

# POSTER CATEGORY KEY

CATEGORY	POSTER NUMBERS	DAYS
PET	1000	Saturday, 17 Sep
Electrophysiology	1001-1011	Saturday, 17 Sep
Optical imaging	1012	Saturday, 17 Sep
Others	1013	Saturday, 17 Sep
MRI	2000-2018	Sunday, 17 Sep
MRI	1014-1016	Saturday, 18 Sep
MRI	3018	Monday, 19 Sep
MEG/EEG	3000-3017	Monday, 19 Sep

## Poster No.1002

### Functional Mechanism of Purkinje Cells in Cerebellar Ataxia: Modeling Study

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**Introduction:** The cerebellum receives a variety of inputs and it accomplishes information processing based on its internal rules. Purkinje cells play a major role in the information processing of the cerebellum. These cells can learn input patterns from parallel fiber by long term depression in parallel fiber to Purkinje cell synapses, but it is not clear how Purkinje cells encode information in their firing activity. Previous studies reported different mechanisms for information processing in Purkinje cells, and some studies mentioned that Purkinje cells encode weak and strong parallel fiber input patterns using different mechanisms. Thus, it remains a controversial issue how Purkinje cells encode parallel fiber patterns in their output.

**Methods:** In this study, pattern recognition in Purkinje cells was explored using a multi-compartmental model of a Purkinje cell. In our simulations, the effects of parallel fiber inputs with varying strengths on a Purkinje cell output were explored. The proposed structure for this purpose consisted of several steps. Briefly, in the first step parallel fiber patterns were created and stored (learned) using a long term depression based rule in MATLAB. Then, the resulting vector of synaptic weights was copied to the Purkinje cell model in the NEURON (Version 7.1). The learned and novel patterns were presented to the Purkinje cell model, and the Purkinje cell responses were recorded. Finally, Purkinje cell responses to learned and novel patterns were compared in order to determine the proper criterion for pattern recognition in the Purkinje cell. Then, pattern recognition in the Purkinje cell model was investigated in the conditions of calcium-activated potassium (BK) channels blockade, which leads to cerebellar ataxia.

**Results:** Simulation results indicated that in normal conditions in the presence of background synaptic inputs the Purkinje cell model fired at about 83.4 Hz (figure 1.A). The Purkinje cell model responded to parallel fiber input patterns with a short burst followed by a quiescent period (figure 1.B), and pause duration in response to learned patterns is shorter than those of novel patterns. A proper metric for patterns recognition could be the number of spikes in the burst. In ataxia condition in the presence of background synaptic inputs the Purkinje cell model showed burst firing pattern, and it could not distinguish between learned and novel parallel fiber patterns.

**Conclusion:** Learned patterns by long term depression as well as novel patterns could be discriminated based on the number of spikes in the burst, and there were no different mechanisms of information processing for weak parallel fiber input patterns versus strong patterns. In ataxia conditions the Purkinje cell could not recognize learned and novel parallel fiber input patterns. This may be involved in movement disorders in ataxia conditions

**Poster No.3000**

## **Investigation of multivariate methods in development of whole-brain synchronization maps**

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**Introduction:** Extraction of brain functional connectome is one of the first steps of decoding information processing in the human brain which is achieved through several methods in the literature, and investigation of these methods and their operation on EEG data has a crucial role in brain study today. In this research, we applied several multivariate synchronization methods on EEG signals and compared the results. Our EEG signal dataset is recorded from 20 people in relaxed state with closed eyes.

**Methods:** Signals are filtered into frequency bands of delta, theta, alpha, beta and gamma after pre-processing. Local synchronization methods applied include Correlation (Corr), Coherence (Coh), Mutual Information (MI), and Phase Lock Value (PLV). Global methods include Multivariate Phase Synchronization (MPS), Global Field Synchronization (GFS), Omega Complexity (Omega), State-Space estimator (SS) and State-Space estimator Based on Renyi Entropy (SS-Renyi).

**Results:** Local methods had correlation in alpha band and almost in all electrodes, but their correlation in beta and gamma bands was low in most electrodes using Coh method. This method also had the most difference in delta and theta bands. Results for Omega, SS and SS-Renyi was almost the same in all bands with high correlation. GFS was highly uncorrelated with other methods, except in alpha band and some electrodes in beta band which was correlated with Coh.

**Conclusion:** In a nutshell, results indicate that Correlation, Phase Lock Value, Mutual Information, State-Space estimator, Omega Complexity and State-Space estimator Based on Renyi Entropy methods are highly correlated, whilst Coherence method is correlated with these methods in alpha band. Global Field Synchronization is almost uncorrelated with all other methods.

**Poster No.2000**

## **Spike Voltage Topography in Temporal Lobe Epilepsy**

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**Introduction:** Spike voltage topography or 3-D voltage maps of cortical activity, is a descriptive way of defining dipole localization and orientation. We investigated the voltage topography of interictal spikes in patients with temporal lobe epilepsy (TLE) to see whether topography was related to etiology for TLE.

**Methods:** Adults with TLE, who had epilepsy surgery for drug-resistant seizures from 2011 until 2014 at Jefferson Comprehensive Epilepsy Center were selected. Two groups of patients were studied: patients with mesial temporal sclerosis (MTS) on MRI and those with other MRI findings. The voltage topography maps of the interictal spikes at the peak were created using BESA software. We classified the interictal spikes as polar, basal, lateral, or others.

**Results:** Thirty-four patients were studied, from which the characteristics of 340 spikes were investigated. The most common type of spike orientation was others (186 spikes; 54.7%), followed by lateral (146; 42.9%), polar (5; 1.5%), and basal (3; 0.9%). Characteristics of the voltage topography maps of the spikes between the two groups of patients were somewhat different. Five spikes in patients with MTS had polar orientation (Figure 1), but none of the spikes in patients with other MRI findings had polar orientation (odds ratio = 6.98, 95% confidence interval = 0.38 to 127.38;  $p = 0.07$ ).

**Conclusion:** Scalp topographic mapping of interictal spikes has the potential to offer different information than visual inspection alone. The present results do not allow an immediate clinical application of our findings; however, detecting a polar spike in a patient with TLE may increase the possibility of mesial temporal sclerosis as the underlying etiology.

**Poster No.2001**

## **The Effects of Late Bilingualism on The White Matter of The Brain, Connectometry Approach**

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**Introduction:** Bilingualism, active using of two or more languages in daily life, has been founded to improve cognitive functions. Neuroimaging studies have revealed that these cognitive benefits are due to brain structural changes especially more specifically affecting integrity of the white matter. But there remains an unresolved question whether beneficial cognitive effect of learning a new language can be achieved by simply learning a new language at any stage of life or there exist critical periods to achieve such goal with learning new languages? The effects of early and simultaneous language learning on white matter integrity has been demonstrated; IFOF has significantly higher FA in simultaneous bilingual children. Herein we investigated whether these effects are seen in late bilinguals.

**Methods:** 19 healthy individuals who all spoke English as their second language and had lived in the United Kingdom for a minimum of 13 months with various first languages formed our “bilingual group”. The control group consisted of 25 age, sex and education matched native speakers of English. A 3.0-Tesla Siemens MAGNETOM Trio MRI scanner was used with Syngo software to acquire DTI data. A DTI diffusion scheme was used in DSI Studio, and a total of 60 diffusion sampling directions were acquired. The b-value was 1000 s/mm<sup>2</sup>. The in-plane resolution was 2 mm. The slice thickness was 2 mm. The diffusion data were reconstructed in the MNI space using q-space diffeomorphic reconstruction to obtain the spin distribution function. A diffusion sampling length ratio of 1.25 was used, and the output resolution was 1 mm. Diffusion MRI connectometry was conducted to compare group differences in a total of 44 subjects.

**Results:** The connectometry analysis results showed tracks with increased FA in group bilingual with an FDR of 0.0431034. These tracks include Corpus Callosum (CC) and cingulum bilaterally and left IFOF.

**Conclusion:** We found CC bilaterally and left IFOF tract to have higher anisotropy in bilinguals which was in consistent with previous reports. IFOF takes part in semantic processing and its higher anisotropy in bilinguals signifies more efficient semantic processing in bilinguals. We report for the first time a higher anisotropy in cingulum of bilinguals. We suggest that cingulum's role in language switching (which has been reported in previous works) is the reason for this increase in Anisotropy. If this shall be the case, we could emphasis on increasing importance of the immersion and active usage of a second language as the main factors of the bilingualism effects on the white matter structure comparing with just early learning of the second language

## Poster No.1005

### Introducing a New Technique to Mapping of Broca's Area in Anesthetized Patients Preliminary Experiences

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**Introduction:** Surgical operations of the cerebral cortex close to the motor speech area are very sensitive and some side effects can be permanent and irreversible. As a routine (common) practice, awake craniotomy is applied for surgeries of the fore mentioned zone. Awake craniotomy requires a very skilled anaesthetic team as well as the patient's cooperation during the surgery. Unfortunately, this procedure can be very stressful for both the patient and the surgical team. Hence a technique that could map patients' motor speech areas without the need to have them awake (conscious) would be valuable and at the same time, exciting. Recently, we have tried a new (different) technique on a small number of subjects and the results are promising. In this talk, we will review the existing practices and also will present our recent results/findings.

**Methods:** In this technique long and short latency responses (reflexes) via laryngeal muscles are recorded. In order to record (register) any response, needles are placed on laryngeal muscles. We then stimulate various regions of the cerebral cortex and based on the response observed in laryngeal muscles, primary motor cortex (PMC), Broca's area and the supplementary (SNM) zones can be identified. This technique was tried on two patients, anaesthetised and awake, and the outcomes were similar (identical).

**Conclusion:** The method of laryngeal muscles response for the determination of motor speech area in anaesthetised patients seems to be effective and valuable.

**Poster No.2002**

## **Designing an Array of Wideband, Compact and Body Matched Antennas for Brain Microwave Imaging**

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**Introduction:** Stroke is the third cause of death and first or second leading cause of disability in the world. According to the WHO, 15 million people suffer a stroke each year and about 5 million of them die, while about 5 million of them become permanently disabled. In Iran roughly 300 000 people suffer a stroke each year. Attack of stroke is a medical emergency. The patient must receive drug treatment within 4 hours of the onset symptoms for a full recovery. Conventional imaging devices such as MRI and CT are expensive, static and usually available in hospitals and major clinics. Microwave imaging provide a fast, cheap and mobile solution for this. Microwave imaging technique could replace or supplement conventional imaging methods. In microwave imaging systems, an ultra-short time domain pulse is transmitted and the scattered signals are collected for post-processing purpose. Therefore, designing an array of antennas that is able to send and receive such signals is very important. In this paper, an array of wideband, compact and body matched antennas for brain microwave imaging is presented.

**Methods:** In this paper, an array of wideband antennas is presented. The design and optimization procedures is performed in CST Microwave Studio. To design a body-matched wideband antenna, the human body exposure effect should be considered. For this reason, the homogenous (simple) and multilayer inhomogeneous (semi-sophisticate) head models entered in simulations. Finally, an image reconstruction method was used for array performance validation.

**Results:** At the end of designing and optimization procedures, Antenna element and array characteristics exposed to the simple and semi-sophisticate human head models are desirable. This ensures effective sending of wideband (in frequency domain) pulses through the head and receiving backscattered signals. The images obtained by the image reconstruction method indicate the effectiveness of the array in stroke detection.

**Conclusion:** In this paper, an array of wideband and body matched antennas (1 to 4 GHz) with very small size (about 18 x 18 mm) is presented. The efficiency of proposed antenna array for brain stroke detection was validated by performing imaging methods on numerical head models. Its compact size and body matching became it an ideal candidate for using in microwave imaging systems for brain stroke detection.

## Poster No.1006

### Electrical Mapping of Salicylate Effects in The Hippocampus CA1 Area of Rat

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**Introduction:** In this study short-term and long-term plasticity changes in the synapses of living hippocampal CA1 slices of rats which received sodium salicylate.

**Methods:** Sodium salicylate 300 mg/kg 2 times a day for 3 days was injected intra-peritoneal. Schaffer collateral (using 200 microseconds, 0.1 Hz, 20-150  $\mu$ A square pulse) was stimulated and field action potential of hippocampal CA1 cell body layer (with a 2-10 Mega ohm glass microelectrode) was recorded. Stimulus intensity that would create 50 to 60 percent of maximum response was chosen as the pulse test for the other stages. To induce long term plasticity (LTP), a train of 10 test pulses at 100 Hz was used and responses were recorded for 60 min. To induce short term plasticity, test pulses were presented as pairs, separated by 10, 20, 80, and 200 ms interval, were repeated at 0.1 Hz. Paired t-test and one way ANOVA were used to compare groups.

**Results:** The mean amplitude was reduced in salicylate group none significantly. Titanic stimulation in the slices of salicylate group could not induce LTP ( $P < 0.001$ ). The PS amplitude of IPI=10 ms in the response of paired pulse stimulation decreased in salicylate group too ( $P < 0.05$ ).

**Conclusion:** PGE<sub>2</sub> regulate the cAMP dependent ionic conductivity, and increases neuronal membrane excitability. Salicylate by inhibit Cyclooxygenases, decreased prostaglandins, so neuronal membrane excitability and the ability to induction long-term synaptic plasticity is reduced. The inhibition of the second neuronal response in IPI=10 ms is due to GABAergic feed- back by interneurons innervating the pyramidal cell layer was increased by salicylate.



## Poster No.3001

# Inhibitory Control Deficits in Adult Attention Deficit Hyperactivity Disorder: An Event Related Potential

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**Introduction:** Attention Deficit-Hyperactivity disorder (ADHD) is a common behavioral syndrome characterized by inattention, hyperactivity and impulsivity. Converging data from imaging and neuropsychological studies point to impaired inhibitory control as a fundamental deficit in ADHD. The major aim of the current study was to provide electrophysiological evidence for impaired inhibitory control in ADHDs based on emotional Go/NoGo paradigm using event-related potentials (ERPs). ERPs were obtained in ADHD subjects during an emotional inhibition task involving angry, sad and happy faces compared to neutral face pictures. This study provided evidence that ADHD is a general dis-regulation of inhibitory control and the neural-networks sub-serving inhibition are impaired. Inhibitory Control, ADHD, Go/NoGo, ERP.

**Methods:** Fifteen adults diagnosed with ADHD combined type and 15 healthy men (Control group, CG), all right-handed and aged 21- 30 years underwent a Go/NoGo task where Go stimuli were presented on %70 trials. Exclusion criteria for both groups were an intelligence quotient (IQ) below 80 [assessed by CFT 20-R, 24]. An interview was given to participants to rule out the presence of any somatic or mental disorder (besides ADHD). After receiving a full explanation of the experimental procedures, subjects were asked to perform a task in which there were 6 blocks of emotional tasks requiring execution or inhibition of a button press for a specific emotional target conveying anger, sadness, and happiness. Each of three emotions was used as a NoGo stimulus (inhibition of a button press) while the neutral ones served as Go stimuli and vice versa. All stimuli were presented sequentially in the center of the screen for 500ms with an interstimulus interval 500, 750 and 1000 ms. Each task, involving 6 blocks consisted of 120 trials. ERP and behavioral measures were collected together. The behavioral variables such as number of correct responses: reaction times when Go trials were responded to correctly; and correct inhibition were all recorded.

**Results:** Two major ERP components (P3 and N2) were analyzed in relation to inhibitory mechanisms. In normal groups, these components have been reported to be enhanced for NoGo trials as compared to Go trials that reflect changes in brain activity related to response inhibition in a Go/NoGo task. A significant effect was found on the amplitude of P3 with ADHD subjects having smaller amplitudes compared to controls in NoGo trials. Our findings also showed longer latencies and amplitude reduction of N2 in NoGo trials. The results support the idea that altered N2 and P3 components in NoGo trials reflects the impaired inhibition in ADHD. In general, ERP amplitudes showed clear differences between the Go and No Go conditions in ADHDs in comparison with healthy subjects.

**Conclusion:** The present study focused on electrocortical correlates of inhibitory control during Go/NOGO task in adults suffering from ADHD. Our findings most likely reflect an impaired inhibitory process in ADHD subjects that have difficulty in controlling their impulsive responses. This study provided evidence that the core deficit of ADHD is lack of inhibition (commissions) or over inhibition in others (omissions) in inhibitory demanding circumstances. Of note, behavioral and brain function measures of inhibitory control may provide additional tools for clinical assessment of ADHD in adulthood

**Poster No.1001**

## **Pharmaco-TMS-EEG as a New Tool to Characterize Human Cortical Excitability**

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**Introduction:** The potential of TMS to gain physiological knowledge of the human brain can be strongly enhanced by combining TMS with simultaneous electroencephalography (TMS-EEG) or by combining TMS with exposure to central nervous system (CNS) active drugs (pharmaco-TMS). Recent findings provided evidence that the amplitude of two negative EEG deflections elicited by a single TMS pulse over the primary motor cortex (M1), namely the N45 and N100 TEP components, reflects GABA-A receptor and GABA-B receptor activation, respectively (Premoli et al., 2014). Thus, to study modulation of these two TEP components may inform about the effect of any CNS-active drug on GABA-A and GABA-B receptor mediated neurotransmission, respectively. In vitro, S44819 is a potent and competitive selective antagonist of GABA-A receptors and has been shown to be involved in tonic inhibition controlling pyramidal neurons excitability. Its overactivation contributes to increased tonic inhibition in the peri-infarct zone after ischemic stroke (Clarkson et al., 2010). Investigating to what extent S44819 is able to modulate inhibitory neurotransmission in vivo in humans is thus of much interest, as this may lead to a clinical trial to test its efficacy to enhance functional recovery after stroke.

**Methods:** A pseudo-randomized, placebo-controlled, double-blind crossover phase I clinical study was conducted, testing a single oral dose of 50mg and 100mg of S44819.

**Results:** Results showed a significant decrease in the N45 amplitude after intake of the 100 mg dose of S44819, while the N100 amplitude remained unaffected.

**Conclusion:** These findings suggest that the  $\alpha$ 5-subunit-containing GABA-A receptor plays a role in generation of the N45 potential. S44819 might be a promising candidate drug for improving motor deficits in post-stroke patients.

## Poster No.2003

### The Effect of Time Length of Immersion in Bilingualism on Brain White Matter

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**Introduction:** It has been shown that lifetime bilingualism maintains white matter integrity in older adults. On the other hand, increased FA values following intensive L2 vocabulary training have been observed unless the training is discontinued. Considering these facts, it can be inferred that the time length of immersion in bilingualism (that here we shortly call it T) is associated with structural changes. Analyses in bilinguals using T as a regressor have produced no significant results till now but in this study, we have applied connectometry not suffering some of the limitations of previous methods. Instead of finding the difference in tracks, connectometry tracks the difference associated with the study variable in local connectome.

**Methods:** Diffusion MRI connectometry was conducted for 17 young (mean age of 31), highly immersed late bilinguals using a multiple regression model considering immersion (T) in bilinguals. A percentage threshold of 50 % was used to select local connectomes correlated with T. A deterministic fiber tracking algorithm was conducted to connect the selected local connectomes. A length threshold of 65 mm was used to select tracks. The seeding density was 20 seed(s) per mm<sup>3</sup>. To estimate the false discovery rate, a total of 500 randomized permutations were applied to the group label to obtain the null distribution of the track length.

**results:** The analysis results showed some fiber tracks (IFOF, AF, genu and body of CC of both sides) with increased anisotropy related to immersion with an FDR of 0.0753247, which shows a trend toward significance. It means that the high variation in brain connection patterns, which cause higher FDR, will disappear if the number of subjects is increased.

**Conclusion:** Association between amount of immersion in bilingualism and white matter integrity in fiber tracts is implicated in our study for the first time. This result is probably observed due to the "time-dependent" phenomenon of neural plasticity, especially occurring in those fiber tracts associated with main abilities of language, such as semantic and phonological language pathways (IFOF and AF respectively) and also corpus callosum (correlated with executive function). However, further studies using larger samples and different methods are required.

**Poster No.2004**

## **Working Memory Deficit in Recent-Onset Schizophrenia Associated with White Matter Integrity: Connectometry Approach**

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**Introduction:** Cognitive impairments and their association with the structure of the brain in schizophrenia has long been in the focus of attention. Structural abnormalities in fronto-parietal and fronto-temporal circuitries i.e. decreased anisotropy in SLF, ILF, IFOF, splenium of CC, and posterior cingulum are shown to be associated with working memory (WM) impairments in schizophrenia, which may underlie many cognitive deficits. Due to the limitations of tractography, we applied connectometry, a statistical approach capable of detecting "segments" of fibers associated with study variables, to investigate association of WM with white matter in schizophrenia.

**Methods :**Data used in this study were obtained from an online database available at <http://schizconnect.org/>. Letter-number sequencing (LNS) test was applied as a complex working memory task. Diffusion MRI connectometry was conducted using DSI studio in 29 patients and 32 healthy controls using a multiple regression model considering LNS, sex, and age. Percentage thresholds of 30% to 50% were used to select local connectomes correlated with LNS for each group. A deterministic fiber tracking algorithm was conducted to connect the selected local connectomes.

**Results :** There was a significant group difference between the control and the patient group in LNS scores. The multiple regression results showed there is no track with significantly decreased anisotropy related to LNS in controls ( $p>0.05$ ) unless the percentage threshold is increased up to about 45%. However, in the patients group, significantly decreased anisotropy in the AF, ILF, the body of CC and some fibers of IFOF and cingulum related to LNS with the percentage threshold of 35% and more ( $p<0.05$ ).

**Conclusion :** AF and ILF, the main tracts found here, are in close relationship with DLPFC and also parietal lobe and cuneus, to which WM deficiency is mainly attributed [7]. Furthermore, this study confirmed previous ones, showing decreased anisotropy in SLF (as AF is considered a part of SLF) and ILF in schizophrenia [2]. The patients also showed decreased anisotropy in the body of CC here. WM in controls showed no significant relevance to decreased anisotropy at the percentage threshold determined at 35%. However, further research using tractography in this sample is required for validation.

**Poster No.2005**

## **Diffusion Tensor Tractography Can Affect Treatment Strategy to Remove Brain Occupying Mass Lesions**

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**Introduction:** Radical resection of a pathological lesion along with the preservation of eloquent cerebral tissue is the principle goal of neurosurgery. Brain lesions are usually diagnosed by conventional magnetic resonance imaging (MRI), but this method is unable to describe the relationship between lesions and neighboring specific white matter (WM) tracts. Diffusion tensor tractography (DTT) is a new sophisticated imaging modality to reveal the neural fibers and their relationships with lesions. In the current study we assess that how diffusion tensor tractography can effect on treatment planning in patients afflicted by different types of brain lesions.

**Methods:** In this prospective observational study, eight patients with brain mass lesion underwent conventional brain MRI pulse sequences and DTT imaging with 1.5 Tesla system using 64 independent diffusion encoding directions between December 2011 to January 2013. Acquired images were assessed by the neuroradiologist and neurosurgeon. Finally, the treatment strategies were compared using data before and after the tractography.

**Results:** The treatment strategy in six patients changed from radiotherapy into the craniotomy by using tractography data, in one patient changed from radio surgery to craniotomy and in one patient, neurosurgeon preferred to avoid operation.

**Conclusion:** As we can infer from this study, based on the tractography results, the treatment technique may be changed, and the treatment plan could be devised with more accuracy and in case of surgery, may lead to less post-operative neurological deficits and better outcome results.

**Poster No.2006**

## **Distinction in Resting Functional Dependency Structure in Motor System of Parkinson's Disease by Copula Parameters**

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**Introduction:** Resting-state fMRI (rsfMRI) has drawn considerable attention because of its convenient recording at pathological condition like Parkinson Disease (PD). In this study, we aimed to extract dependency structure of rsfMRI in anatomical regions involved in movement (basal ganglia, thalamus, cerebellum, prefrontal cortex, motor cortex) using copula method in order to distinguish PD and healthy. Copula has already been used for connectivity assessment of firing neurons and EEG.

**Methods:** rsfMRI recorded from 10 PD patients and 10 controls during rest. After preprocessing using FMRIB software library, the covariates were regressed out and the results were filtered (0.01-0.08Hz). Functional dependencies between meantime series of each pair of eight ROIs in motor system were quantified using joint statistical distribution -*Copula*. Five copula family were tested: Gaussian, t, Clayton, Gumbel and Frank. The data was transformed to the copula scale using kernel estimator of the Cumulative Distribution Function and maximum likelihood procedure was used for estimating copula parameters. We performed Goodness of Fit (GoF) using RMSE and Kullback Leibler (KL) divergence between the empirical joint CDF and its copula estimation. Evaluation of the Copula parameters against regular correlation has been done by clustering and regression classifications such as Logistic regression, Linear SVM and LDA for distinction between PD and healthy.

**Results:** Show connectivity network of significant parameters in left and right hemispheres respectively. The result of GoF demonstrates that linear copula parameters extracted by Euclidean family are more complete description of relations in the brain network. Shows the results of clustering for correlation coefficients and copula functions individually. The best accuracy (85%) is related to the combination of linear and nonlinear features from all copula functions. The results of classification based on correlation coefficient and copula parameters are shown at table 3.

**Conclusion:** In this study, we introduced Copula concept for quantifying linear and nonlinear functional connectivity. The results show that dependency between cerebellum and basal ganglia areas is much more in healthy than PD and this connection is seen using all types of copulas. We found that functional dependency by copula can distinguish PD and healthy with higher accuracy. Many different copula families can represent and parameterize different properties of dependence structures.

**Poster No.1011**

**Comparison HB in QEEG before and after efficacy of neurofeedback on stress Patients**

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**Introduction:** The present study aims to Comparison HB in QEEG before and after efficacy of neurofeedback on stress Patients.

**Methods:** The research design was Quasi-experimental research methods with pretest-posttest control group. Sample included 50 depression Patients (25 subject in experimental group and 25 subjects in control group). The experimental group received 20 session of neurofeedback intervention. In this study, DASS-42 questionnaire and neurofeedback and QEEG devices was used to collect the data.

**Results:** Neurofeedback treatment was effective on HB in stress. The rate of recovery remained stable in the follow up phase (1 month after intervention).

**Conclusion:** Using neurofeedback can be an effective way in preventing or reducing stress.

**Poster No.1009**

**Comparison Coherence After Efficacy of TDCS on Children with Attention Deficit/ Hyperactivity Disorder (ADHD)**

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**Introduction:** The present study aims to the present study aims to the efficacy of neurofeedback on HB waves in stress Patients.

**Methods:** The research design was Quasi-experimental research methods with pretest-posttest control group. Sample included 50 depression Patients (25 subject in experimental group and 25 subjects in control group). The experimental group received 20 session of neurofeedback intervention. In this study QEEG devices was used to collect the data.

**Results:** The result of multivariate analysis of covariance showed that neurofeedback intervention had significantly ( $p=0/001$ ) decreased the HB waves up experimental group in comparison to control group. The rate of recovery remained stable in the follow up phase (1 month after intervention).

**Conclusion:** It seems that the neurofeedback intervention can be considered as an clinical psychology and Neuroscience intervention and lead to change and decreased the HB waves in stress Patients.



**Poster No.2007**

## **The Attenuation of Maximal Electroshock-Induced Seizure Response by Intranasal Insulin in Rats**

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**Introduction:** Insulin has recently gained a great deal of attention for its central nervous system functions. Brain insulin apart from its role in both peripheral and central glucose metabolism, has been shown to regulate neurotransmission, learning, memory and exert neuroprotection. Therefore insulin may constitute a promising therapy against various neurological disorders and neurodegenerative contexts. The present study aimed to investigate the potential therapeutic effect of insulin against maximal electroshock (MES)-induced seizures.

**Methods:** In this study two groups of male Wistar rats, weighing 250-300 g were used (N=7). In one group animals were treated with intranasal insulin at the dose of 0.5 IU per day and in the other group were treated similarly with normal saline for 12 days. Both groups were subjected to seizure induction by three sessions of MES (50 Hz, 60 mA and 1 sec) at 2 h intervals on days 1, 4, 8 and 12 of experiments. All the MES inductions were made two hours after insulin or vehicle treatments. Then duration of seizure responses was measured after each trial of MES.

**Results:** Obtained results revealed insulin treatment shortens duration of MES-induced seizure. However, this protective effect was only significant at the days 8 and 12 of experiments.

**Conclusion:** Based on the results of this experiment, intranasal insulin treatment via high central bioavailability protects against seizure. Further mechanistic studies on using insulin or provoking its signaling pathways would help identifying innovative strategies to prevent or reduce seizure activity.

**Poster No.2008**

## **The Protective Effects of LPS-Preconditioning on Maximal Electroshock- and Pentylentetrazol-Induced Seizure Reactivity in Rats**

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**Introduction:** Preconditioning is a state that a subthreshold noxious stimulation protects against a later severe damage. Various preconditioning stimuli are used for neuroprotection in different CNS diseases. Seizure tolerance has been demonstrated using a variety of seizure preconditioning approaches like electroconvulsive shocks and low doses of excitotoxins. Since Lipopolysaccharide (LPS) is a well proven agent in preconditioning contexts, the present study aimed to investigate the protective effect of LPS preconditioning in two seizure models in rats.

**Methods:** In this study four separate groups of male Wistar rats, weighting 250-300 g were used (N=7). In two groups, LPS or its vehicle was administered intracerebroventricularly (i.c.v.) at the dose of 1.2µg/rat, 4 days before pentylentetrazol (PTZ; 70 mg/kg, intraperitoneal) induction of seizure. In the other two groups, LPS or its vehicle was injected at the same dose i.c.v., 4 days before maximal electroshock (MES; 50 Hz, 60 mA and 1 sec, three times at 2 h intervals) induction of seizure. Then onset latency and duration of seizure responses in PTZ model and duration of seizure in MES model were measured.

**Results:** Obtained results of this study revealed ultra-low dose LPS-preconditioning increases onset latency and shortens duration of seizure in PTZ model. Also in MES model, the duration of seizure reactivity was decreased in LPS-pretreated rats in comparison with corresponding control.

**Conclusion:** Based on the results of this experiment, LPS-induced delayed preconditioning protects against seizure. Further mechanistic studies on LPS-preconditioning would help identifying innovative strategies to prevent or at least reduce seizure activity and related neuronal damages.

## Poster No.3002

### Linear and non-linear features of EEG and ECG markers of acute stress

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**Introduction:** The stress control is a big challenge of our century. Firstly the identification the stress markers should be done. Level of cortisol is a hormonal marker of stress but it takes too long time to make distinguish. The aim of the study was to assess the EEG and ECG recording having quickly reports in relation to acute stress in addition to the level of cortisol.

**Methods:** twenty-three young man were exposed to triar social stress test. Emotive visual analogue scale (EVAS) questioner, salivary cortisol, EEG (32 channels) and ECG recording were taken before, after test and after 20 minutes of rest. Some psychological evaluation such as IQ, EQ, DASS and previous stress experience at a month ago were taken.

**Results:** the findings showed that the level of cortisol and EVAS increased after stress and the cortisol increase was yet even after recovery time. ECG recording showed that the mean of heart rate variation (HRV) increased after stress and SDs of Poincare plat and spectral entropy of HRV decreased after stress test. EEG recordings in the eyes close situation in the almost of channels especially in the right hemisphere, showed the increase of alpha 1 band after stress that remained after recovery. Because of the high correlation of channel activity, the corrected p-value less than 0.0001 was considered for significance level. There was significant cubic or invert regression between trend of cortisol and some EEG changes such as alpha 1 activity in F8 channel and spectral entropy of alpha 1 activity of FP2 channel.

**Conclusion:** the newest linear and non-linear EEG and ECG features of stress were introduced and validated.

**Poster No.2009**

## **Stereological Analysis of Brains of Methamphetamine Abusers Compared to the Controls**

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**Introduction:** Methamphetamine (MA) is an addictive and stimulant drug that its abuse causes psychological and cognitive symptoms. MA abuse can cause structural changes in the brain. The aim of this study was to evaluate stereological changes of brains of methamphetamine abusers compared to the controls.

**Methods:** This case-control study was conducted on MRI images from methamphetamine abusers and healthy controls (n=10 in each group), at Zahedan, Iran. The subjects were selected using the convenience sampling method. MRI images of the brains of the two group in frontal, coronal and sagittal axis with 4 mm slice thickness and 0.5 mm intervals were acquired. Parameters including total volume (V) and volume density (Vv) of different parts of the brain were estimated based on Cavalries' point counting stereological method. To analyze the data, descriptive statistics and Mann-Whitney U-Test were applied. The significance level considered as less than  $p < 0.05$ .

**Results:** The results showed that the volume of the cerebellum ( $p=0.035$ ), the volumes and volume density of the ventricles ( $p=0.029$ ,  $p=0.011$ ), and gray matter volume and volume density ( $p=0.03$ ,  $p=0.043$ ), and the basal ganglia volume density ( $p=0.009$ ) in MA group was significantly smaller than the control subjects. But white matter volume and volume density ( $p=0.015$ ,  $p=0.043$ ) in the MA abusers was significantly larger than the healthy subjects. In addition to, there were not significant differences between the total brain volume, the hippocampus volume and the basal ganglia volume between the two groups ( $p > 0.05$ ).

**Conclusion:** According to the results of present study MA abusing can cause structural changes in the brain of those patients. MR imaging using stereological techniques can be used for determining the level of these damages in substance abuser

**Poster No.2012**

**Comparison of Magnetic Resonance Spectroscopic Imaging and CT Scan for Clinical Target Volume Definition in Radiation Therapy Treatment Planning of Glioblastoma Multiforme**

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**Introduction:** One of the most important aspects in radiotherapy is target definition. Since routine methods of imaging (CT and MRI) are inadequate for treatment of glioblastoma multiforme (GBM), magnetic resonance spectroscopy (MRSI) as a functional imaging modality has recently been taken into consideration for target definition. In this study we tried to use MRSI in addition to CT and MRI in order to identify clinical target volume (CTV). The aim of the present study was to compare the clinical target volumes based on anatomical imaging (CT-MRI) and anatomical-biochemical imaging (CT-MRI-MRS).

**Methods:** In this study, we used images of 16 GBM cancer cases. MRS and MRI images were fused with CT images. Then, treatment planning was performed for each patient in two combined methods (CT+MRI and CT+MRS planning).

**Results:** CTVsCT+MRS were significantly larger than CTVCT+MRI (P- value<0.05). no other considerable changes in other important factors of treatment planning were found.

**Conclusion:** Application of MRSI for target volume identification of GBM may lead to an increase in volume in comparison to CT planning alone; thereby, it is recommended to apply MRS images for the purpose of target determination of radiotherapy because of its advantages

## Poster No.3003

### Review the Pattern of Brain Waves in Depression Review the Pattern of Brain Waves in Depression

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**Introduction:** A number of studies have indicated that brainwave patterns in individuals with depression are different from those of normal individuals. The aim of this study is to assess possible differences in brainwave activities in subjects with depression and normal individuals using the qEEG instrument. In a research study entitled "The quantitative-spectral analysis of EEG in psychiatric clients" which has been conducted by Churchman et al. (2003) the results indicated that qEEG in 83 percent of the patients and percent of the normal subjects was anomalous. Most of the anomalies related to a decrease in the short band waves, i.e. delta and theta, or in one of them, were accompanied by an increase in beta. However, in normal subjects no decrease in delta or theta was recorded. Clinical studies on patients with depression have indicated a decrease in the activity of the left frontal lobe of the brain.

**Methods:** In the present study uses a descriptive comparison, 15 patients with major depressive disorder with psychiatric diagnosis and major depression confirmed by the investigator using the Structured Clinical Interview (SCID-I) with 15 normal subjects who were selected for sampling and were compared in terms of brain wave activity. TO quantification EEG data for both, electroencephalogram device QEEG 21 channels as research tools were used. 7 seconds of brain waves of both group in a relax position (eyes closed) were studied. all artifact-free EEG data was quantificated by Fast Fourier Transform (FFT ) and in 4 form of PFT bands waves were determined : alpha , beta , theta and delta. In this study, due to different measurement of average power measurement and analysis of variance MANOVA connectors were used.

**Results:** The study showed that depressed patients alpha activity in frontal, central, temporal lower than normal group. The beta activity in depressed patients, especially in the central region in the right hemisphere is more and theta activity in the central area and the occipital is less than the normal group. These results indicate that depression causes changes in brain wave activity patients. There was also no significant difference in delta wave activity and EEG theta and delta bands can be reduced as a certain sign of poor brain function in depression considered.

**Conclusion:** The results indicated that depressed patients had a lower level of alpha activity in the prefrontal, frontal and temporal lobes compared to normal individuals; this is clearly in line with the findings of. Moreover, the beta activity in the right hemisphere and in the frontal lobe was higher in depressed patients compared to normal individuals. The results also indicated that the patients with depression had demonstrated a lower theta activity in the frontal and occipital lobes compared to the normal group. However, no significant difference in delta activity was detected. It has been suggested that depression and a special sort of tension are related to unequal patterns of brainwave activities in different lobes.

## Poster No.1004

### The Effect of Transcranial Direct Current Stimulation on schizophrenic Patients

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**Introduction:** Among mental illnesses, psychosis and particularly schizophrenia are more significant than the others. Schizophrenia is a complex mental disorder which can have the most severe and destructive effect on the patients' lives. This illness can be cured through various treatments such as medication, psychotherapy and shock therapy (ECT). However, some patients show no reactions to these treatments. Transcranial direct current stimulation (TDCS) is considered to be a non-invasive method in which some parts of the brain are stimulated using weak electric currents.

**Methods:** The present experimental study used pre- and post-tests on two experimental and control groups. The population of the study included all patients being treated in three schizophrenia centers in Karaj. The diagnosis of the participants was confirmed by a psychiatrist using DSM-V criterion. The participants included 30 schizophrenic patients who were randomly assigned to two groups of experimental (15 patients) and control (15 patients). Initially, the two groups were matched on the kinds of drugs being taken. The participants had not had any drug changes for two months prior to the start of the experiment, and six months in case clozapine was taken. The TDCS therapy for the experimental group lasted ten 20-minute sessions and stimulated the F3 anodal and the cathodic regions of the brain with the current strength of 2 mA. The same condition has applied to the control group theatrically. According to protocols of the study, participants were assessed during the first and last session of the treatment in terms of positive, negative, and general symptoms, as well as any signs of agitation, anxiety and depression using the PANSS. The collected data was calculated using the SPSS20, and the effects of the treatment were analyzed via covariance.

**Results:** The findings of the present study did not indicate any reduction in the positive and negative symptoms. However, the use of TDCS has significantly reduced the general symptoms and the signs of agitation, anxiety and depression. The control group did not show any significant statistical changes in the tested variables.

**Conclusion:** Given the findings of the present study regarding the influence of TDCS in reducing the general symptoms and the signs of agitation, anxiety and depression of schizophrenic patients, it seems it is essential to do more research on this topic in order to be able to take an effective step toward reducing the problems faced by such patients.

## Poster No.3015

### The Role of Low Frequency Oscillations in Attentional Modulation in Area MT

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**Introduction:** Local field potential (LFP) has been intensively studied in neuroscience recently. It is believed to mostly reflect synaptic activities of cortical neurons. The power of high frequency oscillations (30-200 Hz) in LFP signals has been shown to be dependent on the phase of low frequency oscillations (1-12 Hz) in a variety of cortical regions in different species. This phenomenon called phase-amplitude coupling (PAC) is assumed to mediate inter-regional communications in the cortex. We tested this assumption in an attention paradigm. Attention filters the most significant information in the animal's environment from primary sensory areas to higher cortical areas and can be focused on different features, objects and spatial points. Spatial attention in particular increases the firing rate of neurons that represent an attended position.

**Methods:** We investigated whether spatial attention modulates the dependency of the power of high frequency oscillations to the phase of low frequency oscillations called PAC power in LFPs of macaque MT. We trained a male macaque monkey to respond to a small direction change in one of two moving random dot patterns (RPD) moving to the same direction and ignore the direction change in the distracter RDP. Multi-unit activity and LFP signals were recorded from area MT using a five-channel Mini-Matrix system. We calculated the PAC power in trials in which the monkey attended inside the receptive field (RF) of the recorded neuron (attended condition) and in trials in which he attended outside the RF (unattended condition) for the interval 400-1400 ms after the stimuli onset. PAC power was defined as the peak-to-peak amplitude of the probability distribution function of high frequency power relative to low frequency phase averaged across different trials. The phase and power time series were taken from the same or different recording sites. In order to have an accurate estimation of PAC, we carried out the analyses on the data of sessions with at least 75 trials for each attention condition that yielded 169 site pair

**Results:** We found that attention leads to a significant decrease of PAC power in phase-power pair of (2-6 Hz, 80-100 Hz) and increase of PAC power in (7-11 Hz, 70-90 Hz) ( $p < 0.001$  for both cases, permutation test). We also found a negative correlation between the attentional modulations of PAC power at these two frequency pairs (0.22  $p < 0.01$ , Spearman test).

**Conclusion:** Our results suggest that attention uses phase-amplitude coupling between alpha (7-11 Hz) and gamma (70-90 Hz) bands to transfer the information regarding the attended stimulus to higher brain areas.



## Poster No.1013

### PINEAL GLAND, STATE OF ART

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The pineal gland or epiphysis is a small organ derived from third ventricle of the diencephalon. It is an endocrine gland of major regulatory importance. Pineal gland modifies the activity of adenohypophysis, neurohypophysis, endocrine pancreas, parathyroid, adrenal gland and pubertal development. Its effects are largely inhibitory. Irrespective of the fact that it has undergone remarkable transformations during phylogeny, the pineal organ is an important part of the biological clock in all vertebrate classes. A major pineal function is the rhythmic production of melatonin observed in all vertebrate via periodic regulation of its biosynthesis enzyme "serotonin N-acetyltransferase (SNAT)". In the pineal that contains modified photoreceptors, circadian variation in postganglionic sympathetic input causes parallel variation in SNAT activity and thus pineal melatonin production.

In the hypothalamus, suprachiasmatic nucleus that contains few thousand neurons appears to be the neural substrate for day-night cycle. It implicated also in motor activity, body temperature, renal secretion, sleeping and waking, and plasma concentration of many hormones. This may influence the activity of upper spinal preganglionic sympathetic neurons. These neurons in turn via superior cervical ganglion neurons project to pineal gland. According to current concepts, melatonin released directly to circulation after its formation. The level of melatonin in human plasma rises during darkness ( $258 \pm 44$  pg/ml of Plasma) and falls during the day ( $162 \pm 41$ ). Subcutaneous injections of melatonin in animal model provoke its high concentration in the hypothalamus and in the eye suggesting the specific receptors in these organs. By measuring the concentration of melatonin by gas chromatography-negative chemical ionization mass spectrometry, in human plasma it was demonstrated that: 1) melatonin is exclusively derived from the pineal gland, 2) propranolol and clonidine reduce melatonin levels, 3) some blind people appear to have free-running melatonin induced circadian rhythms, 4) bright light can acutely suppress human melatonin production, 5) manic depressive patients appear to be supersensitive to light, even when they are well, 6) melatonin level are greater in manic patients than in depressed patients, 7) Melatonin blocks the secretion of gonadotropins from pituitary gland and also, 8) is a neuro-protector. In addition, Anti-tumor activity of pineal gland attributed to melatonin for its anti-mitotic effect

Over all, the intrinsic rhythmicity of an endogenous circadian oscillator in the suprachiasmatic nucleus of the hypothalamus governs cyclical pineal behavior. With aging, from the second decade calcareous deposit accumulates in pineal extracellular matrix, this process induces loss of circadian rhythmicity. By immunohistochemical analysis using anti arrestin antibodies (visual arrestin or antigen-S), for the first time we demonstrated the signature of photoreceptor ontology during development of the pineal organ and retina. We identified striking variation among of different vertebrate classes. Consequently, we divided the pineal organ in four main categories: true pineal photoreceptor (amphibian), modified pineal photoreceptor (bird), pinealocyte sensu stricto (mammalian) and third eye in front of lizard. These results are in accord with the interspecific variation not only with respect of pinealocyte, but also in regard to the organization of the intra pineal neuronal network. The pineal gland as a tiny organ in the center of the brain played an important role in Descartes' philosophy. He regarded it as the principal seat of the soul and the place in which all our thoughts are formed. In the *Passions (passions of the soul, 1649)*, Descartes attached significance to the gland because he believed it to be the only section of the brain to exist as a single part rather than one-half of a pair. Most of Descartes' basic anatomical and physiological assumptions were totally mistaken, not only by modern standards, but also in light of what was already known in his time. In Conclusion, The pineal gland's function and its network in endocrine system is still a spot of a mystery. However, the pineal gland continues to have an exalted status in the realm of pseudoscience.

**Poster No.3004**

## **The Effect of Acute and Chronic Metformin on Streptozotocin -Induced Memory Loss and Hippocampal CA1 Health Neurons**

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**Introduction:** Diabetes mellitus increased the blood glucose level, oxidative stress and production of free radicals that leads to create Amyloid plaque and Alzheimer's Disease. In this investigation the effects of metformin one of the important drugs for diabetes on memory deficiency and number of CA1 pyramidal neurons in STZ - induced Alzheimeric rats were studied.

**Methods:** The experimental groups consist of control group, STZ group(3mg/kg) and care group with STZ(3mg/kg) and metformin( 200mg/kg dose in once, one week, three weeks and eleven weeks period).ICV administration of STZ was down in the first and the third day of the surgery and received metformin (ip) starting one day before the surgery to the end of care period. The animals memory were examined with passive avoidance test and the number of intact neurons in CA1 area in experimental groups were counted. The statistical analysis were performed using SPSS software and one-way analysis of variance and Graph Pad prism software.

**Results:** Injections of STZ significantly reduced memory retention( $p < 0.001$ ) and intact neurons in CA1 area( $P < 0.001$ ) compared to the control group. Metformin in once( $P < 0.001$ ), one week( $P < 0.001$ ), and three weeks( $p < 0.01$ ) period improved the effects of STZ on memory loss and increased the number of intact neurons( $p < 0.001$ ) in CA1 area compared to the STZ group. Eleven weeks metformin can not improved the memory and the number of intact neurons significantly.

**Conclusion:** The chronic use of metformin in long time in diabetic patients lead to memory deficiency.

## Poster No.2013

### **A Novel Approach to Investigate Cognitively Normal State to Mild Cognitive Impairment Transition Using Structural Covariance Network of Gray Matter Atrophy. Right Parahippocampal Gyrus as a Key Region**

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**Introduction:** Morphometric imaging measures are sensitive biomarkers of brain anatomical changes. Using cortical-thickness data for constructing connectivity matrices gives one the ability to use global and regional measures of graph theory in networks. We are aimed to investigate difference between MCI-converters and non-converters using network of atrophy ratio.

**Methods:** We used Alzheimer's Disease Neuroimaging Initiative (ADNI) online database. Cognitively normal population (NL) were divided into two groups. 1)Converters to MCI at least after 2years of follow up as NL(N=33)and 2)staying stable as NL for at least 8years(N=47).The statistical model adjusted for Age, Gender, Handedness and educational status. Baseline and year-one Cortical-thickness average (TA) and subcortical-volume (SV) measures of FreeSurfer from longitudinally registered 1.5T T1 images were used. After QC, atrophy (thinning) ratio calculated by“1-(endline/baseline)” for each ROI(68TA and 18SV),Scaled for TA and SV separately and used to make connectivity matrices for each group. Graph Analytical Toolbox (GAT) used for further connectivity analyses, where connectivity means the correlation between thinning ratio of two regions.

**Results:** Global: Significantly ( $p.val < 0.05$ ) lower mean Clustering coefficient both in minimum density of full connectivity and in AUC across densities. Regional: Right-Parahippocampal gyrus(R-PHG) showed highly significant ( $p.val = 10^{-8}$ ) more nodal-degree in non-converters.

Conclusion: nodal-degree in R-PHG of converters is an indicator of its different atrophy ratio in comparison with other brain regions, noteworthy more sensitive than hippocampal atrophy here. R-PHG was previously suggested as an early biomarker of AD in functional connectivity studies.

**Conclusion:** These results demonstrate a potential for prediction of NL-MCI transition. Significantly higher clustering coefficient in non-converters can be seen as harmonized atrophy across different regions condensed in various clusters. Impaired unequal atrophy ratio results in disconnectivity and decrease in network clusters.

**Poster No.3005**

## **Comparing Brain and Heart Waves Among Individuals With Good and Poor Prospective Memory Performance**

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**Introduction:** all cognitive processes somehow relate to brain states. Prospective memory, remembering cognitive ability to perform specific actions at some time in the future. Studies have shown that during the prospective memory tasks, the frontal, Coupled with frontoparietal networks, Anterior Cingulate Cortex, Posterior Cingulate Cortex, temporal cortex and insula are more activity in maintenance and understanding the intentions of prospective memory. The heart rate and heart rate variability during cognitive tasks can be predict qualitative differences in cognitive function between people. This study aims to assess neurocognitive and physiological in individuals with good and poor Prospective memory performance using computerized cognitive task and brain and heart frequency bands.

**Methods:** In this study 68 students (22 with good Prospective memory performance and 29 with poor Prospective memory performance) were selected using call and screening method (computerized cognitive task TBPM) and were studied according to a causal- comparative method. computer cognitive task (TBPM) was used to evaluate prospective memory and Procomp2 -Thought Technology Ltd was employed for EEG recordings at Fz (10-20 International Placement System. Multivariate analysis of variance (MANOVA) was used for comparesons between groups.

**Results:** The results showed significant difference between the two groups with good and poor Prospective memory performance scores in brain wave of (Alph band) Low alpha Ep mean) ( $p < 0.001$ ), (Low alpha Ep mean (long)) ( $p < 0.0009$ ), (Alpha Ep mean) ( $p < 0.001$ ), (Alpha Ep mean (long)) ( $p < 0.0009$ ), (Alpha mean) ( $p < 0.001$ ). and heart wave of (BVP IBI std. dev. (SDRR)) ( $p < 0.01$ ), (BVP VLF total power mean) ( $p < 0.02$ ).

**Conclusion:** Results showed that brain waves in the alpha band and heart waves on the heart rate variability is higher in individuals with good prospective memory performance. In fact, heart rate variability during prospective memory cognitive task can be to explain qualitative differences in cognitive function between individuals.

## Poster No.2014

### Effectiveness of PARSI cognitive rehabilitation program in improving social cognition and emotion recognition of children with attention deficit and hyperactivity disorder

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**Introduction:** Attention Deficit and Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder. Deficit of emotion recognition has negative effects on children with ADHD. The purpose of current study is to determine the effects of PARSI cognitive rehabilitation program on emotion recognition and social cognition of children with ADHD.

**Method:** this study is of experimental nature with single test design. Participants were 6 children with ADHD, aged 7-12 years. Children were randomly assigned to either an intervention (n=3) or control group (n=3). The former group received PARSI intervention based on emotion recognition and social cognition for 5 weeks, 2 sessions per week, every session lasting for 1 hour. The assessment was done in 5 phases, two weeks before the treatment, one day before the treatment, 5 sessions after treatment, 10 sessions after treatment and two weeks after the treatment. False belief test, 38 Theory of mind questionnaire items, Nimstim of emotion recognition test and Ekman of emotion recognition test were used as research tools. Data analysis was performed by visual analysis chart and effect size was computed subsequently.

**Results:** To determine amount of variation on each test, percentage of non-overlapping data (PND) was assessed which turned out to be 100 percent for experimental group and 33 percent for control group. Thus, it can be concluded that unlike the control group, emotion recognition scores, and social cognition scores in experimental group reveal a significant variation.

**Conclusion:** Findings of the present study demonstrated significant improvement in emotion recognition and social cognition of children with attention deficit and hyperactivity disorder and confirmed that PARSI rehabilitation program can be used for improving emotion recognition and theory of mind in children with ADHD.

## Poster No.2015

### Structural and Functional Alterations in Insomnia: An Activation Likelihood Estimation Meta-analysis

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**Introduction:** Neural mechanisms underlying insomnia, the most prevalent form of sleep disorders, are poorly understood. Functional and structural neuroimaging has been widely applied in patients with insomnia, but these studies have often yielded diverse results. The present study aimed to identify consistent and specific structural deficits and abnormal activation in patients with insomnia compared with good sleepers.

**Method:** We conducted our search on PubMed database between December 1993 to July 2015 and included all whole brain functional magnetic resonance (fMRI), voxel-based morphometry (VBM) and positron emission tomography (PET) studies on patients with insomnia and healthy controls. Stereotactic data were extracted from 9 studies that included 228 patients and 228 control subjects. Subsequently, we applied activation likelihood estimation procedure to find the consistent patterns across previous literatures.

**Results:** The convergent findings across all previous insomnia-fMRI studies is in the left inferior frontal gyrus (IFG). PET and VBM studies did not contribute to this result at all, maybe due to the low number of them.

**Conclusions:** IFG is an important region involved in attention and emotion regulation and many other functions. Our results highlight the role of IFG in the neurocognitive processing abnormalities, that are common among patients with insomnia

**Poster No.3006**

## **Source Localization using EEG and fMRI: A Step Toward Multi-Modality**

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**Introduction :** One of the main purposes of brain imaging techniques is to localize the active neuronal regions of the brain. Electroencephalography (EEG) measures the neural electrical activity of the brain, in the scale of milliseconds with no information about the spatial location of active neurones. Functional magnetic resonance imaging (fMRI) measures the active areas of the brain by blood oxygenation level dependent (bold) contrast images, with limited resolution in time. In this abstract, we explain solving the ill-posed problem [1] of localizing the neural sources using EEG, by using sparse constraint. A model is also introduced to estimate these sources using bold signal. We compare the two methods to shed light on a future work of combining these two imaging techniques into a unique multi-modal framework for a good spatio-temporal resolution of the estimation.

**Methods:** The aim of the EEG inverse problem is to estimate the activation of neural sources at every time instant corresponding to EEG. This problem does not have a unique solution, since the number of observation channels are much smaller than the number of sources. However, by using the sparse hypothesis about the solutions, the problem can be solved, because we can hypothesize that a certain task only activates certain parts of the brain at the same time. Proximal algorithm is used here for its ability to solve the problem when the regularisation (sparse) penalty term is not differentiable [2]. The bold signal has a roughly linear relationship with the underlying neural activities. This can justify an inverse problem for the bold signal [3] meaning that the neural activities can be estimated if we are given the bold responses of the fMRI. According to the balloon model [4], we write the bold response as the linear convolution of the neural activity and a model of the hemodynamic response.

**Results:** EEG and fMRI are recorded at the same time from subjects while doing a motor imaginary task (clenching the right hand repeatedly). The explained methods using EEG and fMRI are applied. The results show that EEG has estimated the neural activities with high temporal precision. It has also detected activities in the left motor cortex and in supplementary motor area; however, it has detected activities in the visual cortex which might be caused due to the instantaneous activity that is observable in EEG, but not in fMRI. fMRI has detected a higher activation of the left motor cortex, but the result has low temporal resolution. It is therefore clear that the two modalities can be complementary to each other. So, if a computational approach can be used in this regard, it can benefit from this fact to have a more precise estimation. One of the main concerns of multi-modal co-registration is the spatial mapping of electrode positions onto the head coordinate space recorded in MRI [5]. This is done to have a model of the head. Here, a 3-layer spherical model is used [6]. We used some experiments to model the head and to label electrodes in the anatomical coordinate. The localization of the EEG sources in this anatomical structure can be achieved using the high contrast T1-weighted MR images to identify the regions of gray matter as the possible locations of EEG sources. (For the illustration of the 3-layer head model, see Figure 3).

**Conclusion:** The problem of the estimation of neural sources was tackled in this document using EEG and fMRI, by using sparse constraints. The results of the two approaches illustrate the advantages and limitations of each of the methods. The complementary characteristics of the two modalities made us record EEG and fMRI simultaneously to have the first experimental joint analysis, since the previous researches have focused more on simulation results.

## Poster No.3014

### Neural representation of feature conjunction in the prefrontal cortex

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**Introduction:** Feature conjunction is a concept of visual coding in neuroscience. It will arise when two features are combined into unitary percepts. Recent studies suggested that a primate brain involves conjunction of features each coded in a separate sensory area.

In this project a decoding method based on frequency domain feature extraction is proposed to show the separate coding of color, motion and conjunction of both in visual system. The purpose of this study is to investigate the neural difference between the conditions in which the two features are integrated together or not. This involves analyzing especially local field potentials (LFPs) with the aid of machine learning algorithms to find signal components that might be selective for integration of visual features.

**Methods:** For this purpose, we trained one monkey to do a visual delayed match to sample task to match a sample and a test stimulus in each trial based on a rule given at the beginning of the trial. In each trial the monkeys are expected to match the color, the direction of motion or both components of the sample stimulus to that of the test stimulus. Sample and test stimuli consist of two sets of overlapping patches of moving dots that are initially distributed randomly on the screen. The LFP was recorded from lateral prefrontal cortex (IPFC) of the monkey. The animal was implanted with an electrode array of 96 channels on IPFC region. First, the colors and directions are decoded separately based on a machine learning algorithm. Next, a series of frequency, time and time-frequency feature was considered to classify the conjunction feature. Support vector machine (SVM) classifier was used to classify the two conjunction conditions.

**Results:** The results show the coding of color and motion conjunction in IPFC is coded based on different features of coding of color or motion separately.

**Conclusion:** In this study we find the coding of color, direction and the conjunction of color-direction in IPFC. Although the decoding performance of conjunction is weaker than the coding of color or direction separately, the results show decoding of conjunction in this area is significantly above chance.



## Poster No.2016

### Effects of peripheral sympathetic block on neural correlates of painful limb movement; an fMRI case study

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**Introduction:** Acute pain is an effective alarm system that protects individuals from environmental hazards but pain perception that sustains after the resolution of the initial acute injury is maladaptive. This was the case in one peculiar patient of our clinic. A 35 yrs. old woman complaining from pain on movements of her left shoulder. The pain sensations started after an acute trauma and persisted for more than 4 years. After ruling out the central and peripheral structural abnormalities as probable cause of the symptoms, the case turned out to be a clinical diagnosis dilemma. Recent literature underscores the role of central mechanisms, besides peripheral factors, in chronic pain states. We used fMRI to reveal the neural correlates of pain perception in this patient, hoping to unravel the probable functional etiology.

**Methods:** The subject participated in two fMRI scan sessions, separated by fifteen days. The first session was run during a routine visit. Second session was run one hour subsequent to patient undergoing *peripheral sympathetic nerve blockade* procedure. The fMRI task consisted of alternating painful and non-painful limb-rising periods (18s) interleaved by rest periods (18s). This sequence was repeated nine times in each session. We used statistical parameter mapping (SPM) and region of interest analyses to compare the pattern of pain-related [painful > non-painful] BOLD responses before and after the palliative nerve block procedure.

**Results:** In the pre-block session, pain-related activations were observed in distributed occipito-parietal and frontal regions. Deactivation was observed in regions of left inferior, middle, and medial frontal (IFG, MiFG, MeFG) and, to our interest, in the left anterior cingulate cortex (ACC) as well as anterior portion of right para-hippocampal gyrus. In the post-block session the test revealed activations in left precentral/postcentral gyri, regions in Left precuneus, and right cerebellar crus I.

Nerve block resulted in a significant change in pain-related responses in the areas of left IFG, Left MeFG, left ACC, Right fusiform gyrus, and bilateral crus I/II of cerebellum.

**Conclusion:** Overall, the finding of atypical pain responses in the pre-block scan and the modulation of activities in ACC and PFC following nerve block provide evidence for abnormal central pain processing in this patient. Comparison of pain-related activities in this patient with literature on findings from chronic pain patients. supports the diagnosis of sympathetic mediated pain in this patient. We discuss that fMRI could be envisioned as a prospective tool for diagnosis of chronic pain etiologies.

## Poster No.1008

### The role of deficient fear conditioning as a malfunction of Amygdala in proactive aggression

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**Introduction:** Proactive aggression, the cold and calculated form of aggression, may predispose adolescents to conduct problem and psychopathy in future. Impairment in fear conditioning is one of the characteristics of proactive aggressive people leading them to be apathetic toward the consequences of their behaviors. On the other hand, many studies highlighted the role of amygdala as an essential component in a neural network influencing on fear conditioning. So it is theorized that proactive aggression is underlined by the malfunction of Amygdala. Given the role of Amygdala in fear conditioning, this study aims to explore the role of this brain structure in outbreak of proactive aggression by the use of the partial conditioning task.

**Methods:** In this regard, two groups of adolescents selected in convenience, filled proactive and reactive questionnaire (Raine et al, 2006). There were two groups of adolescents. One scored higher than median in proactive aggression subscale (n= 25) and the non-proactive group who got scores lower than median (n=41). For the conditioning task, monochrome color slides (green) were used as the conditioned stimulus, a startling aversive white noise (100 dB) as the unconditioned stimulus. Simultaneously electrodermal activity (SCR), a well-known index of Amygdala activity, were collected. Each experiment compromised of habituation, conditioning and extinction phases. The magnitude of SCRs in each phase were compared among two groups

**Results:** The ANOVA revealed a significant main effect of conditioning phases. But results did show no significant main effect of groups or an interaction of groups and conditioning. However, both groups acquired conditioning but a visual inspection of their patterns showed some differences. Differences in extinction phase and habituation effect between proactive aggressive adolescents and non- aggressive one were seen.

**Conclusion:** It seems that the regulation of fear and emotional memory and response related to Amygdala function is impaired in proactive aggression. It is suggested to repeat this experiment in clinical samples with higher scores in proactive aggression to get more precise results.

**Poster No.2017**

**THE FUNCTIONAL DIFFRENCES ASSOCIATED WITH CLINGING BEHAVIOR THROUGH FMRI IMAGES AMONG BORDERLINE PERSONALITY DISORDER PATIENTS AND NORMAL POPULATIONS**

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Neuropsychological and imaging studies of patients with borderline personality disorders (BPD) are suggestive of frontal lobe dysfunctions in these individuals. In normal subjects, functional brain imaging has been used to investigate the neuroanatomy of impulse control. There are no such imaging studies for personality disorders specially in clinging behaviors.

This study aims to investigate which neuronal networks are involved in behavioral differences of BPD patients in comparison with healthy populations. We will study 20 borderline personality disorder patients and 20 matched controls. According to autobiographical interview key words will be defined for rejecting and neutral episodes. In a block designed fMRI task patients will recall these episodes. Contrast between rejecting condition and non-rejecting condition will be analyzed. We hypothesis there will be some functional differences in the frontal lobe and limbic area in the borderline personality disorder patients in comparison with normal populations according to their responses to rejecting task.

**Poster No.3007**

## **Interrupted Brain Network Topology in Children with Dyslexia: An EEG Study**

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**Introduction** Large-scale brain network analysis may yield insight into structural and functional changes during life, and reveal deviation from normal trajectories that result in disorders such as dyslexia, learning disability, attention deficit, and autism. Neuroimaging research suggested abnormalities in the organization of functional networks in developmental dyslexia. Here, we examined differences in the topological properties of functional networks between dyslexics and typically reading children (3<sup>rd</sup> grade) using graph analysis. Graph metrics characterize brain networks in terms of integration and segregation.

**Methods:** We used EEG resting-state data and calculated weighted connectivity matrices for multiple frequency bands using the phase lag index (PLI). From the connectivity matrices we derived minimum spanning tree (MST) graphs. A number of metrics were computed from those graphs and statistical analyses were performed on these metrics as well as on the averaged PLI connectivity values.

**Results:** Based on standard graph theory measures of the whole-brain functional network, we measured efficiency and clustering coefficient of weighted networks, as well as the leaf number and tree hierarchy of minimum spanning tree. It is observed that efficiency and clustering coefficient have significant difference in multiple frequency bands with consistent decrease in efficiency, while clustering coefficient increases in delta and theta frequency bands, and decreases in multiple bands. Minimum spanning tree reveals rather hierarchical organization of the brain network in interrupted network.

**Conclusion:** Results indicate that lower efficiency and higher organizational network are features of dyslexia disorder, and implies the significant of the detection of the impairment during childhood using brain network topology.

**Poster No.3016**

## **Stress functionally rewires the brain: an EEG base study**

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**Introduction:** Stress is key for survival, but long stress can be detrimental. Therefore, for preventing possible risks after experiencing a stressful condition, it is essential to control stress level. In this regard, EEG studies have shown that in a stressful condition, pattern of brain-wave oscillation changes. These changes are associated with changes in cortisol level. But it is still unclear how the brain areas work together to stop hypercortisolism and control the amount of released cortisol? Therefore, in this research, we use the functional connectivity (FC) approach to discover this important fact.

**Methods:** Resting state EEG was recorded from 20 male subjects (23.47±2.67 yrs. old) in three sessions including before stress, after stress and 20 minutes after rest. Stress was induced by trait social stress test. After standard preprocessing, band specific FC maps were extracted by measuring partial correlation between all pairs of 30 channels. Subsequently, FC maps of three conditions were statistically compared and the significant changes were recognized. A paired t-test was applied between data of (1) before and after stress condition to identify how stress changes the brain connectivity pattern (2) after recovery and stress condition to identify how brain behaves after stress and if it could suppress the stress effects by changing its pattern of connectivity.

**Results:** According to figure 1, brain FC changes from “before” to “after inducing” stress condition appeared mostly in the fronto-temporal connections especially in delta, alpha, beta and gamma bands. In addition, from “after stress” to “20 minutes after release of stress”, a significant FC alteration ( $P < 0.05$ , FDR corrected) was also observed at the temporo-parietal connections especially in theta and beta bands. This flexibility in changes of the brain functional connections has an important role in inducing and changing of the stress effects. Interestingly, changes in FCs are significantly correlated with relative cortisol level.

**Conclusion:** Variation of stress condition will influence the cortisol level in a way to change the FCs. This rewiring pattern could help ones to cope with a stressful situation and prevent its consequences.

**Poster No.2018**

## **Functional areas of the brain have intrinsic temporal variabilities**

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**Introduction:** Scientists have used to average time series activities of the brain regions in neuroimaging studies. It is believed that averaging reduces noise level and enhance signal to noise ratio. Although, there might be information in the noise which is removed by averaging. Over the past several years, many researches have shown that variability is a useful feature of the brain activity. It is beneficial for learning, cognition, and perception and it has been also being indicated in aging and neurodevelopmental disorders. In fact, temporal variability is a helpful attribute in resting state recordings where stimuli or tasks are absent and customary denoised signal is meaningless.

**Methods:** In this study, we included f/MRI data of 40 healthy control subjects. All the subjects were selected from a dataset of New York University Child Study Center. All images were collected using 3T Siemens Trio system. Each participant underwent a T1-weighted structural MRI and a task-free fMRI scan in the same session (MRI: TR/TE = 2530/3.25 ms, flip angle = 7°, isotropic voxel size = 1.3 \* 1 \* 1.3 mm<sup>3</sup>, and 6-min task-free fMRI: TR/TE = 2000/15 ms, flip angle = 90°, matrix = 64 \* 64, voxel size = 3 \* 3 \* 4 mm<sup>3</sup>). Subjects were instructed to "keep your eyes open/close, relax, and remain awake". The brain images were then parcellated according to CC400 functional atlas (Craddock et al., 2012) and time series of 392 regions were extracted. Standard deviation of resting state BOLD signal was considered as variability of the brain region activity. Then, data of all the subjects we averaged to ignore individual differences and we named it as Intrinsic Temporal Variability (ITV) of the region. Subsequently, we did a bootstrapping shuffle test for this metric and found variability of 238(out of 392) regions significantly differ from the chance and are specified to them.

**Results:** To look at ITVs diversities of the brain regions, we used a region specific paired sample t-test on the distributions of the variabilities for all the subjects. In most paired comparisons, distributions showed a significant dissimilarity. It seems that brain regions have various variabilities but their biological underlying mechanism needs to be explored.

**Conclusion:** In this research, we introduced a useful characteristic of the functional brain areas, entitled as "Intrinsic Temporal Variability". It's based on familiar concept of BOLD signal variation, measured from the resting state fMRI. Results of this work has obtained from a neuroimaging point of view and its' correspondence to physiological basis requires further studies.

## Poster No.3008

### A new framework for EEG-based computer-aided diagnosis of depression using multi instance learning over the Riemannian manifolds

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**Introduction:** Depression is a common disorder, which as predicted by the World Health Organization, it would be the second largest burden of disease by 2020. Routinely, the depression is diagnosed by clinical interview, which is unreliable. EEG-based CAD as a quantitative method for diagnosis can help clinician to increase the confidence of diagnosis. In a CAD system, the robustness of the system is crucial as the major requirement for actual clinical practice. We achieved this goal by considering the non-stationarity of the signal by describing each subject using a bag of concepts in the multi instance learning (MIL) framework and describing the concepts robustly using spatial covariance matrices.

**Methods:** To have a robust representation of EEG signals, first we use the spatial covariance matrices of EEG signals in different time segments as descriptors of that signal. The space of SPD matrices (covariance matrices) can be formulated as a connected Riemannian manifold. We use Log-Euclidean distance [8] to compute geodesic distance over this manifold. To have a representation of the signal that considers its non-stationarity, we represent each subject using a bag of different concepts (covariance matrices of different EEG segments) and compute the similarity between two different subjects in the bag-level using kernel approach without explicit inducing the concepts. The similarities are computed using Log-Euclidean Gaussian kernel.

**Results:** We use a dataset composed of EEG signals of 25 normal and 25 depressed subjects, which were recorded according to the 10–20 recording system in eyes-open and eyes-closed resting conditions for 5 minutes and 500 Hz sampling rate. Covariance matrix for describing EEG signal is compared with some common methods including Higuchi, spectral entropy, band power, and AR method. The experimental results show the superiority of covariance matrix in comparison with other competitors in both eyes-open and eyes-closed resting conditions with 64% and 60% accuracy. As the other experiment we compare the proposed approach with some other covariance-based representations. The experimental results confirm the superiority of the MIL-based approach with 86% and 96% accuracy in eyes-open and eyes-closed resting conditions.

**Conclusion:** In this paper, we proposed a new representation for piece-wise stationary EEG signal using MIL framework and applied it to diagnose depression. Experimental evidences confirm the superiority of the proposed approach in comparison with other competitors. This superiority is the result of considering the non-stationary nature of EEG signal in representation step using MIL framework, and applying covariance matrix as the basic descriptor which intrinsically attenuates the noise contribution.

## Poster No.1003

### Effects of chronic ghrelin on synaptic plasticity and long-term potentiation in hippocampal dentate gyrus following amyloid $\beta$ -induced Alzheimer's disease

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**Introduction:** Alzheimer's disease (AD) is a multifactorial progressive neurodegenerative disorder characterized by loss of memory and cognitive deficits, influenced by the metabolic status, in which the impairment of neuropeptides/neurotransmitters systems, cerebrovascular deposits of amyloid have been previously observed. Ghrelin is a multifunctional hormone produced in a wide variety of tissues, which has been associated with the progression of obesity and metabolic syndrome, but has been also linked to neuromodulation, neuroprotection, memory and learning processes. This study investigated the effects of ghrelin-induced memory retention on amelioration of cognitive deficits via restoration of long-term potentiation and induction of synaptic plasticity in hippocampal dentate gyrus (DG), using a rat model of AD induced by amyloid- $\beta$  (1-42) injection.

**Methods:** Five groups of male rats (n=40, 230–270 g) including control (intact), sham-operated, ghrelin-treated (200 ng /rat, intracerebroventricular (ICV), daily for two weeks), A $\beta$ 1-42 injected (5  $\mu$ l/rat) and A $\beta$ 1-42 plus ghrelin-treated animals were designed. Ghrelin was administered after an ICV injection of A $\beta$ 1-42. To assess cognitive performance and the motor dysfunction, passive avoidance tests and open-field were performed, respectively. Step-through latency (STL) was evaluated as learning and memory index. Intrahippocampal field potential recordings were done and LTP were used to detect the electrophysiology changes.

**Results:** Results showed that following A $\beta$ 1-42 injection, STL and induction of LTP were significantly decreased whereas ICV injection of ghrelin significantly enhanced memory retention by improvement of STL and restitution of LTP in DG with increased EPSP slope and PS amplitude, suggesting the involvement of ghrelin in postsynaptic mechanisms of hippocampal LTP.

**Conclusion:** It was revealed that neuroprotective effects of chronic ghrelin not only can enhance but also can restore LTP in DG area in A $\beta$ -induced AD. These results suggest that ghrelin may be considered as a promising therapeutic agent to alleviate cognitive deficits of AD.



## Poster No.1017

### Local functional connectivity changes in autism using resting-state functional magnetic resonance imaging

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**Introduction:** The inherent heterogeneity of autism presents great challenges for researchers, but evidence across neuroimaging modalities is now converging, implicating aberrant connectivity patterns involving numerous functional networks. Given the complexities and inconsistencies of the autism spectrum disorder (ASD) literature, data-driven techniques can provide unbiased approaches to uncovering connectivity pattern. Based on our understanding of the brain as a complex network, graph theory is applied to examine differences in connectivity patterns at the regional level between the ASD and healthy control groups. Graph theoretical analyses are used to capture the local parameters of the intrinsic connectivity network using resting state functional magnetic resonance imaging data. According to the graph theory, functional connectivity networks can be depicted as graphs composed of nodes representing regions with the edges representing connectivity between them.

**Methods:** We included 29 high-functioning adolescent and male adults with autism ( $20.49 \pm 6.16$  years old) and 31 male healthy controls volunteers ( $21.75 \pm 8.24$  years old). Resting state functional magnetic resonance imaging (fMRI) data were previously collected by the Siemens 3 T platform using a single-shot EPI sequence with following parameters: TR:2000 ms, TE: 28 ms. The preprocessed resting state fMRI dataset were parcellated into 116 regions using anatomical templates defined by Tzourio-Mazoyer et al. and the mean time series for each region extracted. Hence, the undirected weighted functional network was constructed using values of connectivity strength between regions based on partial correlation. Partial correlation analysis helps to remove the effect of indirect paths. To assess local network properties, graph theoretical measures were used to quantitatively describe connectivity patterns at the regional level. In spite of the individual variability, we analyzed local parameters of the brain functional connectome in autistics and compared them with healthy controls. Statistical evaluation was based on the differences between the means of local graph measures in two groups using several cost functions (1-40). The statistically significant level of difference was considered to be at FDR corrected.

**Results:** Nodal graph metrics provide information about local interactions among one region to other regions. Comparison between ASDs and controls using nodal metrics of the brain network presented in the red colour indicates enhancement of the metrics in ASDs compared to controls, while the blue colour denotes decrement. Significant group differences were observed in five nodal metrics including betweenness, degree centrality, closeness, efficiency and nodal clustering coefficient. The results indicate that ASD vigorously influence supra marginal region. In addition, statistical analysis in local parameters of functional network between controls and individuals with autism demonstrated that more differential nodal parameters observed at the right hemisphere regions.

**Conclusion:** Our findings suggest that partial correlation method can reveal mechanisms of abnormality in autism spectrum disorder. #Alteration of the functional connectome due to autism shows region-specific characteristics. Only limited regions of the brain in autistics people show significant abnormal properties in comparison to control group. Significant changes at the nodal metrics mostly in terms of centrality in ASDs compared to controls. For the future studies, significantly altered regional metrics showed a great potential to be used as an objective measure for automatic screening of autism

**Poster No.1012**

## **Hemodynamic response of prefrontal cortex to emotional stimuli using functional near-infrared spectroscopy**

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**Introduction:** Despite having relatively poor spatial and temporal resolution, near-infrared spectroscopy (NIRS) has several methodological advantages compared with other non-invasive measurements of neural activation. For instance, the unique characteristics of NIRS give it potential as a tool for investigating the role of the prefrontal cortex (PFC) in emotion processing.

**Methods:** The aim of this study was to elucidate the similarities between hemodynamic changes and emotional effects during processing of audio-visual stimuli using functional near-infrared spectroscopy. Changes of excitement was recorded simultaneously with hemodynamic measurements as potential biological markers of emotion related to the middle prefrontal cortex. These multiple measures were then related to the self-report correlates, which is the subjective appraisal in term of valence and arousal by using SAM rating. The relative oxygenated and deoxygenated hemoglobin concentration ([oxy-Hb] and [deoxy-Hb]) changes in the frontal region were monitored using a four-channel continuous-wave NIRS system. In addition, an inexpensive electroencephalogram headset (Emotiv Epoc) device was used, which can detect positive mental states like excitement according to neurological activities. Ten male subjects matched for age, sex, handedness, and years of education were included. They were submitted to emotional cues processing (IAPS) when fNIRS and Emotiv were recorded.

**Results:** The correlation between whole parameters such as hemodynamic changes, arousal, valence, and excitement were calculated for each channel. Results indicated reliable correlation ( $r > 0.3$  and  $p < 0.05$ ) between arousal and both oxygenated and deoxygenated hemoglobin concentration while it is deoxygenated hemoglobin that is more correlated with arousal.

**Conclusion:** It is highly likely that selecting middle prefrontal region and its activities leads to less correlation between valence and the other parameters. On the other hand, there is a significant correlation between power of excitement signals and oxygenated hemoglobin, rather than its initial stage. It means that long term excitement as a slow change parameter may follow the pattern of HbO<sub>2</sub> in PFC.

## Poster No.1014

### Overlapping neural correlates of impulsivity and hypomania in Parkinson's disease

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*\*F.S. & M.T. contributed equally to this study*

**Introduction:** Impulsive behaviors and hypomania are common non-motor symptoms in Parkinson's disease (PD). While they have some clinical similarities, presented in PD patients, the neuronal correlates of impulsivity and hypomania, and their relation to each other regarding the regional network activity in terms of glucose metabolism, has not been well elucidated yet. The aim of this study is to find out the regional overlap associated with impulsivity or hypomania in PD.

**Methods:** We recruited 24 right-handed, non-demented, not-depressed PD patients. We measured impulsivity score for each patient based on Barratt Impulsiveness Scale (BIS-11)5. Furthermore, Hypomania-score was measured for each patient using Mania Self-Rating Scale (MSS). 18-fluoro-deoxy-glucose positron emission tomography (FDG-PET) imaging was performed in all of 24 subjects. Two separate multiple regression analyses were performed in SPM 8 1) between FDG-metabolism data and BIS-11 scores and 2) Between FDG-metabolism data and MSS scores. Subsequently, we compared FDG-metabolism associated with impulsivity and hypomania to find an overlapping region.

**Results:** The Results have indicated the positive association between impulsivity and voxel activity in the left ACC, right superior frontal gyrus and pars opercularis. Furthermore, there is a positive association between hypomania and voxel activity in the right middle frontal gyrus, right paracentral gyrus and right paracentral lobule. Thus, based on the results, the regional overlap between metabolism correlates of impulsivity and hypomania have identified in the middle frontal gyrus.

**Conclusion:** Our findings provide evidence that impulsivity and hypomania in PD have overlapping neural correlates, suggesting specific brain areas being linked with both of the symptoms. A previous study found a role for the middle frontal gyrus in contingency awareness during conditioning, correlated specifically with the acquisition of awareness on a trial by- trial basis. A lack of this awareness could be seen as a common trait of patients suffering from impulsivity or hypomania.

## Poster No.3009

### Alteration of functional brain network during the development in infancy period

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**Introduction:** This study involves discovering of changes in the brain functional network in course of development. One of the helpful solution to investigate these changes is minimum spanning tree (MST). The MST is superior to other methods since it does not need a spurious threshold or fixing number of nodes and edges. Parameters of the MST including diameter, betweenness, leaf number, eccentricity and hierarchy could be used for investigation of changes in a network.

**Methods:** In a longitudinal study, resting state EEG of 15 infants (7 girls, full term) were recorded at 6-month and 18-month of the age. After standard preprocessing of the EEG data, brain functional network was estimated using the phase lag index (PLI). Subsequently, the MST and its parameters were calculated from the weighted PLI (WPLI) connectivity matrix [3]. Considering our previous findings on power spectrum analysis, the WPLI matrix was estimated in four different frequency bands including delta (1-4 Hz), alpha(7-10 Hz), beta(13-23 Hz), gamma(30-40 Hz).

**Results:** The results showed a frequency specific pattern of changes in the brain functional connections. The functional networks related to the frequencies which are enhanced during the development (eg. gamma), showed increase of eccentricity and diameter while leaf number, betweenness and hierarchy were decreased. Interestingly, contradictory results were observed for the networks related to those frequencies which are declined in course of development (eg. delta).

**Conclusion:** The findings indicate that complexity of the brain functional organization reversely follows the changes in oscillatory pattern in infancy period.

## Poster No.1010

### Comparison alpha in asymmetry after efficacy of neurofeedback with alpha in asymmetry after efficacy of tDCS on depression Patients

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**Introduction:** The present study aims to Comparison alpha in asymmetry after efficacy of neurofeedback with alpha in asymmetry after efficacy of tDCS on depression Patients.

**Methods:** The research design was Quasi-experimental research methods with pretest-posttest control group. Sample included 75 depression Patients (25 subject in experimental group for neurofeedback intervention and 25 subject in experimental group for tDCS intervention and 25 subjects in control group). The experimental group for neurofeedback intervention received 20 session and experimental group for tDCS intervention received 10 session of intervention.

In this study, DASS-42 questionnaire and neurofeedback, tDCS, QEEG devices was used to collect the data.

**Results:** Neurofeedback treatment than tDCS treatment was more effective on alpha in depression. The rate of recovery remained stable in the follow up phase (1 month after intervention).

**Conclusion:** Using neurofeedback can be an effective way in preventing or reducing depression.

**Poster No.1007**

**Effect of Anodal and Cathodal Transcranial Direct Current Stimulation on DLPFC on Modulation of Inhibitory Control in Attention Deficit and Hyperactivity Symptoms**

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**Introduction:** The purpose of this study was to improve the inhibitory control functions through transcranial direct current stimulation (tDCS) in adolescents with ADHD symptoms.

**Methods:** Twenty high school students with ADHD symptoms participated in this single-blinded, crossover, sham-controlled study. All the participants were tested during the application of Stroop and Go/No-Go tasks that is used to measure inhibitory control, using 1.5 mA of tDCS for 15 min over the left dorsolateral prefrontal cortex (DLPFC).

**Results:** Anodal stimulation on left DLPFC had no effect on interference inhibition during the Stroop task and increased the proportion of correct responses in the “Go stage” of the Go/No-Go test compared with sham condition. Cathodal stimulation on the left DLPFC increased the inhibition accuracy in the inhibition stage during Go/No-Go task in comparison with sham

**Conclusion:** tDCS over the left DLPFC of adolescents who suffer from ADHD symptoms can improve inhibitory control in prepotent response inhibition.

## Poster No.3010

### Motor Performance in Relation with Sustained Attention in Children with Attention Deficit Hyperactivity Disorder

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**Introduction:** present study compare relationship between motor performance, sustained attention and impulse control in children with Attention Deficit Hyperactivity Disorder and normal children.

**Methods:** in this descriptive\_ analytic study, 21 boys with ADHD and 21 normal boys in the range of 7- 10 years old was participated. Motor performance by using Bruininks Oseretsky Test of Motor Proficiency and sustained attention and impulse control by using Continuous Performance Test were evaluated.

**Results:** analysis by T\_Test and Mann\_Whitney revealed significant difference between ADHD group and normal group in gross, fine and battery motor performance also sustained attention and impulse control ( $P<0/0001$ ). Analysis by Z\_Fisher test indicated no significant difference between Correlation Coefficient of inattention and gross motor performance in two groups ( $P=0/276$ ) but significant difference between Correlation Coefficient of inattention and fine ( $P<0/0001$ ) and battery ( $P<0/0001$ ) motor performance were shown. Correlation Coefficient impulsivity and gross ( $P=0/379$ ), fine ( $P=0/92$ ) and battery ( $P=0/562$ ) motor performance shown no significant difference between two groups.

**Conclusion:** according to study results there was relationship between sustained attention and impulse control and most of motor performance in both groups. therefore this findings help Occupational Therapist to determine rehabilitation priorities and to use exact strategies in order to enhance motor performance in children.

Poster No.3012

## Comparison of Blind Source Separation Methods in Muscle Artifact Correction of Dense Array EEG

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**Introduction:** Scalp electroencephalogram (EEG) recording is a useful modality to evaluate patients with epilepsy before surgery. Although EEG signals display synaptic activities directly with high temporal resolution (less than one millisecond), due to the limited number of recording channels, it has low spatial resolution. In epilepsy context, dense array electroencephalogram (dEEG) recordings can be used as a useful diagnostic tool in the presurgical work-up contributing to obtain reasonable temporal and spatial resolution. Muscle Artifact in (EEG) recordings is a common problem that makes the EEG signals approximately unreadable. Thus, an artifact removal preprocessing step is required to improve the interpretation of the ictal scalp EEG measurements.

**Methods:** In this paper, we compare the ability of Canonical Correlation Analysis (CCA) and seventeen Independent Component Analysis (ICA) methods, namely SOBI, SOBIrob, PICA, (extended) InfoMax, two implementations of FastICA, COM2, ERICA, SIMBEC, AMICA, RobustICA, three implementations of CubICA, EFICA, ICAEBM, COMBIICA and Multi-COMBIICA in muscle artifact removal using Normalized Mean Square Error (NMSE). The proposed methods are applied on synthetic dEEG data generated by a realistic head model. In this paper, the effect of SNR values on the quality of artifact removal is evaluated. In order to make noisy mixture of EEG signals, forty epochs of muscle activity extracted from real 257-channel EEG data are added to clean data with different SNR values. Then, NMSE values of the methods are computed as a function of SNR. To reconstruct the EEG data, different numbers of independent sources are used.

**Results:** Simulation results demonstrate that suggested techniques clean muscle artifacts successfully. Here, both SOBI and CCA gave better results in terms of performance criterion.

**Conclusion:** In conclusion, our investigations propose a framework for choosing an efficient method to remove artifacts from contaminated dEEG signals.



## Poster No.1015

### Structural and Functional Neural Adaptations in Obstructive Sleep Apnea: An Activation Likelihood Estimation Meta-analysis

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**Introduction:** Obstructive sleep apnea (OSA) is a common multisystem chronic disorder. Functional and structural neuroimaging has been widely applied in patients with OSA, but these studies have often yielded diverse results. The present quantitative meta-analysis aims to identify consistent patterns of abnormal activation and grey matter loss in OSA across studies.

**Methods:** We used PubMed to retrieve task/resting-state functional magnetic resonance imaging and voxel-based morphometry studies. Stereotactic data were extracted from fifteen studies, and subsequently tested for convergence using activation likelihood estimation.

**Results:** We found convergent evidence for structural atrophy and functional disturbances in the right basolateral amygdala/hippocampus and the right central insula. Functional characterization of these regions using the BrainMap database suggested associated dysfunction of emotional, sensory, and limbic processes. Assessment of task-based co-activation patterns furthermore indicated that the two regions obtained from the meta-analysis are part of a joint network comprising the anterior insula, posterior-medial frontal cortex and thalamus.

**Conclusion:** Our findings highlight the role of right amygdala, hippocampus and insula in the abnormal emotional and sensory processing in OSA.

## Poster No.3018

### Based on the Network Degeneration Hypothesis: Separating Individual Patients with Different Neurodegenerative Syndromes in a Preliminary Hybrid PET/MR Study

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**Introduction:** The network degeneration hypothesis (NDH) of neurodegenerative syndromes suggests that pathological brain changes distribute primarily along distinct brain networks, which are characteristic for different syndromes. Brain changes of neurodegenerative syndromes can be characterized *in-vivo* by different imaging modalities. Our aim was to test the hypothesis whether multi-modal imaging based on the NDH separates individual patients with different neurodegenerative syndromes.

**Methods:** Twenty patients with Alzheimer's disease (AD) and 20 patients with frontotemporal lobar degeneration (behavioral variant frontotemporal dementia (bvFTD, n=11), semantic dementia (SD, n=4), or progressive non-fluent aphasia (PNFA, n=5)) underwent simultaneous magnetic resonance imaging (MRI) and 18-fluorodeoxy-glucose positron emission tomography (FDG-PET) in a hybrid PET/MR scanner. The three outcome measures were voxel-wise values of degree centrality as a surrogate for regional functional connectivity, glucose metabolism as a surrogate for regional metabolism, and volumetric-based morphometry as a surrogate for regional grey matter volume. Outcome measures were derived from pre-defined core regions of four intrinsic networks based on the NDH, which have been demonstrated to be characteristic for AD, bvFTD, SD, PNFA, respectively. Subsequently, we applied support vector machine to classify individual patients via combined imaging measures, and results were evaluated by leave-one-out cross-validation.

**Results:** Based on multi-modal voxel-wise regional patterns, classification accuracies for separating patients with different neurodegenerative syndromes were 77.5% for AD vs. others, 82.5% for bvFTD vs. others, 97.5% for SD vs. others, and 87.5% for PNFA vs. others. Multi-modal classification results were significantly superior to uni-modal approaches.

**Conclusion:** Our finding provides initial evidence that the combination of regional metabolism, functional connectivity, and grey matter volume, which were derived from disease characteristic networks, separates individual patients with different neurodegenerative syndromes. Preliminary results suggest that multi-modal imaging based on network degeneration hypothesis may generate promising biomarkers of neurodegenerative syndromes

**Poster No.1000**

**Impulsivity is Associated with Increased Metabolism in the Fronto-Insular Network in Parkinson's Disease**

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**Introduction:** Various neuroimaging studies demonstrated that the fronto-insular network is implicated in impulsive behavior. We compared glucose metabolism (as a proxy measure of neural activity) among 24 patients with Parkinson's disease (PD) who presented with low or high levels of impulsivity based on the Barratt Impulsiveness Scale 11 (BIS) scores.

**Methods:** Subjects underwent 18-fluorodeoxyglucose positron emission tomography (FDG-PET) and the voxel-wise group difference of FDG-metabolism was analyzed in Statistical Parametric Mapping (SPM8). Subsequently, we performed a partial correlation analysis between the FDG-metabolism and BIS scores, controlling for covariates (i.e., age, sex, severity of disease and levodopa equivalent daily doses).

**Results:** Voxel-wise group comparison revealed higher FDG-metabolism in the orbitofrontal cortex (OFC), anterior cingulate cortex (ACC), and right insula in patients with higher impulsivity scores. Moreover, there was a positive correlation between the FDG-metabolism and BIS scores.

**Conclusion:** Our findings provide evidence that high impulsivity is associated with increased FDG-metabolism within the fronto-insular network in PD.

## Poster No.2011

### The Lower Hippocampus Global Connectivity, the Higher its Local Metabolism in Alzheimer Disease

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**Introduction:** Based on the hippocampus disconnection hypothesis in Alzheimer disease (AD), which postulates that uncoupling from cortical inputs contributes to disinhibition-like changes in hippocampus activity, we suggested that in patients with AD, the more the intrinsic functional connectivity between hippocampus and precuneus is decreased, the higher hippocampal glucose metabolism will be.

**Methods:** Forty patients with mild AD dementia, 21 patients with mild cognitive impairment, and 26 healthy controls underwent simultaneous PET/MRI measurements on an integrated PET/MR scanner. 18F-fluorodeoxyglucose-PET was used to measure local glucose metabolism as proxy for neural activity, and resting-state functional MRI with seed-based functional connectivity analysis was performed to measure intrinsic functional connectivity as proxy for neural coupling.

Group comparisons and correlation analysis were corrected for effects of regional atrophy, partial volume effect, age, and sex.

**Results:** In both patient groups, intrinsic connectivity between hippocampus and precuneus was significantly reduced. Moreover, in both patient groups, glucose metabolism was reduced in the precuneus (AD, mild cognitive impairment, controls) while unchanged in the hippocampus.

Critically, the lower connectivity between hippocampus and precuneus was in patients with AD dementia, the higher was hippocampus metabolism.

Conclusion:

**Results:** provide evidence that in patients with AD dementia, stronger decrease of intrinsic connectivity between hippocampus and precuneus is linked with higher intrahippocampal metabolism (probably reflecting higher neuronal activity). These data support the hippocampus disconnection hypothesis, i.e., uncoupling from cortical inputs may contribute to disinhibitionlike changes of hippocampal activity with potentially adverse consequences on both intrahippocampal physiology and clinical outcome.

**Poster No.3013**

**Investigating Functional Connectivity of Musical Induced Emotions Using EEG Technique**

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For several decades researchers are wondering how emotions are processed in the brain; and to understand this complex problem they have employed different methods and stimuli.

This research is exploring how musical induced emotions are processed in brain. Through a website questionnaire a stimulus set of 15 tracks (30 sec each) was designed. Thirty participants (14 female) listened to these tracks while their brain electrical activity was being recorded with an Ant Neuro 64 channel EEG device. After listening to each track they reported how the music track influenced them emotionally using a three dimensional emotion model including Valence, Arousal, and Reflection. The signal was analyzed due to the participants' self reports and connectional connectivity of brain regions was calculated with correlation coefficient of channels and absolute power of each EEG band.

The results show that different brain regions are engaged in processing of different aspects of emotions and in order to classify these emotions, these regions can be used as a supervisory control for feature extraction input in classifier algorithms.

## Poster No.3017

### Encoding of Visual Features in Prefrontal Cortex

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**Introduction:** Neurons in the lateral prefrontal cortex (IPFC) of primates are known to preferentially encode behaviorally relevant information. Although some studies have shown a coding for shape and direction of motion in the IPFC, there is only sparse direct evidence for color coding of behaviorally relevant color in this area. Here we investigated color representation in IPFC activity by determining if a given stimulus' color can be decoded from local field potential (LFP) responses it evokes in the IPFC.

**Methods:** We trained a rhesus monkey to match one (out of four possible) color of a test stimulus, a moving random dot pattern (RDP), to that of a sample one presented after a short delay. A 96 electrode array (Utah) was implanted subdurally in the IPFC and LFPs were recorded simultaneously from all electrodes. By training a Bayesian machine-learning algorithm on instantaneous LFP phases at different frequencies from a random subset (80%) of trials, we decoded the stimulus color in the remaining (20%) trials.

**Results:** The algorithm achieved a performance significantly higher than chance ( $p < 0.05$  t-test). This was, evident in all frequencies and highest for frequencies over 70 Hz (70% accuracy in decoding of one against the other three colors). More than 80% of the recording sites contained significant information to decode the color used in a given trial. Our results show that the phase of high frequency LFPs recorded from the IPFC of rhesus monkeys contains significant information about task-relevant stimulus colors.

**Conclusion:** Given that the high frequency component of the LFP in this frequency range is a signature of spiking activity, generated by neurons adjacent to that site and that a high proportion of recording sites encode color, our results suggest that color is coded broadly in a widespread phenomenon in the IPFC.

## Poster No.1016

### MRI Texture Analysis in Multiple Sclerosis by wavelet transforms

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**Introduction:** Magnetic resonance imaging (MRI) is a useful method for the diagnosis of Multiple sclerosis diseases. Visual inspection of magnetic resonance images cannot distinguish between MS lesions and normal white matter (NWM). texture analysis may be an attractive method to evaluate and detect brain lesions.

**Methods:** In this study, texture analysis was applied on MR images of MS patients and wavelet transforms were explored to extract textural features for discriminate between MS lesion and NWM. The MRI datasets were used in this study consist of 30 multiple sclerosis patients and 30 healthy subjects. Analyses were run with MaZda software for texture analysis. from 270 statistical texture features extracted, we chose 8 parameters based on wavelet transforms. We used principle component analysis (PCA), linear discriminant analysis (LDA) and, Nonlinear discriminant analysis (NDA) methods for texture analysis

**Results:** texture-based classification was successful in differentiating between MS lesion and NWM, with misclassification rates of 3.3%.

**Conclusion:** Texture analysis may be a useful tool for help radiologists in better diagnosis.

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