLD correlates and the sLORETA connectivity did not show the same ROIs to be connected. Since GFS measures the amount of zero phase-lag brain activity, and since lagged coherence is insensitive to precisely this type of activity, the combination of the two measures might lead to important new insights on different types of brain interactions, namely an undirected type, mediated by common-phase oscillations, and a directed one, mediated by sequential patterns of activation.
Further research is also needed to enlighten the relationship of the different measures of functional to structural connectivity. Specifically, the analysis of structural connectivity through probabilistic fibre tracking is planned, since white matter tracts may provide the basis for all kinds of functional connectivity. Also important will be the comparison of EEG connectivity measures and fMRI causal connectivity measures.

methodology
Connectivity, anatomical, functional, EEG, fMRI, DTI

Poster

Neurobiology (NB)

NB-01

Modulation of Neural Plasticity by Stem Cell Transplantation After Stroke

Robert H. Andres[1,2], Guohua Sun[2], Erin McMillan[3], Clive N. Svendsen[3,4], Hans R. Widmer[1], Andreas Raabe[1], Tonya M. Bliss[2], Gary K. Steinberg[2]

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Introduction: Transplantation of human neural stem cells (hNSCs) is a promising therapeutic approach for stroke. However, questions regarding their mechanism of action remain unanswered. A growing body of data proposes that hNSCs enhance endogenous repair mechanisms after cerebral ischemia. Here we addressed the hypothesis that hNSCs improve brain repair by enhancing axonal plasticity and axonal transport in the post-ischemic brain.
Methods: Vehicle or hNSCs derived from fetal cortex were transplanted into the ischemic cortex of NIH:rnu rats 7 days after distal middle cerebral artery occlusion. Neurological recovery was assessed weekly using four sensorimotor tests. The extent of axonal sprouting was quantified in different brain regions by confocal image analysis of the injected anterograde axonal tracer (BDA), and impairment of axonal transport was assessed by amyloid precursor protein staining. To investigate putative mechanisms of axonal plasticity, a co-culture assay of rat E14 cortical progenitor cells with hNSCs was used with immunodepletion of vascular endothelial growth factor (VEGF), thrombospondin (TSP)-1/2, SPARC, and Slit. In vitro axonal transport function was assessed by live imaging of dextran-labeled vesicles in cultured rat cortical neurons.
Results: Transplantation of hNSCs significantly improved behavioral recovery and increased transcallosal and corticospinal tract axonal rewiring. Neutralization of VEGF, TSP-1/2, and Slit, but not SPARC, partially abolished the response on axonal outgrowth in vitro. Furthermore, hNPC treatment enhanced axonal transport in vivo and in vitro. Neutralization of VEGF, but not the other aforementioned factors, significantly inhibited this effect in vitro.
Conclusions: Transplanted hNSCs significantly improve axonal rewiring and attenuate impairment of axonal transport after stroke. VEGF, TSP-1/2, and Slit were identified to mediate the effects on axonal sprouting in vitro. Defining possible mechanisms-of-action is important as cell therapies advance to the clinic.

neurobiology, neurology, neurosurgery
stroke, stem cells, plasticity, neural transplantation

Poster / Talk

NB-02

Neural differentiation potential of human umbilical cord Wharton's jelly-derived cells

Marianne Messerli[1], Andreina Schoeberlein[1], Anna M. Wagner[1], Ruth Sager[1], Daniel V. Surbek[1]

[1]*Dept. of Clinical Research, University of Bern & Dept. of Obstetrics and Gynecology, University Hospital Bern, 3010 Bern, Switzerland*

OBJECTIVE: Perinatal brain damage accounts for the major part of the clinical problems in surviving premature infants. A considerable therapeutic potential has been ascribed to mesenchymal stem cells. The umbilical cord connective tissue (Wharton's jelly) represents a promising source of mesenchymal stem cells. Thus, the aim of this study is to characterize the phenotype of human Wharton's jelly-derived cells and to assess their neural differentiation potential.
STUDY DESIGN: Wharton's jelly cells from umbilical cord tissues of uncomplicated term pregnancies were evaluated. The expression of the minimal surface marker set for mesenchymal stem cells defined by the International Society for Cellular Therapy (ISCT) was measured by flow cytometry. Accordingly, mesenchymal stem cells have to be ≥95% positive for CD105, CD90 and CD73, but negative for CD45, CD34, CD19, CD14 and HLA-DR (Dominici et al., Cytotherapy, 2006, 8:315). Adaptations of published multistep protocols (Portmann-Lanz et al., AJOG, 2010, 294:e1; Fu et al., Acta Neurobiol Exp, 2007, 67 :367; Zhang et al., Differentiation, 2010, 79 :15) were used to produce neural progenitor cells, namely neurosphere-like bodies. Analysis of neural differentiation markers was performed by real-time PCR and flow cytometry.
RESULTS: Isolated umbilical cord Wharton's jelly cells were plastic adherent and highly positive for CD105, CD73, CD90, but negative for CD45, CD34, CD14, CD19 and HLA-DR. A subset of Wharton's jelly cells displayed the neural progenitor cell marker nestin, whose protein and gene expression was increasing during neurogenic pre-induction into neurosphere-like bodies. In addition, mRNA levels of the neural progenitor cell markers PAX6, musashi-1 and nanog were elevated in neurospheres relative to undifferentiated Wharton's jelly-derived cells.
CONCLUSIONS: Wharton's jelly cells meet the criteria for the phenotypic characterization of mesenchymal stem cells. The up-regulated expression of the neural progenitor cell markers nestin, PAX6, musashi-1 and nanog in neurospheres compared to undifferentiated cells strongly indicates that neural precursor cells can be obtained from Wharton's jelly-derived mesenchymal stem cells. Terminal differentiation into the neural subtypes is currently tested.

neurobiology

Poster

NB-03

Optimization of the Placenta-derived Mesenchymal Stem Cells for Neuroregeneration to treat Pre- and Perinatal Diseases.

Ramesh Periasamy[1], Marianne Messerli[1], Ruth Sager[1], Andreina Schoeberlein[1], Daniel Surbek[1]

[1]*Laboratory for Prenatal Medicine, Dept of Obstetrics and Gynecology, University of Bern, 3010 Bern, Switzerland.*

Introduction:
1% of the newborns are affected by neurological injuries. Severe neonatal morbidity and mortality are mainly due to the preterm delivery and its underlying causes. Treating such complex diseases is difficult. Multipotent stem cells like the placenta-derived mesenchymal stem cells (P-MSCs) have the ability to differentiate towards neuronal lineages with suitable stimulation. P-MSCs are easily accessible, less immunogenic, ethically acceptable and could be a valuable source as cell graft for pre- and perinatal neuroregeneration. Elucidating the mechanisms behind homing, proliferation and differentiation of transplanted cells as well as support and alteration of the microenvironment will be an essential step forward on the way to successful cellular therapy of the disease.

Material & methods:
A number of culture conditions were tested with the aim of optimizing the neurodifferentiation of P-MSC: different substrates [0.1% gelatin/no serum (G+S-) vs. no-gelatin/20% serum (G-S+)], enzymes for passaging (0.5%trypsin-EDTA vs. accutase), cell density. The expression of the P-MSC for cellular markers relevant for the neural differentiation such as Nanog, Nestin, Oct-4, FRZ9, SOX-2 and PAX6 was characterized by flowcytometry and real-time RT-PCR. Cell proliferation was assessed using the MTS assay.

Result:
Different placenta with passage 5 were analysed for positive for the cell surface markers CD105, CD73, CD90 and negative for CD34, CD45, CD19, CD14 HLA-DR, as expected. G+S- cells have smaller morphological size and higher proliferation rate (approximately 40-50% faster) than G-S+ cells. Regardless of the enzyme used for passaging, Compared to G-S+ cells, G+S-cells showed a higher expression of markers for early stem cell development and neurogenesis (Nanog, Nestin & Oct-4).

Conclusion:
The results will help to select for the optimal cell population before initiating the neural differentiation and will aid transplantation studies. More data will be needed to unravel the mechanisms that control the stem cell fate and differentiation potential. Optimization of the cell graft before transplantation will lead to a better homogenicity of the cell population and therefore will enhance the efficacy, repeatability and presumably the safety of cellular therapy for pre- and perinatal brain injury.

neurobiology, other
Neuroregeneration, Prenatal brain damage, Perinatal brain damage, Mesenchymal Stem Cells, Stem cell transplantation

Poster

NB-04

Cortical Thickness and Intensity in Auditory Verbal Hallucinations

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Context: Functional and structural studies have added important knowledge concerning the neurobiological mechanisms underlying auditory verbal hallucinations (AVH), however the exact mechanisms and relation between gray matter (GM) structures and function in AVH remains unresolved. Recently cortical thickness and intensity analysis allow whole brain investigation of more detailed structural changes in cortical GM. This approach was used in the present study investigating specific GM changes related to AVH in schizophrenic patients.
Methods: Anatomical data from ten patients with schizophrenia suffering from AVH, ten never-hallucinating patients with schizophrenia, and ten healthy control subjects were acquired with high-field 3 Tesla MRI. After transformation into a standard space and cortical alignment, local differences in whole brain cortical thickness and intensity between the two patients groups were investigated and brain regions with changes specific for the AVH patients were identified. These regions were then used as predetermined regions of interest to compare AVH patients to healthy subjects.
Results: Hallucinating patients presented thinner and less intense GM in the language dominant hemisphere, predominantly in sensory areas relevant for speech processing. Increased cortical thickness and decreased intensity were found in regions related to self-monitoring.
Conclusions: Reduced cortical thickness combined with reduced GM intensity is best explained by regional apoptotic processes with loss of neuropil. Thus synaptic derangement and deregulation may be the structural basis for dynamic functional disorders of the language circuits related to the phenomenon of AVH. The thickness increase and intensity decrease in regions involved in self-monitoring can be interpreted as the result of adaptive plasticity incited by the ambiguous output of the language system.

neurobiology, psychiatry
Schizophrenia, auditory verbal hallucinations

Poster

NB-05

Parkinson’s disease: when striatal direct and indirect pathways work together

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In Parkinson’s disease (PD), dopaminergic denervation produces an imbalance between direct and indirect pathways, leading to an inhibition of thalamocortical projections. This, in turns, causes bradykinesia or slowness of movement, a PD key symptom. However, bradykinesia only appears after a large striatal dopamine depletion and compensatory mechanisms probably delays the appearance of this symptom. The goal of our study was to analyze the role of direct and indirect pathways in these putative compensatory mechanisms.
We used 6-hydroxydopamine (6-OHDA) PD rats and control animals. We measured the spontaneous locomotor behavior four weeks after the lesion and then proceed to in situ hybridization for markers of both striatal direct and indirect pathways. We also analyzed the correlation between behavior and gene expression.
As expected, parkinsonian rats showed a lower velocity than control animals four weeks after the lesion. We observed a significant and positive correlation between velocity and both D1-class dopamine receptor (D1R) mRNA (direct pathway) as well as enkephalin (ENK) mRNA (indirect pathway) in the lesioned striatum. We also found a significant and positive correlation between D1R mRNA and ENK mRNA. These correlations were only present in PD rats. Based on the classical basal ganglia model, we would expect that an increase of ENK expression in the indirect pathway induces an increase of bradykinesia and that direct and indirect pathways work in an opposite way, but we found the contrary with a synergy between both pathways.
In conclusion, our results demonstrate strong mutual influences between both direct and indirect pathways, and spontaneous locomotor activity in parkinsonian rats; moreover both pathways work in synergy. We suggest that these mechanisms could play a role in compensatory mechanisms delaying appearance of bradykinesia in PD.

neurobiology
Parkinson's disease, 6-hydroxydopamine, enkephalin, D1 dopamine receptor

Poster

NB-06

Intracerebral transplantation of human placenta-derived mesenchymal stem cells for neuroregeneration in a rodent model of perinatal brain injury

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OBJECTIVE
Peripartal brain injury in the premature infant leads to a large spectrum of clinical problems. There is no established therapy available. Stem cell transplantation has been proposed as a therapy for neurodegenerative diseases. The aim of this study is to assess the therapeutic potential of human stem cell treatment in an animal model of peripartal brain damage.
METHODS
Newborn anesthetized Wistar rats (postnatal days 2-4) were fixed in a stereotaxic frame (Kopf). Mesenchymal stem cells (MSC) derived from human placenta (chorion) or umbilical cord Wharton's jelly (250'000 cells in 5 µl) were injected into the left lateral ventricle using a 32-gauge needle at a very low speed (Lab Animal Studies Injector, Hamilton). The animals were sacrificed 3-4h, 1 week, 2 and 4 weeks after transplantation. In brain sections, donor human MSC were detected by immunohistochemistry using a mouse anti-human HLA Class 1 ABC antibody. In an ongoing study, stem cell are transplanted into animals with an experimental perinatal brain injury. The injury model combines intraperitoneal LPS injection and ligation of the left carotid artery, followed by general hypoxia (8% O2).
RESULTS
Coordinates for the lateral ventricle in postnatal day 2 rats are 0.18 mm posterior to Bregma, 1.2 mm from midline and 1.8 mm below dura. Single donor-derived cells detected in the brains of healthy rats shortly (1-2h) after transplantation showed an unaltered morphology. After 4h, donor cells had started migrating throughout the ventricular system. A few cells had already migrated into the parenchyma. Two weeks after transplantation, 84% of the uninjured pups had survived the transplantation procedure. The first 24h after transplantation were crucial for the survival. Single cells were found in the solid tissue around the ventricles.
CONCLUSIONS
Human stem cells were successfully delivered into the lateral ventricle of neonatal rat brains. Donor cells were detected in the hosts' brains up to four weeks after transplantation. Longer term studies will be done to analyze the proliferation, the long-term survival and engraftment of the donor cells. The co-expression of lineage specific proteins and human-specific markers will give information about the fate of the transplanted human cells in the brains of both injured and .control rats. As a proof of principle, stem cell-treated and non-treated rats will be subjected to behavioral tests to assess the improvement of motor and memory deficits.

neurobiology
stem cell therapy

Poster

NB-07

Reinforcement learning in dendritic structures

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The discovery of binary dendritic events such as local NMDA spikes in
dendritic subbranches led to the suggestion that dendritic trees could be computationally equivalent to a 2-layer network of point neurons, with a single output unit represented by the soma, and input units represented by the dendritic branches \cite{poirazi}. Although this interpretation endows a neuron with a high computational power, it is functionally not clear why nature would have preferred the dendritic solution with a single but complex neuron, as opposed to the network solution with many but simple units. We show that the dendritic solution has a distinguished advantage over the network solution when considering different learning tasks. Its key property is that the dendritic branches receive an immediate feedback from the somatic output spike, while in the corresponding network architecture the feedback would require additional backpropagating connections to the input units. Assuming a reinforcement learning scenario we formally derive a learning rule for the synaptic contacts on the individual dendritic trees which depends on the presynaptic activity, the local NMDA spikes, the somatic action potential, and a delayed reinforcement signal. We test the model for two scenarios: the learning of binary classifications and of precise spike timings.
We show that the immediate feedback represented by the backpropagating action potential supplies the individual dendritic branches with enough information to efficiently adapt their synapses and to speed up the learning process.

neurobiology
synaptic plasticity, reinforcement learning, dendritic computation, theoretical neuroscience

Poster / Talk

NB-08

Spatio-temporal credit assignment in population learning

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We present a model for plasticity induction in reinforcement learning which is based on a cascade of synaptic memory traces. In the cascade of these so called eligibility traces presynaptic input is first correlated with postsynaptic events, next with the behavioral decisions and finally with the external reinforcement. A population of leaky integrate and fire neurons endowed with this plasticity scheme is studied by simulation on different tasks. For operant conditioning with delayed reinforcement, learning succeeds even when the delay is so large that the delivered reward reflects the appropriateness, not of the immediately preceeding response, but of a decision made earlier on in the stimulus-decision sequence. So the proposed model does not rely on the temporal contiguity between decision and pertinent reward and thus provides a viable means of addressing the temporal credit assignment problem. In the same task, learning speeds up with increasing population size, showing that the plasticity cascade simultaneously addresses the spatial problem of assigning credit to the different population neurons. Simulations on other task such as sequential decision making serve to highlight the robustness of the proposed scheme and, further, contrast its performance to that of temporal difference based approaches to reinforcement learning.

neurobiology
Synaptic plasticity, Reinforcement learning, Spiking neurons, Theoretical neuroscience

Poster

NB-09

Neurophysiological correlates of delinquent behaviour in adult subjects with ADHD

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Introduction:
It is known that the attention deficit/hyperactivity disorder (ADHD) shows an enhanced prevalence in arrested offenders compared to the normal population. The aim of the present study was to investigate whether ADHD symptoms are a major risk factor for criminal behaviour, or whether further deficits, mainly abnormalities in emotion-processing, have to be considered as important additional factors that promote delinquency in the presence of ADHD symptomatology.

Methods:
The event related potentials (ERPs) of 13 non-delinquent and 13 delinquent subjects with ADHD and 13 healthy controls were compared using a standard, neutral Go/Nogo continuous performance task (NCPT) and a newly developed version of the CPT that requires emotional evaluation (ECPT). ERPs were analyzed regarding their topographies and Global Field Power (GFP).

Results:
Offenders with ADHD differed from non-delinquent subjects with ADHD in the ERPs representing higher-order visual processing of objects and faces (N170) and of facial affect (P200). Also, they were distinguishable from non-delinquent ADHD subjects in their brain activity associated with late monitoring and evaluative functions (LPC) of behavioural response inhibition. Concerning neural activity thought to reflect the allocation of neural resources and cognitive processing capability (P300) and attention/expectancy (CNV), deviances were observable in both ADHD groups and may thus be attributed to ADHD rather than to delinquency.

Conclusion:
Concluding from our results, ADHD symptomatology may be a risk factor for delinquency, since some neural information processing deficits found in ADHD seemed to be even more pronounced in offenders with ADHD. However, our results suggest additional risk factors consisting of deviant higher-order visual processing, especially of facial affect, as well as abnormalities in monitoring and evaluative functions of response inhibition.

neurobiology
Delinquency, ADHD, event related potentials, emotion-processing

Poster

NB-10

Propagation and neural differentiation of neonatal rat spiral ganglion stem cells cells: The potential of Creatine administration.

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Background. Irreversibility of hearing loss in humans is mainly due to the inability of the ear to replace its lost hair cells and auditory neurons. While inner ear stem cells are potential candidates for the cure of hearing loss their limited availability urges for the development of strategies to improve the in vitro expansion of these cells.
Purpose. Creatine administration has been reported previously to exert neurotrophic properties on neuronal progenitor cells isolated from different brain regions. In the present study we investigated whether Creatine might enhance the long term propagation and differentiation of inner ear stem cells.
Methods. Stem cells were isolated from the neonatal rat spiral ganglion and propagated in basal medium containing mitogens. Creatine supplementation was started from the third passage. The number of spheres was assessed at each passage. To address the effects of Creatine on differentiation of expanded spiral ganglia cells, number of neuronal cells was analyzed by beta-III-tubulin immunohistochemistry after two weeks culture in absence or presence of Creatine. Moreover, the differentiation properties of primary versus in vitro expanded spiral ganglion stem cells was compared.
Results. We observed that Creatine administration promoted number of spiral ganglia derived spheres as compared to controls. Moreover,creatine significantly increased the yield of neuronal cells of differentiated progenitors by 40%, while the total cell number remained steady in both experimental conditions. Notably,both the total cell count and the number of beta-III-tubulin positive cells were more than two fold higher in the primary cultures compared to passaged cultures.
Conclusion. Our study shows that inner ear stem cells can be expanded over considerable time periods. Creatine supplementation promoted both the propagation and neural differentiation of rat spiral ganglia stem cells. In sum, use of Creatine is a promising tool for the optimization of inner ear stem cell culture conditions. More efforts are needed to optimize culture conditions to achieve higher yields of spiral ganglion cells.

methodology, neurobiology, other

Poster

NB-11

The fetal human inner ear: A novel source of Progenitor cells

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Background. Progenitor cells capable of generating inner ear hair cells and auditory neurons have been recently isolated from human autopsy-derived temporal bones (Senn et al., submitted 2010). However, hair cells could only be generated from the vestibular part of the inner ear and not from the cochlea. To explore a new source capable of generating human auditory hair cells and neurons, donated human fetal inner ear tissues have been studied.
Objective. To prove the existence of progenitor cells capable of generating auditory hair cells and neurons from the fetal human inner ear.
Methods. The protocol has been approved by the Ethical Board of the Canton Bern. Abortion fetal tissues have been obtained from the University Department of Obstetrics and Gynecology at the University Hospital. The inner ear tissues have been dissected into a single cell suspension, supplemented with mitogenic growth factors to induce the formation of spheres. Second or third generation spheres were plated to differentiate into inner ear specific cells including hair cells and auditory neurons.
Results. Sphere-forming progenitor cells have been successfully isolated from (n = 5) fetal inner ear tissues. Propagation of spheres was possible into the 8th generation. Sphere-derived cells of fetal vestibular and cochlear tissues gave rise to considerable numbers of hair cells and auditory neurons, identified by expression of the specific markers Myosin VIIa and beta-III-tubulin, respectively.
Conclusion. Fetal inner ear tissues are potent sources for inner ear progenitor cells, which can be propagated, and ultimately readily differentiated into specific inner ear hair cells and neurons. In comparison to autopsy-derived, adult human temporal bones, the numbers of generated inner ear sensory cells and neurons are substantially higher. Importantly to note, also cochlear hair cells could be generated. In sum, our findings add a promising step for future, cell based therapies for hearing loss and balance disorders.

neurobiology, other

Poster

NB-12

Non-hypoxic HIF-1 stabilization results in higher numbers of cultured dopaminergic neurons

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Background. Hypoxia-inducible factor-1 (HIF-1) is a transcriptional activator involved in adaptation to hypoxic stress. Actual tissue oxygen levels in both the developing and adult brain measures about 2-3% only and midbrain tissue has been reported to be sensitive to oxygen level fluctuations.Notably, HIF-1 alpha activation and signaling triggers cytoprotection in many cell types including neurons.
Purpose. Aim of the present study was to investigate the potential of chemical stabilization of HIF-1 alfa by DMOG on survival of cultured dopaminergic neurons.
Methods.Ventral mesencephali (VM) were isolated from Wistar rat fetuses (at embryonic day 14) and dissected in cold DMEM. Tissue was grown as organotypic free floating roler tube (FFRT) cultures for one week. DMOG [1mM] administration started at day in vitro 2 and was repeated with medium change at day in vitro 5. Untreated cultures served as controls. At the end of the culture period tissue was fixed and sectioned. Sections were immunohistochemically stained for the dopaminergic marker tyrosine hydroxylase (TH) and for the cell proliferation-associated protein Ki-67.
Results. Chronic DMOG treatment resulted in significantly higher numbers of TH positive cells (by 50%) as compared to controls. Likewise, the number of Ki-67 positive cells in VM FFRT cultures was significantly augmented in the DMOG treated groups (by 70%) as compared to controls.
Conclusion. Our findings suggest that stabilization of HIF-1 alpha provides a means to promote differentiation and / or survival of dopaminergic neurons. Moreover, the increased proliferation rate imply that a pool of precursor cells were stimulated by HIF-1 alpha stabilization. These data support previous reports assessing the possible therapeutic utility of HIF-1 alpha induction for Parkinson disease

neurobiology, physiology

Poster

NB-13

Age-dependent Effects of Creatine Supplementation on Striatal Neural Progenitor Cells

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Huntington's disease (HD) is an autosomal dominant neurodegenerative disorder, characterized by a loss of GABA-ergic medium-sized spiny neurons in the caudate putamen. Neural stem cell transplantation has emerged as a promising experimental therapeutic strategy for HD, however, the variables responsible for the success of this approach, including the optimal developmental stage of the grafted cells, are largely unknown. The creatine (Cr) kinase phosphotransfer system plays a pivotal role in cells with high and fluctuating energy demands, including neuronal precursors. Supporting cellular energy metabolism by Cr supplementation is a clinically translatable method for improving cell transplantation strategies for HD. We have previously shown that Cr promoted survival and differentiation of cultured rat striatal progenitor cells. The present study aims at investigating possible differential effects at early (E14) and late (E18) developmental stages.
Striatal precursor cells were isolated from E14 and E18 rat embryos and cultured for 7 days with and without Cr added at a concentration of 5 mM to the culture medium. Chronic Cr treatment resulted in a significantly increased percentage of GABA-immunoreactive neurons as compared to untreated controls, both in the E14 (170.44±4.67) and E18 group (141.73±8.29). This effect was greater in E14 cultures ($p<0.01$). Short-term treatment from day in vitro (DIV) 6-7 also resulted in an increased induction ($p<0.05$) of the GABA-ergic phenotype in E14 (162.97±10.37), as compared to E18 cells (133.27±9.51). Total neuronal cell numbers and general viability, as assessed with the MTT assay, were not affected ($p>0.05$). Protective effects of Cr against a metabolic insult induced by serum and glucose deprivation were equal in E14 and E18 cultures ($p>0.05$).
In sum, our findings demonstrate that the role of Cr as a GABA-ergic differentiation factor depends on the developmental stage of striatal progenitor cells, while Cr-mediated neuroprotection is not significantly influenced by this parameter. These findings may have implications for optimizing cell replacement strategies in HD.

neurobiology, neurology, neurosurgery
Striatum, Creatine, Huntington's Diesease, Cell Transplantation, Regenerative Medicine

Poster

NB-14

Modulation of persistent sodium current and rhythmic activity in spinal cord networks by beta-pompilidotoxin

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The origin of rhythm generation in mammalian spinal cord networks is still poorly understood. In a previous study, we showed that oscillatory activity in organotypic spinal cord cultures is mainly due to depolarization block caused by a fast inactivation of the transient sodium current (INaT). Recently, toxins called alpha- and beta-pompilidotoxin (alpha- and beta-PMTX) have been extracted from solitary wasp venom. Alpha-PMTX slows the sodium channel inactivation process and beta-PMTX seems to be 6-7 times more potent than alpha-PMTX. In the present study, we therefore investigated the effect of beta-PMTX on rhythmic activity and on sodium currents in spinal networks. Using intracellular recordings and multielectrode array (MEA) recordings in dissociated spinal cord cultures, we found that beta-PMTX reduces the number of population bursts and increases the background asynchronous activity. We then uncoupled the network by blocking all synaptic transmission (APV, CNQX, bicuculline and strychnine) and observed that beta-PMTX increases both the intrinsic activity at individual channels and the number of intrinsically activated channels. This latter result suggested that previously silent cells become spontaneously active after application of beta-PMTX. To confirm this assumption, we performed intracellular recordings under uncoupled condition. Beta-PMTX has two effects: it switches a number of silent cells into spontaneously active cells and it increases the firing rate of intrinsically spiking cells. Finally, we investigated the effect of beta-PMTX on sodium currents. We found that this toxin does not affect the inactivation of INaT but increases the peak of the persistent sodium current (INaP). All together, theses findings suggest that beta-PMTX acts on INaP thereby enhancing intrinsic activity leading to a profound modulation of spontaneous rhythmic activity. This work was supported by Swiss National Science Foundation Grants No. 3100A0_120327.

neurobiology
Persistent sodium currents, ß-pompilidotoxin, Spinal cord networks, Spontaneous activity

Poster

NB-15

Intracortical source estimation of RSN related EEG spectra.

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Resting State Networks (RSNs) as identified in fMRI BOLD data are associated to EEG spectral fluctuations. Thereby, each RSN is associated with several EEG frequency bands, has a specific pattern of spectral correlates and the topography of the spectral correlates differs with respect to RSN and frequency band. It was therefore suggested that individual regions constituting an RSN may have different EEG spectra and information transfer between these regions might be established through cross-frequency synchronization.
To explore whether separate regions have different spectra, we estimated the intracortical sources of RSN related EEG spectral fluctuations using sLORETA for one specific RSN: the Default Mode Network (DMN).
In 20 healthy young subjects (92 channels EEG, artifact corrected, downsampling to 100 Hz, bandpass filter 1-30 Hz, segmentation matching 252 fMRI volumes, FFT 0.390625 Hz resolution) we calculated the intracortical sources within 6239 gray matter voxels (EEG inverse solution with signal-to-noise SNR10). These estimated sources in each voxel of each frequency step were correlated to the temporal dynamics of the DMN (segments displaying remaining artifacts were excluded). Finally, a t-test revealed the group statistics of the intracranial sources of different EEG spectra in relation to DMN dynamics.
We found that alpha2 shows positively correlated sources in the left and right inferior parietal gyri (IPG) areas of the DMN and negatively correlated sources in the anterior cingulum. Theta1 shows negative values in the anterior and posterior cingulum and positive values in the left IPG. Theta2 shows prominent positive correlations in posterior insular cortex bilaterally. Alpha1 and beta1-3 show negatively correlated sources in orbitofrontal and temporal lobe and positively correlated values are prominent in the superior parietal to central lobe.
Thus, our results give first evidence for the hypothesis that different sub-regions of a RSN are associated to distinct frequency bands.

neurobiology
Resting State; EEG, fMRI, sLORETA

Poster

Neurology (NE)

NE-01

Modulating bodily self-consciousness with vestibular stimulation: body parts ownership and tactile perception

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A contribution of vestibular signals to bodily self-consciousness is suggested by neurological observations: vestibular stimulation restored self-attribution of body parts in brain-damaged patients suffering from somatoparaphrenia and improved tactile perception in patients with hemianesthesia. Following these clinical observations, the present studies investigated how vestibular stimulation can influence bodily experiences in healthy participants.
In a first experiment, we investigated whether galvanic vestibular stimulation (GVS) interfered with the mechanisms underlying self-attribution of the hand using the so-called 'rubber hand illusion' (Lopez et al., 2010 Consciousness and Cognition). The (unseen) left hand and a left rubber hand were stroked synchronously, or asynchronously, for 1 minute. Synchronous stroking of the participant's hand and the rubber hand induced an illusory self-attribution of the rubber hand. We compared whether this illusory self-attribution was influenced by binaural GVS (anode left/cathode right, 'exciting' the right ear vs. anode right/cathode left, 'exciting' the left ear) applied during the stroking and compared the results with a baseline without GVS and sham stimulation (electrical stimulation on the neck). Immediately after the stroking, self-attribution of the rubber hand was assessed by means of questionnaires. The results showed that left anodal/right cathodal GVS significantly increased illusory ownership of the rubber hand and illusory location of touch (as if the touch participants felt was caused by the paintbrush touching the rubber hand). We propose that these changes might be due to a spatial or temporal modification of visual-tactile integration, leading to an enhancement of visual capture. Such changes were found selectively for left anodal/right cathodal GVS and we speculate that this finding is due to an interference with activity in the right posterior insula and temporo-parietal junction, regions integrating vestibular, visual and tactile signals.
In a second experiment, we investigated whether air caloric vestibular stimulation (CVS) influenced tactile perception. We measured tactile two-point discrimination thresholds for the right and left hand using pairs of plastic rods separated by 7 distances (from 2-14 mm). A 0 mm distance was produced with a single rod. Each distance was tested 10 times in a randomized order. Participants reported verbally whether they experienced one touch or two touches. They performed this task while they received either cold CVS (air temperature 20°), or sham CVS (air temperature 37°), in their left ear. The results showed that the percentage of two points detected decreased significantly during left cold CVS as compared to sham stimulation at body temperature. Detailed analysis showed that the increase in discrimination threshold during left cold CVS was only significant for the left hand. Such vestibular influence on tactile discrimination may be due to interfering effects of CVS with multisensory insular and temporo-parietal regions, mainly in the right hemisphere.
In conclusion, the present results indicate the possibility to manipulate important bodily experiences for human self-consciousness by using vestibular stimulation in healthy participants.

Reference: Lopez C. et al (2010) How vestibular stimulation interacts with illusory hand ownership. Conscious Cogn 19, 33-47.

Funding: Swiss National Science Foundation (SINERGIA CRSII1-125135/1)

neurology
body representation, multisensory integration, vestibular, tactile, somatosensory

Poster

NE-02

Hemispatial neglect during naturalistic motion perception and its modulation through cerebral lesion location

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Hemispatial neglect is a neurological disorder defined as the failure to attend and act upon the contralesional side of space, which can not be explained by elementary sensory loss. Neglect is frequent after right-hemispheric lesions involving an extended cortical and subcortical attentional network. It is well known that homogeneous, unidirectional motion towards the contralesional side of space (e.g. during optokinetic stimulation) can ameliorate neglect symptoms. However, the influence of multidirectional, naturalistic motion on neglect severity is largely unknown. In order to answer this question, we asked a group of neglect patients to perform a free visual exploration task with static and dynamic stimuli (i.e. pictures and short motion picture sequences presented on a computer screen) and measured their eye movements, a reliable indicator of visual attention allocation. Preliminary results show that – in comparison to static stimuli – naturalistic motion has differential effects: In a sub-group of patients, motion ameliorated neglect (i.e. it triggered a better exploration of the left space), whereas in another sub-group, it further deteriorated behavioural performance (i.e. it triggered an even more pronounced left-sided inattention). A further analysis on magnetic resonance imaging data shows that, in patients whose neglect deteriorated with motion, the overlapping lesions were more posterior temporal, and in patients whose neglect ameliorated with motion, the overlapping lesions were more anterior. A subtraction analysis (dynamic worse - dynamic better) showed that temporal regions were affected in patients whose neglect deteriorated with dynamic stimuli. Our preliminary results thus suggest that the presence of lesions involving the temporal cortex (and probably higher visual areas) can modulate neglect severity during naturalistic motion perception. This modulation may have a significant impact on both diagnostics and rehabilitation of hemispatial neglect.

neurology, psychology

Poster

NE-03

Impaired time perception in hemispatial neglect: When does overestimation become underestimation ?

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Hemispatial neglect is a frequent neurological disorder after right-hemispheric lesions and is characterised by a pathological inattention to the contralesional side of space. However, recent evidence suggests that patients suffering from neglect also show impairments in other cognitive domains than visuo-spatial attention, for instance in time perception. Particularly, previous data show that neglect patients tend to overestimate time in the sub-second range and to underestimate time in the supra-second range. The aim of the present study was to further analyze the link between attention and time in neglect patients, especially the transition point of time between over- and underestimation. For this purpose, in a pilot study, neglect patients performed a time-reproduction task. Patients were asked to perceive several sub- and supra-second time intervals, to estimate their duration, and to reproduce the same duration immediately after presentation by means of a key press. Preliminary data analysis shows that – compared to a control group – neglect patients overestimated stimuli that were presented for 700 ms and underestimated stimuli that were presented for 6300 ms. However, their performance was similar to that of the control group for stimuli that were presented for 2100 ms. Hence, it seems that the transition point of time between over- and underestimation is at about 2 seconds. As expected, a space dependent left-right bias of time perception was not found in patients in the suprasecond range. However, there was unexpectedly no lateralized performance in the subsecond range. Further research is needed to analyse whether time perception is differently influenced by space (e.g. presentation in the left or the right hemifield) in the sub- and supra-second range and to assess the impact of this time perception impairment on the activities of daily living.

neurology, psychology

Poster

NE-04

Balancing the self: Vestibular mechanisms of self-identification and self-location in vestibular-defective patients

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Bodily self-consciousness is constituted of several components, such as self-location, ownership for one's body and body parts and first-person perspective. Neurological conditions such as out-of-body experiences and heautoscopy, during which the self is experienced to be localised out of the physical body, represent flagrant examples of abnormal bodily self-consciousness.
In healthy populations, related bodily distortions can be induced experimentally using virtual reality and the so-called "full-body illusion" (Lenggenhager et al., 2007). During this manipulation, participants are filmed from the back and the filmed image is projected onto a head-mounted display (the participants thus see their own back about 2 meters in front of them). The participant's back is stroked for 1 minute, either synchronously or asynchronously with respect to the virtually seen body. This manipulation evokes self-identification with and self-location towards the virtual body after synchronous stroking, but not after asynchronous stroking.
Although previous research investigated the role of visual and tactile signals in the image of one's self-in-the-body, the contribution of vestibular signals remains to be determined. Abnormal self-location during out-of-body experiences is associated with vestibular illusions such as floating, projection and levitation. Moreover brain regions integrating visual and tactile signals overlap with the vestibular cortex and depersonalisation –a phenomenological "loss of the self", emotional numbing and modulation of bodily perceptions – has been associated with disorders of the vestibular system. Here, we investigated the role of vestibular signals in self-identification and self-location. For this, we tested the full-body illusion in bilateral vestibular-deficient patients during stroking of the patient's body, or of a neutral object (self-identification and self-location measured as described in Lenggenhager et al., 2007). We also quantified depersonalisation symptoms (Cambridge Depersonalisation Scale; Sierra & Berrios, 1996) and abnormal bodily perceptions (Perceptual aberration scale; Chapman et al., 1978).
Our preliminary data (n = 7) replicate previous findings in showing a greater self-identification with and self-attribution of the virtual body only in the synchronous stroking condition. Such effects were also found for a neutral object. In addition, patients tend to have a larger drift forwards than previously reported in the healthy population irrespective of the object presented (virtual body or neutral object).
We propose that larger drifts in patients could be caused by a general distance underestimation due to the vestibular deficit. The fact that this effect is observed irrespective of the object presented could be related to the enhanced visual capture reported in such patients (Lopez et al., 2006). If confirmed in a larger population, these results would highlight the role of vestibular information in maintaining multisensory balance during the construction of an adequate image of one's self in the body.
This research is supported by an SNF Sinergia grant

neurology, psychiatry, psychology
Bodily self-consciousness

Poster

NE-05

Impaired manual dexterity in Parkinson‘s disease (PD): role of premotor areas and higher-order motor control

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A controversial concept suggests that impaired manual dexterity in Parkinson’s Disease (PD), as measured by coin rotation (CR) task, may reflect an apraxic disorder as it is little responsive to dopaminergic treatment (Gebhardt et al., 2008, Quencer et al., 2007). Furthermore, CR appears to be associated with higher-order praxis function rather than with bradykinesia and rigidity, particularly in later stages of the disease (Vanbellingen et al., in preparation). Impaired fine motor control not explained by parkinsonism is thought to be caused by a dysfunction of lateral premotor (PM) areas that project temporal-spatial representations of skilled movements to appropriate targets in downstream primary motor cortex (Denes et al., 1998). Neuroimaging studies demonstrated increased activities in PM areas of patients with PD, particularly in more advanced stages (Lefaucheur, 2006), that may compensate for deficits in motor skill (Wu and Hallett, 2005). The main goals of the present study are twofold: First, to compare functional MRI activity associated with CR between right-handed patients with PD (early and more advanced stages) and age-matched controls employing a block design experiment. Second, to correlate CR-related fMRI signal in PD with praxis scores of the Test of Upper Limb Apraxia (TULIA) (Vanbellingen et al., 2010) and Unified Parkinson’s Disease Rating Scale (UPDRS). Both measurements are obtained outside the MR scanner immediately before fMRI experiments began. Patients are tested in stable ON (n = 6) or are drug naïve (n = 3), that is, never received any dopaminergic treatment. For the CR paradigm subjects are instructed to rotate a Swiss 50 Rappen coin between their thumb, index and middle finger. The task is monitored by video. Preliminary findings suggests an increased activation of ipsilateral PM (Brodmann area 6) in PD (n = 9) versus controls (n = 9) without any significant difference in CR task performance. Furthermore, in the PD patients there is a weak association of contralateral PM (area 6) activity with TULIA, which is not detectable with UPDRS. Further experiments will be needed to substantiate these findings, which point to a premotor involvement and higher-order nature of dexterous difficulties in PD. In particular, elucidation of the findings in more homogenous patient groups (naïve versus advanced) will be of interest.

neurology
Parkinsons Disease, Apraxia, fMRI

Poster

NE-06

Lesion-symptom mapping in continuous post-stroke motor skill recovery

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Background
Focal ischemic brain damage is one of the leading causes of permanent disability in adult life. However, is known from clinical experience that stroke survivors show highly indiviudal patterns of behavioral recovery, the determinants of which is still poorly understood. We asked wether the degree of concurrent damage to motor and somatosensory cortices would relate to different patterns of recovery in patients with hemiparesis, especially since somatosensory involvement might preclude successfully re-learning fine motor skills.

Methods
We measured skilled hand function using the modified Jebsen Taylor Test in 26 patients with first-ever stroke that invovled primary sensorimotor cortices longitudinally over 9 months. We modelled recovery dynamics using expoential and linear fits to the individual behavioral time courses and grouped patients according to the model that best fit their data. Individual lesions were mapped into stereotactic space using MRIcron and SPM5. We then used simple subtraction and non-parametric voxel-based lesion-symptom mapping to asses the structural correlates of the differing recovery dynamics. Probabilistic cytoarchitectonic maps were used to map the precise location of those correlates.

Results
Ten out of 26 patients showed continuous exponential recovery over 9 months, 16 a linear time course. Lesion-symptom mapping showed that the ten patients with exponential recovery had higher lesion load in cytoarcitectonic motor area 4a (67% probability of damage) and somaotsensory area 1 and 4b (60%). A cluster of lesioned voxels within the hand motor area and the underlying white matter correlated significantly ($p<0.05$) with slower recovery.

Conclusions
Focal damage to primary sensorimotor hand areas and underlying white matter results in a characteristic exponential recovery pattern.

neurology
Lesion-symptom mapping, post-stroke recovery

Poster

Neurogenetics (NG)

NG-01

Duchenne Muscular Dystrophy: Relationship between Cognitive Functioning, Gene Mutations and Metabolites in the Brain

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Objective : In contrast to the ongoing muscular degeneration, patients suffering from DMD seem to have non-progressive cognitive deficits. The reason for this divergence remains unclear, however, it has been associated with dystrophin isoforms (e.g. Dp 140) normally expressed during early brain development. The absence of Dp140 in some DMD patients probably has an influence both on cognitive functioning and on metabolites expressed in the brain.
Participants and Methods: Sixteen boys with a genetically confirmed diagnosis of DMD performed an age-scaled cognitive assessment. For each patient, we determined whether the location of the mutation on the dystrophin gene was compatible with formation of an intact Dp140 isoform. Furthermore, quantitative metabolic analysis by localized 1H-MR spectroscopy was performed in the cerebellum and the temporo-parietal area in DMD patients and healthy controls to investigate possible metabolic abnormalities.
Results : Full scale IQ was significantly higher in patients with Dp140 compared to the other patients. Nevertheless, the entire patient group still had below average IQ and a consistent choline deficit in the cerebellar white mater as well as in the temporo-parietal cortex. Remarkably, choline levels did not correlate with IQ. Furthermore, the level of other metabolites was not associated with mutations causing the formation of Dp140.
Conclusions : In contrast to cognitive performance, the metabolic brain composition did not significantly depend on whether or not gene mutations concerned the expression of the dystrophin isoform Dp140 in DMD patients' brain. Thus, the effect of the missing Dp140 isoform on cognitive performance is not mediated through the observed metabolite composition.

neurogenetics, neurology, psychology
genetic neuropsychology, cognitive functioning, magnetic resonance spectroscopy

Poster

Neuroradiology (NR)

NR-01

Is CT-Angiography a suitable Tool for the Evaluation of Cerebral Circulation in Brain Death Diagnosis?
The Bern Experience 2007-2010

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Introduction:
The determination of brain death (BD) in potential organ donors is a complex issue involving medical, ethical, and legal aspects. Legislation allows (in some special cases even requires) to perform technical exams that show cessation of cerebral circulation to shorten the time between the required two independent clinical confirmations of brain death. For a long time, the gold standard for these additional technical exams was conventional angiography. Since 2007, however, Swiss legislation also allows CT angiography (CTA) as an additional tool to establish the diagnosis of BD. We report our experience with CTA in this setting.
Material and Methods:
Between 2007 and 2010, a total of 29 patients (14 female, 15 male; age 16-89 yrs, mean 49 yrs) were examined for the determination of BD using CTA. Cause of clinical presentation was a direct trauma to the head in eight cases, primarily intracranial disease (e.g., subarachnoid or intracranial hemorrhage) in 15 cases and systemic causes in six cases. The examination protocol consisted of un-enhanced head scan, a bolus-triggered angiogram of the brain supplying vessels in the head and neck followed by a second head scan approximately 80 sec. after contrast injection. The studies were evaluated by experienced neuroradiologists according to criteria defined by a French group and accepted by the Swiss Academy of Medical Science (SAMS) [1,2].
Results:
The studies could be performed according to protocol in all patients. In 22 cases, the cessation of cerebral circulation was confirmed in the late-phase CT. In seven cases, the cessation of brain circulation could not be confirmed due to residual contrast enhancement in the relevant cerebral vessels, i.e., the M4-segments of the middle cerebral artery and/or the internal cerebral veins. In these seven cases, clinical reevaluation after at least six hours (according to the SAMS guidelines) confirmed the diagnosis of BD. Using the clinical exam as the “gold standard”, CTA achieved a sensitivity of 75.9 %.
Conclusion:
CTA is a useful additional tool for the confirmation of the diagnosis of brain death. As it can be performed fast in all institutions where a CT scanner is available, it is a feasible alternative to catheter angiography to evaluate cerebral circulation.

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neuroradiology
CT-Angiography, brain death, cerebral circulation

Poster

NR-02

Preterm born children differ from controls in the neural organization of language

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Background: Extremely preterm born children are at increased risk for cerebral abnormalities that my underlie cognitive difficulties often seen in this population. Several studies report slightly decreased cerebral volume and reduced volume in specific brain structures (i.e. corpus callosum, hippocampus, amygdala). How these structural deviations affect the cognitive processing in these children is still unclear. A previous study suggests an association between language performance and language organization in healthy children. Better Verbal-IQ is suggested to relate to stronger left-sided language lateralization in frontal language areas. The present study explores the relationship between language performance and the neural organization of language in preterm born children when compared with controls.

Methods: To investigate the relationship between word production measured outside the scanner and neural language organization during a word production task performed in the MR scanner we recruited 15 preterm born children (< 32 weeks of gestational age or below 1500g) and 15 healthy term-born controls, matched for age, gender and handedness. All children were between the ages of 7-12 years and had normal cerebral ultrasound, no severe chronic illness or medical problems and normal intelligence. Children underwent language fMRI to assess the localization and lateralization of language (word production task) and performed a word production task outside the scanner (D-KEFS; Verbal Fluency). fMRI data was preprocessed and analyzed using SPM5. A laterality index (LI) was computed for each child to describe the asymmetry of activation over the frontal brain area (left-hemisphere lateralization (+1), right-hemisphere lateralization (-1)).

Results: Preterm born children showed a positive correlation between word production and the hemispheric lateralization of language in frontal brain areas (r= .54, p= .028, controlled for age). Better word production skills of preterm born children related to more asymmetrical and hence more lateralized language organization in frontal areas. This relationship did not occur in controls (r= .25, p= .198, controlled for age). Word production performance and LI during a word production task of preterm born children did not differ from controls. In both groups (preterms and controls) 13 out of 15 children had left-sided language organization (mean LI preterms LI= .62; mean LI controls LI= .60), two children in each group had bilateral language representation.

Discussion: In preterm born children, better word production can be linked to a more lateralized neural language organization. No such association was detected in controls. Hence, preterm born children are likely to engage different neural pathways during word production than controls. Variations in the neural organization of language between preterm born children and controls may occur due to subtle structural differences of certain brain regions or may reflect different cognitive strategies used to perform the task.

neuroradiology
children born preterm, language organization, functional magnetic resonance imaging

Poster

NR-03

Mapping resting-state functional connectivity of cytoarchitectonic areas using multivariate correlation analysis

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Background:
Studies of the human brain using resting-state functional magnetic imaging (rsfMRI) have shown consistent resting state networks (RSNs), i.e. spatio-temporal patterns of functionally connected (FC) brain areas. Most RSNs have been defined either based on major anatomical landmarks or using voxel-based multivariate techniques and assigning anatomical meaning a posteriori. Recent evidence suggests that defining areas based on their cytoarchitecture may provide a better characterization of task-related FC [1], but this approach has not yet been applied to human RSNs. As a proof of principle, we acquired rsfMRI and applied a recently developed multivariate technique to cluster the FC of cytoarchitectonic areas in the resting human brain.

Methods:
We acquired rsfMRI in two male subjects using standard blood-oxygenation level dependent (BOLD) contrast. We extracted the mean time-series of 98 regions of interest (ROIs, 49 per hemisphere) using the freely-available probabilistic cytoarchitectonic atlas [2] and bandpass filtered in $0.009Hz<f<0.08Hz$. As linear and nonlinear FC measures, equal-time cross-correlation and mutual information were used. The null hypothesis of random FC was sampled using ensembles of surrogates of the ROI time series [3]. The resulting FC matrices were subjected to a clustering algorithm that is appropriate for separating strongly interrelated groups [4].

Results:
We found resting-state FC clusters that were consistent between subjects and mostly symmetric across hemispheres. They included bilaterally (I) the primary sensorimotor and premotor cortices (II) secondary somatosensory cortices (III) visual cortices (IV) auditory cortices and insula (V) hippocampus and amygdala (VI) lateral inferior parietal cortices and (VII) superior parietal cortices. Language related areas were only found to cluster asymmetrically in one subject, and the other lacked a superior parietal cluster. A number of areas, notably lateral occipital visual areas, did not show any significant FC using our method.

Conclusions:
Cytoarchitectonic areas not only share common histological features, but also homologous resting-state FC patterns. These patterns correspond to known RSN (e.g. cluster I, III), but there are also additional RSN in subcortical structures (e.g. cluster V) and parietal cortices (VI). The lack of lateral occipital FC might be due to the closed-eyes condition. Differences to known RSN derive from the fact that current cytoarchitectonic maps do not cover the entire brain. Further improvements of this preliminary work will include group-analysis in a larger sample and comparison with epilepsy patients.

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neuroradiology
resting state functional magnetic resonance imaging

Poster

NR-04

Dynamic Arterial Spin Labeling Technique (mTI-GRASE-ASL): Clinical Applicability

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A special arterial spin labeling technique is presented, that enables the acquisition of perfusion weighted signal at multiple delay times (TI) in one scan. The single-shot 3D readout part is a gradient and spin-echo combination (GRASE) that uses switched gradient rephrasing of signals to produce several times as many signals as TSE, which translates into faster imaging time and higher SNR per imaging time. One of the major issues in quantitative perfusion measurements using ASL, which might result in inaccurate perfusion values, is the contamination of the microvascular perfusion with different arrival times for the labeled blood in different regions. In order to overcome this problem, the TI was varied in 14 steps of 200ms, between 200ms and 2800ms. In this way a difference signal between the control and labeling is available at 14 time steps and for each voxel. This hemodynamic curve can be further evaluated in the context of sophisticated physical models suitable for the quantification of cerebral perfusion (CBF) maps.
As a case example, the mTI-GRASE-ASL was applied to a patient with Moya-Moya with bilateral carotid artery stenoses and narrowing of the V4-segment of the left vertebral artery. The patient already suffered an infarct in the vascular territory of the right middle cerebral artery. GRASE-ASL measurement time 6min, 26 slices, 4.7mm in-slice resolution. The difference maps reveal various phases of cerebral perfusion. Angiography-like images can be calculated from the perfusion difference images dataset as well.

(SPUM Consortium (33CM30-124114)

methodology, neuroradiology
Dynamic Arterial Spin Labeling Technique - GRASE

Poster

NR-05

Feasibility of Tableside Flat Panel Parenchymal Blood Volume Measurement in Neurovascular Interventions: Preliminary Experience

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Background:
Cerebral blood volume is an important perfusion parameter in estimating the viability of brain parenchyma, e.g. in cases of ischemic stroke. Recent technological advances allow parenchymal blood volume (PBV) imaging in the angiography suite just before, during or after an interventional procedure. The aim of this work is to share our preliminary clinical experience in different neurovascular interventions.

Methods:
Flat panel CT PBV measurement was performed on a biplane flat detector angiographic system (Axiom Artis Zee, Siemens, Erlangen, Germany). Fifteen patients (10 women, 5 men) were examined; age range 40-86 (median 61.5) years. Presenting symptoms included: acute stroke or stroke-like symptoms in 7 patients, subacute stroke in 3 patients, headache and nausea in 5 patients. In the 10 stroke patients an arterial stenosis or occlusion was confirmed. The remaining 5 patients suffered an intracranial hemorrhage, 3 of them suffered a subarachnoid hemorrhage due to aneurysmal rupture.

Results:
In the 15 cases studied, 18 PBV measurements were performed. 14 acquisitions were of good diagnostic quality. The remaining 4 acquisitions failed technically (one due to motion artifacts, one due to selective intra-arterial contrast agent injection and the other two due to injection technique and/or hardware failure). In an acute stroke case with occlusion of the left internal carotid artery treated by endovascular recanalization techniques, the pre-interventional PBV acquisition depicted the hypoperfusion on the left side, which normalized after successful intervention.

Conclusion:
Flat-panel PBV measurement in the angiography suite provides an attractive and feasible tool for peri-interventional neuroimaging. The technique suffers some technical limitations and potential errors, which should be optimized in the recent future.

neuroradiology
Flat Panel - Angiography - Parenchymal Blood Volume Measurement

Poster

NR-06

Interictal epileptic networks assessed by simultaneous EEG/fMRI - Differences in mesio- and laterotemporal lobe epilepsies

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Background: Laterotemporal epilepsy (LTLE) and mesiotemporal epilepsy (MTLE) differ in ictal semiology reflecting different ictal propagation pattern. In MTLE ictal pathways have been assessed by SPECT (1) and the underlying networks shown structural abnormalities (2). Recent studies of simultaneous EEG/fMRI in the seizure free period have reported concordance between the interictal epileptic network and ictal electroclinical data. We present a group analysis of BOLD correlates to interictal epileptic discharges (IEDs) in LTLE vs MTLE and aim to correlate the different pattern of interictal epileptic activity to ictal and anatomical changes.

Methods : We examined 20 patients (10 MTLE/10 LTLE) with ICA-based EEG/fMRI. All patients received EEG (8 minutes) outside, and simultaneous EEG/fMRI (16 minutes) inside the scanner using a single-shot T2*-weighted sequence (EPI, TR/TE 4130ms/30ms or TR/TE 1980ms/30ms). ICA was applied to the EEG to extract epileptic activity as predictor for the BOLD signal in the correlation analysis. The functional data were coregistered and normalised in Talairach space. Data sets of patients with left hemispheric seizure onset zone were flipped. Correlation estimation was done at a threshold $p<0.05$ corrected for multiple comparisons (false discovery rate). Two patients of both groups did not display significant BOLD correlates. A overlay map was generated for the MTLE and LTLE group with a minimum cluster size of 4 functional voxels. (Brainvoyager 1.10.2R)

Results:
The MTLE group showed a overlay of BOLD correlates within the seizure onset zone in the mesiotemporal lobe (MTL) in 67%, but < 20% in the controlateral MTL. Regions in the overlay map > 50% comprised ipsilateral insular/operculum (78%), pericentral region (78%), and a bilateral cluster in the middle cingulate gyrus (78%) as well as a widespread cluster in the mesial parieto-occipital region (67%). Controlaterally, insular (67%) and pericentral (56%) regions showed a overlay with a smaller spatial extent.
In the LTLE group the seizure onset zone is not as homogeneous as in MTLE. The observed overlay of BOLD cluster thus may exclusively correspond to region involved in a common distant epileptic network. All regions on the overlay map > 50% of patients were localized in the hemisphere of the seizure onset zone.(temporopolar (56%), insular/operculum (56%) and parietal regions (56%)). The overlay in the LTLE group covers less brain tissue reflecting the high variablitity of propagation pathways.

Conclusion:
We have detected group effects of brain areas commonly involved into interictal networks in MTLE and LTLE that reflect ictal propagation pathways of the underlying epilepsy syndrome. The findings are supported by recent studies that disclosed anatomical anomalies in corresponding brain areas. Regions differentiating MTLE from LTLE were mainly confined to the limbic system (MTL and cingulate gyrus). EEG/fMRI measurements provide, beyond the correlation of interictal BOLD correlates with the putative seizure onset zone, information about brain areas involved in the interictal networks.

[Swiss National Science Foundation: SPUM Consortium (33CM30-124089)]

methodology, neurology, neuroradiology

Poster

Neurosurgery (NS)

NS-01

Nogo-A and NgR1 expression in the adult rat nigro-striatal system.

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The myelin associated protein Nogo-A and the cognate receptor NgR1 are among the most potent growth inhibitors of the adult CNS. Nogo-A is mostly expressed on the surface of oligodendrocytes but its presence also in neurons of the adult CNS suggests that Nogo-A bears other functions beyond the inhibition of axonal regeneration and plasticity. Despite Nogo-A and NgR1 have been described in large neurons in the striatum and some DAergic neurons in the substantia nigra (SN), at present, only little is known about the distinct expression of Nogo-A and NgR1 in the nigro-striatal system, a brain structure severely affected in Parkinson's disease (PD). Given the crucial importance of the identification of subpopulations of dopaminergic neurons for future therapies, the present study aimed at investigating the distribution pattern of both Nogo-A and NgR1 in the nigro-striatal system. For that purpose adult female Wistar rats were perfusion fixed and the brain processed for immunohistological analyzes.
Nogo-A immunoreactive (-ir) cells were predominantly distributed in the substantia nigra pars compacta (SNc) and in the ventral tegmental area. Notably and in accordance with previous in situ hybridization studies, cells with intense immunoreactivity were detected in the nucleus rubber. Double-immunofluorescence staining disclosed that in the SN a substantial number of tyrosine hydroxylase (TH)-ir neurons also expressed Nogo-A. In the striatum small sized and large sized Nogo-A positive cells were detected. While no colocalization was observed for Nogo-A and DARPP-32 the subpopulation of large cells also expressed the cholinergic marker ChAT. NgR1 was abundantly expressed throughout the rat midbrain and striatum. In particular, a high density of NgR1-ir cells was observed in the SNc. Similarly to the observation made for Nogo-A, double labeling experiments showed colocalization of NgR1 and TH in subpopulations of cells of the SNc, whereas only few NgR1-ir cells were detected in the SN pars reticularis. The absence of colocalization with the astroglial marker GFAP showed that NgR1 was not expressed in astrocytes.
In sum, the expression of Nogo-A and NgR1 in brain regions involved in the pathology of PD suggests that these two molecules may play a substantial role in this still not curable disease.

neurosurgery
Neurite outgrowth inhibitors, Parkinson's disease, histology

Poster

Psychiatry (PA)

PA-01

Thought disorder: A left lateralised breakdown of the language network

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Background: Indented component analysis (ICA), a new approach to fMRI analysis, will be used to examine changes of the language network separate for each hemisphere in relation to the severity of formal thought disorder (FTD) in schizophrenic patients.
Material and Methods: We investigated 16 schizophrenic patients with different severity of FTD and matched healthy controls using ICA decomposition of the BOLD signal. The spatial similarity of the individual language networks was correlated to the severity of FTD.
Results: The integrity of the left language network decrease with increasing severity of FTD ($r = -0.79$, $p < 0.01$), while the integrity of the right language network show no significant correlation to the severity of FTD.
Discussion: For the first time the isolated breakdown of the left sided language network was linked specifically to schizophrenic FTD. This result unites older manly left hemispheric findings of structural and functional abnormalities in schizophrenic FTD.

psychiatry
Schizophrenia; Task positive networks; fMRI

Poster

PA-02

Mild upper limb apraxia in schizophrenia – preliminary data

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Introduction: Schizophrenia patients suffer from disturbances of thought, motor coordination and affect. Neurobiology established dysfunction of frontotemporal networks as main underlying problem. Here, we use a standardized test to investigate, whether schizophrenia patients also suffer from upper limb apraxia.
Method: In total, 6 right handed patients with schizophrenia (5 male) were assessed with the Test of Upper Limb Apraxia (TULIA) as well as clinical rating scales including PANSS, Modified Rogers Scale, UPDRS (motor part III), MMSE and Frontal Assessment Battery. In the TULIA test, patients were requested to perform 48 gestures in two main domains: imitation (on seen gesture) and pantomime (on verbal command). Performance was monitored by video and ratings were done blinded. Preliminary explorative analyses were performed using Wilcoxon's rank test and Spearman rank correlations.
Results: One patient demonstrated bilateral, two patients unilateral mild apraxia. Therefore, apraxia was seen in 50% of the sample. Impaired pantomime appears to mainly account for apraxic deficits, which are not explained by extrapyramidal motor symptoms as corresponding measures (TULIA total scores and UPDRS III) correlated inversely (more apraxia, less extrapyramidal). In addition, left TULIA was inversely correlated with the PANSS positive subscore, indicating that patients suffering from severe positive symptoms are more likely to perform poorly in the left TULIA. Other clinical scales and medication did not influence performance in this small group.
Discussion: Mild apraxia seems to be prevalent in schizophrenia and related mainly to the pantomime deficit. Furthermore, the magnitude of positive symptoms is associated with apraxia on the left. The finding is in line with the well established frontal dysconnectivity in schizophrenia. However, the small sample size limits further speculations. The study will be continued.

psychiatry
Schizophrenia, apraxia

Poster

PA-03

Altered fibre tract course within the motor system in schizophrenia

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BACKGROUND:
Motor symptoms are frequent in patients with schizophrenia. Although recent DTI-studies point to white matter alterations of the motor system in patients with schizophrenia, little is known about specific changes such as alterations of the course of fibre tracts connecting key regions of the motor system. Furthermore, there is a lack of approaches with hypothesis driven quantification of specific anatomical fibre tracts. Therefore, we aimed to compare structural connectivity between specific parts of the motor system such as the dorsolateral prefrontal cortex (dlPFC), the pre-supplementary motor area (SMA), the SMA-proper the primary motor cortex (M1), the thalamus and the putamen in patients with schizophrenia and in healthy controls in a DTI-fibre-tracking study.

METHODS:
DTI-data (42 DE directions, 4 B0 images, b-value = 1300mm/s2) and T1-weighted MPRAGE were measured in 11 patients (5 men, 6 women) with schizophrenia and in 11 healthy controls (6 men, 5 women) using a 3 Tesla Siemens Scanner. ROIs have been determined using the WFU Pick Atlas implemented in SPM8 and have been transferred into the native space of each single subject. Applying a probabilistic fibre tracking approach (Kreher et al., 2008) the most probable anatomical pathways between the above mentioned key regions of the motor system of each participant have been identified. The resulting probabilistic maps were normalized to obtain values between 0 and 1, spatially normalized into the standard MNI-space and smoothed using an isotropic 3-mm Gaussian kernel. In order to compare the structural connectivity between controls and patients probability maps were compared in SPM8 using two-sample-t-tests and a voxel-level significance threshold of p <0,05, uncorrected for multiple comparisons.

RESULTS:
Our results point to alterations of the course of fibre tracts in patients with schizophrenia.

DISCUSSION
We found higher probabilistic indices of the patients in distinct localisations of the left pyramidal tract connecting key regions of the motor system such as the primary motor cortex with the thalamus or the putamen. Lower probabilitic indices are found in more dorsal areas being involved in planning and execution of movements. Clinically this might be related to the extent of catatonic symptoms. Future studies with larger samples and more rigorous statistical thresholds are required to confirm our findings. It would be interesting to relate our findings to objective measures of motor activity such as actigraphy (Walther et al.,2010) and to examine if changes of probability maps are reflected with changes of commonly used measures of white matter integrity such as fractional anisotropy or mean diffusion values.

psychiatry
DTI

Poster / Talk

PA-04

Abnormal Gamma-band Synchronization during auditory driving in schizophrenic patients suffering from auditory verbal hallucinations

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We tested brain responsiveness to auditory stimulation in healthy controls (n = 26), and in schizophrenic patients that frequently (n = 18) or never (n = 11) experienced auditory verbal hallucinations (AVH). Responsiveness was assessed by driving the EEG with click-tones at 20, 30 and 40 Hz. We compared stimulus induced EEG changes between groups based on spectral amplitude maps and using a global measure of phase-locking (GFS) among electrodes. As expected, the 40 Hz stimulation elicited the strongest changes, however, while controls and non-hallucinators increased 40Hz EEG activity during stimulation, a left-lateralized decrease was observed in the hallucinators. These differences were significant (p=.024, randomization statistics). As expected, GFS increased during stimulation in the controls (t=1.8 p=.08) and non-hallucinating patients (t=2.05, p=.06), which was significant when the two groups were combined (t=2.6, p=.01). In contrast, GFS decreased with stimulation in hallucinating patients (t=-1.57, p =0.13), resulting in a significant GFS reactivity difference between subjects with and without AVH (t=2.9, p<.01). Our data suggests that while the 40 Hz stimulation normally leads to the activation of a synchronized network representing the sensory input, in hallucinating patients, the stimuli partly disrupt ongoing activity in these networks. This ongoing activity may be the source of the hallucinations.

neurobiology, physiology, psychiatry
Auditory hallucinations, schizophrenia, Gamma-band, auditory driving

Poster

PA-05

Altered electrophysiology of semantic word processing in Alzheimer's disease and Semantic Dementia

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With the progressing course of Alzheimer's disease (AD), deficits in declarative memory increasingly restrict the patients' daily activities. Besides episodic (biographical) memory impairments, semantic (factual) memory is affected by this neurodegenerative disorder. With the aim to establish sensitive biological markers for the differentiation of symptom dimensions in dementia sub-types, the present study compared AD patients with healthy controls and Semantic Dementia (SD) patients, a dementia subgroup that shows isolated semantic memory impairments. Automatic and controlled semantic memory retrieval was investigated by combining the recording of event related potentials (ERP) with the performance of a semantic priming task. Precisely, the task demanded lexical (word/nonword) decisions on sequentially presented word pairs, consisting of semantically related or unrelated prime-target combinations. Additionally, the separation of concrete and abstract word material allowed distinct investigation of the semantic memory structure. A non-parametric randomization test on EEG scalp-topographies within the experimental conditions and subject groups was conducted following word onset. The results indicate that the automatic semantic word retrieval (timing post word onset) is altered both in AD and SD patients whereas the controlled semantic word retrieval seems to be affected mainly in the SD group. This could reflect that the semantic database itself is likely to remain preserved in AD, while SD patients presumably suffer from the actual loss of semantic representations. Furthermore, the later the processing stage in semantic word processing, the more the topographies diverge in terms of concreteness between the groups.

psychiatry, psychology
Alzheimer's disease, electrical neuroimaging, priming, semantic dementia, semantic memory

Poster

PA-06

Pathology of Eye and Head Coordination in Schizophrenia

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Previous findings in eye movement research found limited scanpaths and fewer fixations in schizophrenia patients. In such eye movement studies, the head is generally fixed to improve reliability of gaze position. However, in everyday situations, the eyes and the head move simultaneously to catch visual targets. Therefore, we use combined eye and head tracking to investigate attentional and motor dysfunctions in schizophrenia patients and normal volunteers. Eye movements were recorded by video-based pupil oculography and head movements using magnetic coils, which permits free head movements during the task. To initiate eye and head movements, we used a peripheral visual recognition task with a 55 deg. target offset. In the data analysis, parameters of the eye-head signal (e.g. head amplitudes, eye amplitudes, start of the head, start of the eye) were evaluated concerning their potential to be valid pathological markers.

psychiatry
Schizophrenia, Eye Movements, Eye and Head Coordination

Poster

PA-07

Preliminary results from combined EEG/fMRI in schizophrenia patients measured during Resting-State

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It is hypothesized that a communication failure in the distributed brain networks of schizophrenia patients (SZ) leads to some of the behavioural and cognitive symptoms. Moreover, it is suggested that this altered communication pattern is already present during resting state. Using combined EEG/fMRI during rest we aimed for an integrated analysis of fMRI BOLD Resting-State Networks (RSNs) and their associated EEG characteristics. The preliminary results focus on two RSNs: the default mode network (DMN) and the left-working memory network (LWMN). The RSN dynamics of these two networks have been associated with the spatial distribution of EEG spectral fluctuations using EEG covariance mapping.1 A t-test compared the findings of the 11 SZ with 20 healthy controls (CG).2 Generally, SZ had a higher intersubject-variability in DMN and LWMN activity and their associated EEG signatures. Moreover, a shift of the relation between functional network and frequency band from alpha1 in CG to theta2 in SZ was observed for both, DMN and LWMN. Our results suggest that the slowing of EEG in SZ is related to changes in underlying well known functional networks.
1 Koenig et al. Clin Neurophysiol 2008, 119:1262-1270
2 Jann et al. 2010 PLoS ONE, 5:e12945

neurobiology, psychiatry
Schizophrenia, EEG, fMRI, Resting-State Network

Poster

Physiology (PH)

PH-01

Investigating Transcranial Magnetic Stimulation (TMS) effects using Arterial Spin Labeling (ASL)

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Transcranial magnetic stimulation (TMS) has been shown to transiently alter neural activity which can be measured in terms of behavioral changes (i.e. increased reaction time). In the present pilot study we aimed at investigating TMS effects on the level of metabolic response. For this purpose, we used TMS in combination with arterial spin labelling (ASL) in order to address the question of whether TMS stimulation has an effect on cerebral blood flow (CBF).
Two healthy subjects were stimulated using a theta burst TMS protocol over the left motor cortex at an intensity of 80% of the subjects' motor threshold. ASL was performed before (pre TMS) and immediately after the application of TMS (post TMS). During the ASL run, the subjects performed a block design task with alternating bimanual sequential finger-tapping and resting state control conditions.
The pre TMS ASL revealed bilaterally increased CBF in the precentral gyrus (precG), i.e. motor cortex during finger tapping. Post TMS the CBF signal was significantly reduced in the precG of both hemispheres over the whole time course of the ASL run. In the left (stimulated) precG we observed a CBF signal reduction of 33.7%, whereas in the right precG, which was not directly affected by TMS stimulation, the CBF signal was attenuated by 41.7%.
In contrast, the whole brain CBF values increased post TMS (64.3ml/100g/min) as compared to pre TMS (59.8ml/100g/min). In order to exclude that the inter-session variations are the source for these differences, in one subjects resting state ASL was measured on an additional occasion several weeks after TMS treatment. The inter-session variation of the whole brain resting state CBF signal between the three (pre TMS, post TMS, several weeks after TMS) ranged from +3.3% to -5.5%, which is within the range of normal physiologic CBF fluctuations. Thus, the regional reduction of the CBF signal after TMS may indicate that it is possible to detect and to map TMS-induced behavioral effects using ASL. As the CBF signal shows only slight variation on the different ASL testing occasions, the significant regional CBF changes in the precG are attributed to TMS effects.

physiology
TMS, Arterial Spin Labeling

Poster

PH-02

The phobic brain: White matter tracts in patients with spider phobia

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Spider phobia is characterized by excessive and unreasonable fear and avoidance-behaviour when exposed to a phobic stimulus. Fear acts as a pivotal signal in terms of threat and danger. The amygdala is assumed to be involved in the rapid detection of basic emotional properties of incoming stimuli, while the prefrontal cortex is assumed to be involved in higher order emotional evaluation processes. Connections between the amygdala and the prefrontal cortex are known to modulate the amygdala's response to threat. Previous research suggests that visually elicited phobic reactions deactivate prefrontal areas involved in cognitive control over emotion-triggering areas like the amygdala. The fear mechanisms in specific phobias could thus be explained by microstructural abnormalities in white matter integrity and may contribute to the understanding of the occurrence of irrational anxiety symptoms. Diffusion tensor imaging (DTI) is an important tool for characterizing in vivo the anisotropic fiber structure within somatic tissues. A DTI sequence was used to acquire images in 30 patients with spider phobia and 30 matched healthy control subjects. Results: Preliminary data will be presented. Conclusion: The goal of this study is to investigate brain white matter abnormalities using diffusion tensor imaging (DTI) in patients with spider phobia.

physiology
white matter integrity, Amygdala, prefrontal Cortex Spider phobia

Poster

PH-03

Habituation in arousal in listening to Beethoven's 5th symphony

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Introduction: It was already an ancient idea that music is capable of inducing emotions. Defining emotions in a two dimensional way with arousal and valence, arousal may be measured with the surrogate marker of peripheral reactions. There is sound evidence that music is capable to evoke the vegetative nervous system. An impact of music on autonomic functions like heart rate and its variance, skin conductance, respiration rate, blood pressure and muscle tension was shown. Many studies tried to elicit one specific emotion by connecting it to a certain piece of music. But according to E. Namour it is impossible to connect one piece of music to a specific emotion. It is not one stable emotion but a kaleidoscopic pattern of arousal depending on a certain music structure. It was the target of this study to explore the specific arousal pattern of the 5th Symphony of Ludwig van Beethoven (LvB) and its stability over time. Material and Procedure: The participants were asked to listen to the 1st movement of LvBs 5th Symphony two times within the time space of 48 to 72h. While listening they were asked to rate their arousal level. The arousal was measured by a +/- 10 scale. Statistical method: 13 segments were picked out according to the implication-realization theory by E. Namour, where a change in arousal is expected. The segments length was between 10 and 15 seconds. Results: A good correlation between the two ratings was found in every of the 13 segments. Conclusions: There was a good accordance in arousal level of the participants, independently of their knowledge or liking of the piece. There was no habituation in arousal level.

physiology
Music neuroscience

Poster

PH-04

Beethoven’s 5th symphony induces emotions

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Introduction: Music is a unique human construct that may elicit pleasure by co-opting ancient neural systems via inputs from neocortex. But the electrophysiological correlates are yet poorly understood. Many studies proofed that music is capable to elicit an arousal. The present study examined EEG power spectra for different levels of arousal. Furthermore it was tried to explain the appearance of arousal via a harmonic analysis of the score. Methods: 10 Participants were asked to listen to the 1st movement of Ludwig van Beethoven’s 5th symphony (duration 442 seconds). A 76 channel Nihon Koden EEG was used. In a second session they were asked to evaluate their arousal during the listening. Using Vision Analyzer for data processing a FFT has performed and covariance spectral maps were computed in association with the subjective arousal ratings. Results: Covariance maps showed a right frontal suppression of lower alpha-band activity during high arousal, which is compatible with a negative-withdrawal-related brain-state (Davidson, 1995). Conclusions: Music induces consistent neurophysiological changes that can be closely linked to emotional states. Those changes may be well explained by the score.

physiology
EEG Music

Poster

Psychology (PO)

PO-01

Vestibular induced facilitation of egocentric mental transformation

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The brain encodes bodily reference frames via multisensory integration. One primary component of this integration is vestibular information. The vestibular system encodes the spatial trajectories of the head in space, and consequently the coordinates and composition of the entire body. Vestibular encoded reference frames are used to form on and off-line body representations, or schemas. Body schemas are also a key component in accomplishing egocentric mental transformations: the mental transformation of our own bodily reference frames. In this study we investigated whether a bottom-up influence of vestibular stimulation would modulate the ability to perform egocentric mental transformations. Participants performed egocentric and allocentric mental transformations during caloric vestibular stimulation, which specifically activates the semi-circular canals. Their task was to perform lateralization judgments during corresponding mental rotation tasks. Performance of the egocentric mental transformation of body stimuli was facilitated during vestibular stimulation. Thus, participants were significantly faster to make correct spatial judgments during vestibular stimulation as compared to sham stimulation. We propose that the facilitation reflects the greater accessibility to body schema. Vestibular stimulation causes bodily reference frames to be continually updated, which would place body schema at the fore front of neural and cognitive processing, and thus make them more accessible. These findings support previous clinical studies whereby patients had an altered or corrected body schema as a result of vestibular stimulation. The vestibular stimulation used in this study evokes vestibular signals that mimic physical rightward rotations. Our results also revealed an additional facilitation during rightward mental rotations. This enhanced mental rotation performance could reflect congruent direction information processing from “bottom-up “vestibular signals and “top-down” mental imagery processes. Ultimately our results highlight the significant role of vestibular signals in body schema processing and other higher order cognitive processes, such as mental imagery.

This research is supported by the Swiss National Science Foundation (SINERGIA CRSII1-125135/1)

psychology
Vestibular System, Mental Rotation, Body Schema, Spatial Cognition

Poster / Talk

PO-02

Parieto-occipital suppression eliminates implicit bidirectionality in grapheme-colour synaesthesia

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Synaesthesia is a condition in which the input of one sensory modality triggers extraordinary additional experiences. On an explicit level, subjects affected by this condition normally report unidirectional experiences. In grapheme-colour synaesthesia for example, the letter A printed in black may trigger a red colour experience but not vice versa. However on an implicit level, at least for some types of synaesthesia, bidirectional activation is possible. In this study we tested whether bidirectional implicit activation is mediated by the same brain areas as explicit synaesthetic experiences. Specifically, we demonstrated suppression of implicit bidirectional activation with the application of transcranial magnetic stimulation over parieto-occipital brain areas. Our findings indicate that parieto-occipital regions are not only involved in explicit but also implicit synaesthetic binding.

Rothen, N., Nyffeler, T., von Wartburg, R., Müri, R., & Meier, B. (2010). Parieto-occipital suppression eliminates implicit bidirectionality in grapheme-colour synaesthesia. *Neuropsychologia, 48*, 3482-3487. doi:10.1016/j.neuropsychologia.2010.07.032

psychology
synaesthesia, transcranial magnetic stimulation, disruption, bidirectionality

Poster / Talk

PO-03

Language switching costs in bilingual mathematics learning

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Research in bilingual speakers has revealed that the language in which knowledge is acquired affects how easily it is accessible and can be applied to solve problems. Language switching costs in terms of longer response latencies emerge when the language of application differs from the language of learning.
This holds particularly true for arithmetic facts which are assumed to be stored verbally in long-term memory. However, little is known about the source of the language switching costs. They may arise either from the retrieval of the arithmetic fact in the language of training and subsequent translation into the language of application or from the need for additional number processing and calculation.
In this fMRI study, we investigated the neural correlates of language switching costs in complex arithmetic problems. In particular, this study should provide insights into the origins of these cognitive costs.

psychology
Numerical cognition bilingualism learning

Poster

PO-04

Training Synaesthesia

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Grapheme-colour synaesthesia denotes the psychological phenomenon in which digits and/or letters involuntarily evoke a sensation of colour. Automaticity of these sensations is conventionally demonstrated with the synaesthetic Stroop test in which coloured letters are presented and participants have to name the colour of each letter. Some letters are in a colour congruent to the synaesthetic experience (e.g., a red “A” when the synaesthetic colour for “A” is red) and some are incongruent (e.g., a green “A”when the synaesthetic colour for “A” is red). Many studies have demonstrated that synaesthetes are slower in the incongruent compared to the congruent condition. These results may indicate that the synaesthetic Stroop test can be used as a diagnostic marker to identify true synaesthetes. However, recently it was demonstrated that also non-synaesthetes with trained letter-colour associations are able to show a “synaesthetic” Stroop effect in a colour naming paradigm. The present study was designed to replicate and extend these findings. Forty non-synaesthete participants were trained on 10 consecutive days with either the previously used non-adaptive or a new adaptive digit-colour training. Pre- to post-training changes were tested with a conventional Stroop task (colour naming) and a modified Stroop task (digit naming). The results showed a conventional Stroop effect for both types of training. However, in the modified Stroop task interference was solely found for adaptively trained subjects. We conclude that the propagation of interference caused by grapheme-colour associations in trained non-synaesthetes depends on the type of training.

psychology
synaesthesia, non-synaesthetes, training, Stroop

Poster

PO-05

Sex Hormones and the Perception of Infant Faces

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Interactions between a mother or father and a newborn are probably the most elementary of all human interactions. Given this high biological and psychological relevance, the scarcity of work on perception of infant faces is surprising. In a series of studies we investigated emotive responses to infant faces. We compared the sensitivity to computer-manipulated baby faces varying in cuteness of young females during ovulation and during the luteal phase of their menstrual cycle. In a two alternative forced choice experiment participants had to choose the baby which they thought was cuter. During ovulation, females were more sensitive to variations in cuteness. These results suggest an existence of a hormone-modulated visual system for perceiving cuteness, which works highly efficiently in women of childbearing age. In a second experiment with the same stimulus material participants were asked to choose the younger infant. Here we found no phase modulated differences. In a third Experiment we asked participants to choose the baby which they would prefer to babysit. Again there was no phase difference. Different accuracy in cuteness ratings indicates that the sex differences found in previous studies may be driven by hormones (estrogen and prolactin) which are higher in pre-menopausal women than men and which are higher during ovulation than in the luteal phase. Given that cuteness is considered an indicator of being helpless and in need of care, we hypothesize that the ability to detect small variations in the degree of cuteness has evolved to maximize care. We speculate that hormonal influence of this sensitivity has evolved for post-partum care (when prolactin levels are raised). Our new findings help interpret the hormone basis of parental care.

neurobiology, psychology, other
Sex hormones, perception of infant faces

Poster

PO-06

The effects of personality on working memory training outcome

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Based on the growing body of research investigating the relationship between personality traits and cognitive performance, we aimed to determine whether and how individual differences in personality mediate cognitive training outcomes.
In this contribution a study will be presented where we trained university students in two groups during four weeks with either a single or a dual n-back task. We first assessed the Big Five personality traits, and as outcome measures, we assessed performance in two working memory (WM) and two matrix reasoning tasks as a proxy for fluid intelligence (Gf). Generally, both training groups improved performance in Gf to a comparable extent. However, our results indicated that the single n-back training was more effective for participants scoring high on neuroticism, whereas the dual n-back training was more effective for participants scoring low on neuroticism. This interaction is discussed in terms of arousal and resource models. Furthermore, conscientiousness and agreeableness were associated with better single n-back training performance; however, there were only small transfer effects on Gf, which is explained by their task-specific training because of developed strategies. Additionally, associations between post-training questionnaires, such as enjoyment of the training, self-esteem, need for cognition, and the belief that intelligence is modifiable, are shortly discussed.
We conclude by suggesting that future studies should consider individual differences in personality in order to improve the effectiveness of cognitive training.

psychology
Personality and working memory training

Poster

PO-07

Impact of dorsolateral prefrontal lesions on the bivalency effect

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In healthy subjects, a slowing occurs on univalent stimuli when bivalent stimuli (e.g., Stroop-like stimuli) appear occasionally among them – a phenomenon labeled the "bivalency effect". The purpose of the present study was to investigate whether this effect would still occur in patients with dorsolateral prefrontal lesions. The dorsolateral prefrontal cortex (DLPFC) is involved in the regulation of cognitive control and it is assumed that the bivalency effect stems from an adjustment of cognitive control. We tested 10 patients with DLPFC lesions and a matched healthy control group. We used a paradigm requiring predictable alternations between three simple tasks, with bivalent stimuli occasionally occurring on one of these tasks. The results showed a bivalency effect in the control group, but not in patients with DLPFC lesions. They provide evidence for the involvement of the DLPFC in the adjustment of cognitive control responsible for the bivalency effect.

psychology
cognitive control, task switching, dorsolateral prefrontal cortex, bivalent stimuli, univalent stimuli

Poster

PO-08

Dissociation between Inhibition and Working Memory in Children Born Extremely Preterm

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Background: Children born extremely preterm (< 32 weeks of gestation, < 1500 g) face a high risk for executive function difficulties, such as impairments in inhibition and working memory (WM). Both inhibition and WM are assumed to be core concepts of executive functions. Inhibition is the ability to suppress an unwanted or an inappropriate thought or action. WM consists of two domain-specific systems, the phonological loop for acoustic information and the visuo-spatial sketchpad for visual and spatial information. The two systems are controlled by a central supervisory system called the central executive. It has been suggested that inhibition and WM are closely linked and have overlapping neural pathways. Greater WM capacity usually goes along with better inhibition skills. Roberts and Pennington propose that WM is a precondition for inhibitory control, whereas others assume that WM performance depends on adequate inhibitory control. Still, the nature of the relationship between both concepts is unclear.

Methods: To investigate the relationship between inhibition and WM in children born preterm versus term-born controls, we recruited 23 children born at less than 32 weeks of gestational age or below 1500 g (13 girls, 10 boys, mean age: 9.1 years) and 37 healthy term-born controls (22 girls, 15 boys, mean age: 9.3 years). All children were between the age of 7-12 years and had normal cerebral ultrasound, no severe chronic illness or medical problems and normal intelligence. Children underwent a neuropsychological assessment. Inhibition was measured by a Go/Nogo task and two interference control tasks, WM was quantified by digit span (WISC-IV).

Results: Children born preterm did not differ from controls in inhibition ($t = 0.56$, $p = .560$; $t = 0.72$, $p = .727$; $t = 0.81$, $p = .811$) and WM performance ($t = 0.96$, $p = .342$). In controls, inhibition and WM performance correlated significantly ($r = .39$, $p < 0.01$) or by trend ($r = .24$ and $r = -.25$, $p < 0.08$). In children born preterm there was no correlation between inhibition and WM ($r = .16$, $r = .04$ and $r = -.08$, n.s.). In controls, higher WM span was associated with better inhibition performance (i.e. fewer commission errors), whereas in children born preterm no such association was detected.

Discussion: Results indicate a relationship between inhibition and WM in healthy controls. However, in children born preterm, WM and inhibition can be two separable functions. Hence, the present data reflects a possible dissociation between inhibition and WM. In conclusion, children born preterm might have a different organization and interplay between brain functions than term-born controls.

psychology
Children born preterm, neuropsychology, inhibition, working memory

Poster

PO-09

Working Memory Training Improves Working Memory and Reasoning in Old Age

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Cognitive impairments in the elderly, especially memory problems, are prominent targets in a variety of intervention programs. The available results indicate that even in old-old adults brain plasticity is strong enough for effective learning and strategy-dependent increase in cognitive performance. Recently, working memory has become a prominent candidate for training because positive transfer to a broad area of non-trained tasks is expected. It is assumed that improved working memory capacity and executive control has positive effects on different types of high-level cognition, learning of cultural skills and everyday activities.
In this contribution, a study will be presented where old-old adults participated in working memory training. A sample living in an institution performed a computer-assisted working memory training lasting for 12 weeks. The training group compared to controls showed improved performance later on in non-trained tasks measuring working memory and fluid intelligence. The rationale for these effects will be discussed together with the structural demands for the training tasks.

psychology
working memory training, fluid intelligence, transfer, old-old

Poster

PO-10

Impact of emotion, sleep and re-test on face-name association learning.

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In this study, we were interested in three ways to boost learning of face-name associations, namely emotion, sleep and repeated testing without feed-back. We selected face-name associations as a material to learn because it is often used in the rehabilitation of brain-damaged patients and it has ecological validity.
Regarding the role of emotion, Tsukiura and Cabeza [1] investigated recently its impact on face-name association learning; they found that memory for the facial expression, tested with the name as a recall cue, was better for smiling faces than neutral ones. However, to our knowledge, no study looked at the effect of facial emotion on name recall in face-name association learning. As to sleep, various studies [2] suggested that it participates to better consolidation of memory. Finally, repeated testing without feed-back has been shown to increase recall in various experimental tasks [3].
In the present study, we investigated whether emotion facilitates the learning of face-name associations by comparing emotional and neutral faces. The impact of sleep was tested by varying the time of testing (i.e. morning = long interval between learning and sleep, versus evening = short interval). Finally, the role of repeated testing in enhancing memory was assessed by comparing performance on several retrieval tests separated by 12 hours.
Sixteen healthy controls learned face-name associations using a paradigm of errorless learning with pre-exposure of the face. Eight participants came at 8 am (long delay before sleep) and eight participants came at 8 pm (short delay before sleep). Each participant learned 40 face-name associations divided into two lists (each composed of 10 neutral faces and 10 emotional faces) and was asked to recall the name associated with each face following a 2-minute interval filled with counting. One week later, participants came back for 3 retrieval assessments separated by 12 hours. The 40 learned faces were presented one at a time and participants had to recall each associated name. In case of failure, the correct answer was not given.
Our results showed a ceiling effect at the 2-minute-delay post-test and no effect of emotion. After one week, performance had significantly declined; emotion had again no significant effect. More importantly, repeated testing at one week lead to better name recall across the three retrieval tests with the third one being significantly superior to the first one. Interestingly, this was observed independently of the interval between learning and sleep, as it occurred for both groups (8 am and 8 pm). Therefore, the enhancement effect did not depend on sleep but rather on repeated testing, with additional presentation of one element of the pair leading to improved performance from one retrieval test to the other. Possible explanations for the absence of memory enhancement by emotion will be considered. The positive effect of repeated testing will be discussed in reference to concepts such as reconsolidation [4] and accessibility.

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psychology
Memory, learning, face-name association

Poster

PO-11

Implicit sequence learning and off-line learning in amnesic patients

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The purpose of the present study was to investigate whether the performance of amnesic patients in the serial reaction time task (SRTT) improves between two sessions -- a process termed “off-line learning”. Thirteen densely amnestic patients and 13 matched controls performed the classical SRTT on two sessions separated by 24 hours. In both groups, the effect of sequence-specific learning was not affected by the 24-hours consolidation phase. However, both amnesic patients and controls showed a decrease in their general response time level in the second session which is indicative of a sequence-unspecific improvement in performance. Overall, these results suggest that off-line learning is restricted to general motor skill learning and does not extend to sequence-specific learning. This holds for both amnesic patients and healthy controls.

psychology
incidental learning, serial reaction time task, amnesia, consolidation

Poster

PO-12

The Direction of Passive Whole-Body Motion Influences Numerical Cognition

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Numbers are thought to be represented spatially along a horizontal “mental number line” with small numbers on the left and large numbers on the right side. Active head turns to the left and right have recently been shown to influence numerical cognition by shifting attention along the mental number line (Loetscher, Schwarz, Schubiger, & Brugger, 2008). The aim of the present study was to investigate whether a passive whole-body motion would be sufficient to influence numerical cognition. Participants were seated on a hydraulic motion platform and performed numerical tasks while they were passively moved. In Experiment 1, they were asked to generate numbers at random while they were displaced leftward, rightward, upward, downward, forward, and backward. Smaller numbers were generated during leftward as compared to rightward, and during downward as compared to upward passive whole-body motion. In experiment 2, participants judged whether a verbally presented number (2, 3, 4, 6, 7, and 8) was smaller or larger than 5 while their body was displaced leftward or rightward. Reaction times to numbers smaller than five were shorter during leftward as compared to rightward passive whole-body motion. These results suggest that intention to move or motor activity is not required to influence numerical cognition. Our results suggest that vestibular information -induced by passive whole body motion- is sufficient to shift one’s attention on a higher cognitive representation such as the mental number line. This highlights an important role of vestibular information in the attention allocation process, which is often neglected in cognitive studies.

psychology
mental number line, spatial attention, vestibular influences, body motion

Poster

PO-13

EEG markers trace online and offline effects of transcranial direct current stimulation (tDCS) over the left dorsal prefrontal cortex

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According to previous findings, excitatory anodal transcranial direct current stimulation (A-tDCS) over the left dorsal prefrontal cortex (lDFPC) improves word production - a fundamental cognitive function found to be altered in neurodegenerative disease, aphasia but also during normal aging. The present combined EEG-tDCS study explores possible neuro-physiological add-on markers of this putative therapeutic application. Online (during) and offline (after) effects of A- (1.5mA, 30min) compared to S (sham)- tDCS over the lDPFC are traced with event-related potential (ERP) and spectral EEG correlates. Online A-tDCS modulations are demonstrated in the semantic interference (SI) effect, a marker that denotes the functional integrity of the frontal-to-temporally distributed language production system. During A-tDCS, the ERP SI-Effect is enhanced over the left compared to right temporal scalp-electrode sites. This could reflect a superior tuning of neural responses within left hemispheric language-related generators. Moreover, a slight online reduction in the behavioural SI-Effect is observed. Secondly, offline tDCS effects are tracked in the delta frequency band (1-4Hz), a global spectral marker of neural inhibition. Following A-tDCS, there is a reduction (i.e., des-inhibition) in the global delta synchronization during overt picture naming and the global delta power during the resting-state. These findings indicate a sensitivity of the ERP and global delta markers to the excitatory neuro-modulations provoked by A-tDCS over the lDPFC. Implications for the understanding and monitoring of A-tDCS effects in the neuro-rehabilitation of language functions are discussed.

methodology, neurology, physiology, psychiatry, psychology
language production, picture naming, neuro-rehabilitation, EEG, tDCS

Poster

PO-14

EEG correlates of motivational incongruence: an exploratory study

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The construct of motivational incongruence is defined by the insufficient realization of a person's motivational goals. These motivational goals can either imply the presence of desirable experiences (approach goal, in this case dissatisfaction leads to approach incongruence), or the avoidance of aversive experiences (avoidance goals, here dissatisfaction leads to avoidance incongruence). The incongruence questionnaire (INC) is a validated assessment tool for motivational incongruence. The construct of motivational incongruence (as assessed with the INC) has been shown to correlate with other clinically important parameters, as for example subjective well-being and psychopathological symptoms (Grosse Holtforth & Grawe, 2003). It is thus well conceivable that such a construct, tightly related to psychological functioning, should be reflected in the tonic activity of the brain systems, as it can be assessed with resting state electroencephalography (EEG). The present exploratory study therefore for the first time investigates a potential correlation between motivational incongruence (as measured with the INC) and tonic brain activity: 20 healthy subjects completed the INC-questionnaires and the subjects resting brain activity was measured with 70-channel EEG. After preprocessing, EEG data was transformed with a FFT (Fast Fourier Transformation) and the data of the EEG frequency bands was correlated with the INC data in a Topographical Analysis of Covariance (TANCOVA). The most robust finding was a significant correlation between the Alpha 2-Frequency band (10-12.5 Hz) and the approach incongruence: The higher the approach incongruence of a person, the smaller the Alpha2-power in occipital regions. Generators for this effect (as analysed with LORETA) were located in the inferior frontal gyrus (slightly left lateralized), superior temporal gyrus (bilateral), Insula (bilateral) and Cuneus. These findings thus suggests that motivational incongruence is reflected in brain systems related to mental arousal and affective symptoms (e.g. Jones et al, 2010; Jacobs & Snyder, 1996).

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psychology

Poster

PO-15

The evanescence of the term “general slowing” in normal aging

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Research on normal aging often shows a general slowing in processing speed that has been interpreted to reflect declining cognitive abilities. Here, we challenge this assumption and disentangle age-related alterations in automatic (less attention-dependent) and controlled (attention-dependent) word retrieval in semantic memory. Therefore, an automatic semantic priming paradigm was conducted. Two participant groups of healthy young and elderly performed lexical decisions upon visually-presented word/nonword pair stimuli with a stimulus onset asynchrony of 150 milliseconds. Behavioral reaction times and event-related potential (ERP) were measured. The N400, an ERP component sensitive to lexical-semantic retrieval, was analyzed by means of electrical neuroimaging. Controlled semantic word retrieval was assessed with verbal fluency tests. The established semantic priming effects in reaction time and N400 during lexical decisions were found in both age groups. Importantly, the elderly did not differ significantly from the young in these critical effects, except for a delayed N400 microstate. Moreover, no age effect was detected in the general processing speed. However, the age-related decrease of word production was replicated in the verbal fluency tests. The findings indicate that the automatic semantic retrieval remains stable in the normal course of aging. Consequently, the existent slowing in the elderly seems to be attributable to controlled processes. Hence, the distinct investigation of automatic and controlled semantic memory processes questions the justification of the term of general slowing. Thus, the age-related slowing is process dependent.

psychology
Aging, electrical neuroimaging, general slowing, N400, priming, semantic memory

Poster

PO-16

Neuropsychological performances in patients with carotid stenosis

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Objective: Cognitive function is likely to decline in patients with Carotid Artery Disease (CAD). If compared to matched controls in about 1/3 of patients with clinically otherwise asymptomatic carotid stenosis variable neuropsychological deficits are present. Carotid stenosis is an important risk factor for stroke and could therefore possibly also be a modifiable risk factor for cognitive decline. The hemodynamic effect of stenosis of the internal carotid artery can be estimated using cerebrovascular reserve capacity (CVR). The goal of our project is to evaluate CVR as a predictor for the clinical, in particular the cognitive outcome in CAD.

Methods: Patients with symptomatic or asymptomatic carotid artery stenosis of ≥ 70% and age between 55 and 80 years were recruited. Criteria of exclusion are progressive cerebral pathology, alcoholism, and a clinical history of stroke (< 3 month). The patients undergo visits (T0 and T12 months) including a neuropsychological assessment (verbal and a visuo-spatial memory, language, executive functions, gnosis-praxis, motor, treatment speed and attention tasks and an anxiety-depression scale HAD) and a MRI with CVR measurement.

Results: In the first 7 months 45 patients were recruited (18 in Bern and 27 in Lausanne, symptomatic group N=27 and asymptomatic group N=14). The preliminary results show executive impairment in both groups. 50% of symptomatic and 33% of asymptomatic patient showed impaired performances on the verbal inhibition task. In a mental flexibility task 25% of all patients presented with a deficit not discriminating the symptomatic from the asymptomatic group.

Conclusion: Both symptomatic and asymptomatic patients with carotid stenosis showed executive dysfunction in inhibition and in a mental flexibility task. These first data support the notion that cognitive performances in such patients are frequently impaired, even in patients considered “asymptomatic”. Other cognitive domains will now be analyzed and changes over one year will be assessed and correlated with focal CVR compromise.

[Swiss National Science Foundation: SPUM Consortium (33CM30-124114)]

neuroradiology, psychology
Neuropsycho

Poster

PO-17

Synaesthesia leads to a response bias in recognition memory: Evidence from the word-frequency mirror effect

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In contradiction to case-reports, recent group studies using the matrix memory test could not confirm the assumption that synaesthetes have a general advantage in episodic memory tasks. In the present study this finding was further explored in a recognition memory task, assessing the word-frequency mirror effect in a group of synaesthetes and non-synaesthetes. 23 grapheme-color synaesthetes and 46 age-, handedness-, and gender-matched controls were tested on their performance in recognizing items from a previously studied word list containing 24 high- and 24 low frequent words. No significant group difference emerged in the overall memory performance. But synaesthetes showed a significantly higher hit-rate and also a significantly higher false-alarm rate than their controls and there was a trend for synaesthetes to give more “old” responses. When labeling an item as “old”, both groups were more accurate when their judgment was based on recollection rather than familiarity. Again, there was no significant difference between groups. These results confirm the previous finding that synaesthetes have no general advantage in memory tests. Moreover, the higher hit-and false-alarm rates in synaesthetes indicate a strong response bias towards judging an item as old.

psychology
synaesthesia, memory, recognition

Poster

PO-18

Lateralized processing of featural and configural information in familiar and unfamiliar faces

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A wealth of knowledge shows that faces can be recognized on the basis of configural or featural information (Collishaw & Hole, 2000; Cabeza & Kato, 2000; Leder & Carbon, 2006; Lobmaier & Mast, 2007). In two studies using a divided visual field methodology, we investigated lateralized processing of featural and configural information in face recognition. In Experiment 1, 18 participants had to match the identity of a cue face containing either featural (scrambled faces) or configural (blurred faces) information with an intact test face presented subsequently either in the right visual field (RVF) or in the left visual field (LVF). Unilateral presentation was controlled by monitoring eye movements. The visual field of test face presentation interacted with the information provided by the cue image, F (1, 17) = 7.43; MSE = 8.68; $p < .05$; *partial* η^2 = .30, suggesting that featural and configural information is differently processed by the two hemispheres. In Experiment 2 either familiar or novel test faces were presented in the LVF or the RVF to a separate group of 8 participants. Learned faces were recognized better when presented in the LVF than in the RVF, $t(7) = 2.17$; $p < .05$, in line with the hypothesis that configural processing plays a major role in the recognition of familiar faces. Taken together, our findings suggest a left hemispheric superiority for featural processing and a right hemispheric specialization for configural processing, in line with recent evidence from neuroimaging experiments (Lobmaier et al., 2008; Rossion et al., 2000).

psychology
face recognition

Poster

Workshops

Workshop 1: Learning and Memory – From Synapses to Behaviour (Chair: Thomas Nevian)

Bei diesem Workshop wird der aktuelle Stand der Forschung zum Thema „Lernen“ an der Universität Bern auf verschiedenen Ebenen der Komplexität (einzelne Synapsen bis zum Menschen) dargestellt. Dabei werden Themen zur synaptischen Plastizität (LTP & LTD) auf zellulärer Ebene mit theoretischen Modellen und Erklärungen verknüpft. Dabei besteht das Hauptaugenmerk auf „Spike-timing dependent plasticity“, welches eine plausible Theorie für Lernprozesse in neuronalen Netzwerken darstellt. Diese Theorien sollen dann die Brücke zu lernpsychologischen Experimenten beim Menschen schlagen. Der Workshop orientiert sich an einem Teilprojekt des (leider nicht realisierten) NCCR – Learning and Memory. Die Teilnehmer sollen Denkanstösse dazu erhalten, wie zelluläre neuronale Mechanismen, wie synaptische Plastizität mit Lernen und Gedächtnis beim Menschen zusammenhängen könnten und diese diskutieren.

Lectures:

Thomas Nevian: *Synaptic plasticity at cortical synapses - mechanisms of spike-timing dependent plasticity*

Jean-Pascal Pfister: *Functional consequences of a triplet model of spike-timing dependent plasticity*

Walter Senn: *Spike-timing dependent synaptic plasticity modulated by reward and downstream activity: a model*

Thomas Reber: *Autoassociative networks as models of episodic memory*

Workshop 2: DTI and Perfusion – clinical and preclinical application (Chair: Roland Wiest)

Advanced imaging procedures have nowadays become clinically applicable tools that aid in the diagnosis of neurological and psychiatric disorders as stroke, epilepsy, brain tumors, depression and schizophrenia. Moreover, they have been recognized as important research tools for a better understanding of effective connectivity between brain areas and hemodynamic properties associated with disease progression and outcome. This workshop aims to give an overview on the theoretical aspects of the imaging techniques of Diffusion weighted imaging (DWI, DTI), non-contrast enhanced (arterial spin labeling) and dynamic susceptibility contrast enhanced perfusion imaging (DSCE-MRI) as used in today`s clinical research projects targeting neurological and psychiatric disorders. Every topic will be covered by basic researchers and clinicians to provide insights into different views on the same methods.

Lectures:

DWI and DTI

Claus Kiefer: *Theoretical aspects of diffusion weighted imaging*

Kay Jann: *Applications for DTI in psychiatric research*

Non-contrast enhanced perfusion imaging

Andrea Federspiel: *Theoretical aspects of arterial spin labeling (ASL) perfusion imaging*

Marwan El-Koussy and Martinus Hauf: *Clinical applications of ASL - cerebrovascular disease and epilepsy*

Dynamic susceptibility contrast enhanced perfusion imaging (DSCE-MRI)

Johannes Slotboom: *Theoretical aspects of DSCE-MRI*

Roland Wiest: *Clinical applications of DSCE-MRI in brain tumors and acute stroke*

Workshop 3: PANSS – Introduction and first rater-training (Chair: Daniel Müller)

Die PANSS (Positive and Negative Symptom Scale; Kay et al. 1987) hat sich als ein wesentliches diagnostisches Instrument für die differenzierte Erfassung des Schweregrades schizophrener Symptomatik (Positiv-, Negativsymptomatik und generelle Psychopathologie) weltweit in Forschung und klinischer Praxis durchgesetzt. Zu Beginn die Konzeption der PANSS erläutert. Anhand eines Videobeispiels werden Interviewtechniken und Gesprächsstrategien vermittelt und ein erstes praktisches Ratertraining anhand von Videoaufnahmen und mit ausführlicher Nachbesprechung durchgeführt. Der Workshop zielt darauf ab, dass die Teilnehmer eine für Forschungsaktivitäten notwendige Interraterreliabilität von 0.8 erreichen. Hierfür besteht die Möglichkeit, das Training innerhalb von zwei weiteren Terminen abzuschliessen.

Lecturers:

Daniel Müller

Stefanie Schmidt

Workshop 4: Awake Surgery – Safe eloquent tumor surgery (Chair: Jürgen Beck)

Conventional neurosurgery for tumors partially inside or adjacent to presumed eloquent brain areas carry the risk of severe neurological deficits. Surgery in awake patients allows for intraoperative testing of specific tasks using electrophysiological stimulation of both cortical and subcortical areas. Negative stimulation sites may be resected without risk of neurological deficits, therefore allowing a more radical surgery. Positive stimulation sites correspond to highly eloquent brain areas which may as a consequence be spared by adaptation of the surgical procedure and technique.

Awake surgeries are a multidisciplinary challenge: neurological-neurosurgical indication, neuropsychological diagnostics, patient education and training of specific tasks during surgery, specific neuroradiological tests like fMRI, SPECT and DTI-fibertracking, as well as monitoring and mapping techniques during surgery, neuronavigation, intraoperative ALA fluorescence, intraoperative ultrasound and postoperative specific patient rehabilitation as well as neurooncological adjuvant treatment.

The aim of this workshop is to show the fascinating multidisciplinary approach and the specific possibilities to monitor higher cortical functions in individual patients. The interdisciplinary discussion should encourage actual and future scientific studies.

Lectures:

Andreas Raabe: *Awake craniotomy – why it is necessary*

Jürgen Beck: *Relevance of MR complete resection in Glioma surgery*

Philippe Schucht: *Overview: Results in awake surgery*

René Müri/ Klemens Gutbrod: *Higher cortical function and localisation*

Kathleen Seidel: *Mapping and Monitoring: Principles and Techniques*

Case Presentations and Videos:

Klemens Gutbrod: *Surgery in and adjacent to motor and sensory speech areas: Performance and Results from neuropsychological point of view.*

Philippe Schucht: *Surgery adjacent to the visual tract including anaesthesiology and positioning of patient*

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