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Invited Lectures and Conferences (C-01 — C-51)

Thursday, 26 May 2016
18:00–19:00

OPENING LECTURE

Chair: Prof. Dr. Metehan Çiçek

C-01

The parallel evolution of cognition

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What are the biological fundaments of cognition? Until recently we assumed that the cerebral cortex is a *conditio sine qua non* for all higher cognitive operations. Only mammals like humans have a cortex. But now we learn that some birds are able to produce cognitive processes that are on par with apes. The problem is that birds have very small brains without a cortex. How is that possible? I will argue that a) birds do not have a cortex but a pallium that is partly homologous to that of the cortex (implication #1: cortical lamination is not a requirement for complex cognition); b) similar neural circuits can be found in the forebrains of birds and mammals (implication #2: some cognitive function require certain circuits. These then evolve convergently in practically the same way in the different branches of evolution); c) brain size does not correlate when comparing birds and mammals (implication #3: brain size or neuron numbers are useless proxies for cognitive complexity when comparing brains that have different anatomical designs). Thus, neural fundaments for similar cognitive processes have evolved multiple times and in parallel during evolution. The overall picture emerging from this research is the following: There is vast extent of difference in general brain organization between mammals and birds, combined with an astonishing degree of parallelism in the details of cognition and

neural wiring. The most important implication of these discoveries is the following: Brains without cortical lamination can be at least as powerful in terms of cognitive functions as brains with cortex. This forces us to re-consider many basic assumptions of cognitive neuroscience.

Friday, 27 May 2016

09:00–10:30

PANEL SESSION 1

Reflections on the development in molecular biology to neuroscience

Chair: Prof. Dr. Şermin Genç

C-02

MicroRNA and central nervous system

Genç Ş

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MicroRNAs (miRNAs) are small, non-coding RNA molecules, which regulate various metabolic activities. miRNAs have major role in biological and pathological process of central nervous system. We showed miRNAs mediate neuroprotective effects of Erythropoietin and Lithium. Neuroprotective effects of Lithium depend on miR-34a inhibition and miRNA-451 and 888-5p mediates neuroprotective effects of Erythropoietin. In next future, miRNAs expression alternation could be new therapeutic strategy for neurodegenerative disorders. Circulating miRNAs are promising candidates for blood-based biomarkers, given their high stability in circulation and ease of miRNA analysis with existing methods (e.g. realtime PCR). Circulating serum miRNAs would be good choice as biomark-

ers for neurological and psychiatric disorders. Our data showed two miRNA may serve as potential diagnostic markers to discriminate Alzheimer Disease from Frontotemporal Dementia.

Keywords: miRNA, biomarker, neuroprotection

C-03

Bioengineering approaches in neuroscience

Güven S

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Bioengineering aims to generate bio-similar, 3D mimics of native tissues and organs, such as the brain, liver, or heart for regenerative medicine or pharmaceutical research. Bioengineering methods provide the ability to control complex cell organization, density, and contact in the 3D constructed microenvironment and enhance the ability to examine the physical properties and functions of such tissues. Such tools are particularly relevant to neuroscience, where postmortem brain slices are the ultimate *ex vivo* experimental models. Investigating the neural circuit connectivity, transmitter mechanism of neuro-activities, the dynamics of protein and ion channel signaling, and the use of therapeutic agents for neurodegenerative disorders are also within the scope of bioengineering. Although 2D monolayer cell culture models reveal important insights in, for instance, the molecular drivers of neural development and activity, culture dishes does not totally recapitulate the 3D aspects of neural connectivity or the microenvironment of the neural tissues. In this talk we will discuss the current research on generating 3D functional neuron tissue models.

Keywords: bioengineering, 3 D microenvironment, neuroscience

C-04

Investigation of vesicle fusion mechanisms using bottom-up synthetic biology

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We aim to investigate the molecular mechanisms of vesicle fusion by combining interdisciplinary techniques that include electrophysiological, cell biological, biophysical, and biochemical tools. I will present two parts in my lecture. First of all, I have established synthetic neurotransmission, which reconstitutes the vesicle fusion process using purified native vesicles, i.e., synaptic vesicles and large dense-core vesicles (LDCVs). I will show the complete synthetic neurotransmission which reproduces *in vivo* data. Synthetic neurotransmission allows us to directly explore the mechanisms of vesicle fusion. In addition, we have unveiled that synaptotagmin-1 (Ca²⁺ sensor) binds to PIP₂-containing membranes but not to SNAREs (fusion machinery) in a physiological ionic environment. Our data can explain why the binding properties of synaptotagmin-1 are highly controversial and show the molecular mechanisms of vesicle fusion (Dr. Yongsoo Park received an EMBO Installation Grant).

Keywords: Vesicle, neurotransmission, synaptotagmin-1

C-05

Identification of a novel MYC enhancer and a risk-variant that modulates IDH-mutant glioma risk

Oktay Y

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The single nucleotide polymorphism (SNP) rs55705857 located in a non-coding but evolutionarily conserved region at 8q24.21 is strongly associated with IDH-mutant glioma development and was suggested to be the causal variant. However, this genomic locus contains no protein coding genes, no micro-RNAs and had no previously demonstrated mechanistic link to glioma development. Nevertheless, the strict phylogenetic conservation of the region centered on rs55705857 in mammals and the exceptionally strong association with IDH-mutant gliomas suggested a functional role. The hypothesis of this study was that rs55705857 played a direct role in glioma oncogenesis and we sought clues by demographic-, clinical-, molecular-, transcriptomic- and proteomic- comparisons. With a case control study in 285 gliomas, 316 healthy controls, 380 systemic cancers, 31 other CNS tumors, 120 IDH-mutant cartilaginous tumors, we identified that the association was specific to isocitrate dehydrogenase (IDH)-mutant gliomas. Odds-ratios were 9.25 (5.17-16.52 95% confidence interval) for IDH-mutated gliomas and 12.85 (5.94-27.83) for IDH-mutant, 1p/19q co-deleted gliomas. Decreasing strength with increasing anaplasia indicated to a modulatory effect. No somatic mutations were noted at this locus in 114 blood-tumor pairs, neither were there a difference in the frequency of copy number changes between tumors of risk-allele carriers and non-carriers. CCDC26 RNA-expression was rare and not different between the two groups. There were only minor subtype-specific differences in common glioma driver genes. RNA sequencing and LC-MS/MS comparisons indicated to significantly altered MYC-signaling. Baseline enhancer activity of the conserved region on MYC promoter and its further positive modulation by the SNP risk-allele was shown *in vitro*. Our findings implicate MYC deregulation as the underlying cause of the observed association. This work demonstrates that SNP rs55705857, which precedes the somatic IDH mutation, significantly increases the risk of specifically IDH-mutant gliomas (but not gliomas in general, other central nervous system malignancies, other common systemic cancers, other 8q24.21-associated systemic cancers or IDH-mutant non-glioma tumors) and that this process involves deregulation of MYC-signaling. It is also of general medical interest that a SNP located at a non-coding locus with no nearby protein-coding genes and no previously known function can modulate cancer risk through long-distance interactions.

Keywords: glioma, IDH1, MYC, epidemiology, proteomics, RNA-seq

Friday, 27 May 2016

09:00–10:30

PANEL SESSION 2

People who are ushers in a new epoch of neuroscience

Chair: Prof. Dr. Erhan Nalçacı

C-006**Ivan M. Sechenov and his book "Reflexes of the Brain"**

Nalçacı E

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Sechenov was born at 1829 in the region of Simbirsk as a child of an officer and a peasant woman. At 14 years old, he enrolled in an engineer school at Petersburg and gained a good basis for physics and mathematics. Then, he began to the Medical School of Moscow. Between 1856–1862, he studied with J. Müller, H. Helmholtz, C. Ludwig and C. Bernard in the best physiology department of Europe. He gave his PhD thesis titled as "Some facts for the future study of alcohol intoxication". He gave lectures in the physiology department of the different universities of Russia as the director of department. Until those days, in spite of lecturers who just simply transfer the knowledge, with his style depending on asking, researching, creating devices, he made a great domain, and he was accepted as the founder of the Russian physiology. In addition to firstly have a evidence for inhibition in central nervous system, he discovered many significant physiological mechanisms. Summation was firstly defined by Sechenov in the article titled "Electrically and chemically stimulation of sensorial spinal centers in frog". Muscle sense for time and space that we known as proprioception was firstly put forward by Sechenov. In 1862, Sechenov was return back to Petersburg from Paris and wrote his essay which had been matured in his mind for a long time. The original name of this long article was "An assay for physiologically explaining the roots of sprit". Sechenov sent the article to "Sovremennik" in order to be published. However, the censors of the Tsar did not accept to be published *Sovremennik*, which was a revolutionary journal and read diffusely by intellectuals, and allowed to publish with another name in the medical bulletin, which was not popular. "Reflexes of the Brain" stressed the common mechanisms underlying all behavior of animals and human. Monistic materialism was defended by this book against opinions, which widely accepted until those days that there were no mechanisms of sprit that could not be explored, and against the belief that individuals were independently created from each other and free from historical conditions. This book claimed that conscious or unconscious behaviors could be explained by reflexes, which were shaped by stimulus in evolutionary and developmental process. The tradition started by Sechenov was maintained by Pavlov (1849–1936). Some limits due to mechanical approach of Sechenov and Pavlov were moved advanced phase by Vigotsky and Luria.

Keywords: neuroscience history, Reflexes of the Brain, Sechenov

C-07**Santiago Ramon y Cajal and neuron doctrine**

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While cell theory was accepted in 1838, it took approximately 50 years for nervous system to be accepted as consisting of individ-

ual nerve cells. The most important reason for this was inability to study complex tissues with existing techniques. Golgi method was the technique and Santiago Ramon y Cajal was the scientist that made it possible to shift from reticular theory to neuron theory. Thus, Camillo Golgi, who developed the method and Cajal who created the theory were honored with a shared Nobel Prize Award in 1906 for their studies on the structure of nervous system. The most important feature of this method was random staining of approximately 5% of nerve cells, which allowed evaluation of a single neuron and unmyelinated axons within the complex and dense nervous tissue. Cajal meet with the method after fourteen years of its introduction and a new world opened for him. He improved the Golgi method and chose right structures to examine which enabled him to see details that could not be seen by other researchers. In addition, his ability to reconstruct whole components he saw under the microscope in his mind and then draw onto paper enabled him to draw all layers and links of a neuron as a whole while it was still very hard to see a complete neuron. Besides making important discoveries, Cajal had interpreted findings as highly accurate. He published his first article on the concept of nerve cell "Structure of Avian Nerve Centers" in 1888. In this article, he demonstrated for the first time that all extensions of nerve cells freely terminate unlike the anastomotic-structured view and suggested that nerve cells communicate with each other by contacts, not by continuation. Neuron doctrine rapidly became validated by histologic evidence presented by Cajal. This view was previously proposed by His, Nansen, and Forel, but had never been demonstrated until that time. In 1891, Waldayer used the term "neuron" for the nerve cell and Neuron Theory was proposed using Cajal's findings. A breakthrough occurred in neurosciences and modern neuroscience was born. Ramon y Cajal was not only a scientist but also a multi-faceted person a passionate chess player, gymnast, a very talented painter and photographer. Maybe it was that multi-faceted personality which has enabled him to see details under the microscope that could not be seen by others and helped him to lead the emergence of a theory.

Keywords: neuron doctrine, neuroscience history, Santiago Ramon y Cajal

C-08**Luria and cognitive neuroscience**

Üstün S

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Alexander Romanovich Luria, a great scientist in 20th century known for his studies on cognitive neuroscience, is one of the founders of modern cognitive neuroscience and improved the explanations about organic foundation of psychology and brought a new perspective to cognition. In early years of Luria's life, he was impressed by the sociology due to great social movements leaving marks in history like establishment of the first Socialist country. As a consequence of such an environment, he started to study social sciences and for the following years, his interest to social sciences influenced his studies on the field of psychology and neuroscience. In university, after reading psy-

chological books mostly written by Freud, he realized, that psychology has been considered as an abstract concept independent from real life and he propounds the term 'alive psychology'. After establishing a psychology community, he contacted with Freud and started to translate his books. By the time graduating from the university, he started to the medical school and drew attention due to his studies about psychology and he was invited by a Psychology Institute. He met Vigotsky here and after that his scientific carrier changed. They suggested the idea that psychology must be investigated with a sociocultural approach and they went to the Ozbekistan for studying this approach. At World War II, Luria built a rehabilitation hospital for brain injured soldier and cure to many soldier while collected large amount of data. He used this data for investigating higher cognitive functions and their localisations on the brain. Luria believed that psychology needs new approaches. He agreed with the Sechenov and Pavlov who suggested a materialistic basis of psychology but he thought human behaviors cannot be explained by simple reflexes because of their complexity. In the light of these, he suggested a whole new approach. According to this approach, brain areas have a specialization for different cognitive functions and these areas are connected with a hierarchical order. He suggested that during the healing process after brain injury, connections among the brain areas redevelop and this development can be regulated by exterior interference. In conclusion, Luria found out the physiological basis of cognitive functions and its dynamic nature and by means of this, he develop new treatment methods for brain injuries. Luria's contribution to science is not his book and publications only. His real contribution is the new approach which affects all neuroscientist and changes neuroscience.

Keywords: cognitive neuroscience, Luria, neuroscience history

Friday, 27 May 2016

11:00–12:00

CONFERENCE 1

Chair: Assoc. Prof. Dr. Bora Baskak

C-09

fNIRS in attention-deficit hyperactivity disorder

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Objectives: Functional Near-Infrared Spectroscopy (fNIRS) has been established as a neuroimaging method in different fields of neuroscience. ADHD patients have been shown to be characterized by brain dysfunctions, in particular in prefrontal brain areas, which can also be measured with fNIRS. Psychiatric disorders like ADHD are currently mainly treated with pharmacotherapeutic and, to a lesser extent, with psychotherapeutic methods. The success measured as improvement of symptoms under is surprisingly good with high effect sizes (>0.8) in randomized controlled trials, in particular for pharmacological treatment with stimulants. However, there is still room and need for improvement.

Methods: fNIRS investigations have been applied to patient groups with children and adults with ADHD. Neurofeedback methods based on EEG and fMRI methods are increasingly

applied as an alternative or add-on therapeutic approach. The rationale behind these therapies is to show the subjects an immediate feedback of their brain activity. So they can learn how to regulate their brain activity and transfer this ability to real life situations.

Results: Results of different fNIRS studies in ADHD will be presented. Furthermore, we established a neurofeedback protocol for regions of the prefrontal cortex based on measurements of brain activity with Near-Infrared Spectroscopy (NIRS). This NIRS-neurofeedback was applied in children and adults with ADHD with promising results.

Conclusion: Due to its high ecological validity, NIRS-neurofeedback might develop to an alternative or add-on therapy also for ADHD patients in future.

Friday, 27 May 2016

13:45–15:15

PANEL SESSION 3

Time perception from a cellular and cognitive neuroscience window

Chair: Prof. Dr. Metehan Çiçek

C-10

The relationship of time perception with reward system

Apaydın N^{1,2}, Kale HE², Çelikağ İ^{2,3}, Üstün S^{2,3}, Baskak B^{2,4}, Devrimci Özgüven H^{2,4}, Çiçek M^{2,3}

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³Department of Physiology, Faculty of Medicine, Ankara University, Ankara, Turkey; ⁴Department of Psychiatry, Faculty of Medicine, Ankara University, Ankara, Turkey

Objectives: The neural mechanisms underlying time perception are still unclear. Reward and punishment are also known to be effective upon our future decisions and indeed reward has been shown to promote human performance in multiple task domains. With the present functional magnetic resonance imaging (fMRI) study, we sought to elucidate the neural processes that are shared and distinct between brain regions responsible for time perception and reward prospection in healthy subjects.

Methods: Participants were 20 healthy, right handed volunteers. The methods and procedures used in the study had approval from the Ankara University Institutional Review Board. We employed a temporal attention task in which observers had to extrapolate the velocity of an occluded moving object in reward vs. no-reward sessions. On each trial, the target displayed on the left side of the screen and moved toward right side becoming "invisible" in the center of the screen under an occluding surface and the velocity of the target was slightly increased or decreased in this invisible period. After the period of invisible motion, the target reappeared and participants were asked to make perceptual judgments whether it reappeared slightly too early or too late compared with its predicted velocity. In reward sessions the participants gained money reward per correctly done trial. Inside the scanner, the participants performed four 7-minute runs, yielding a total of 128 trials in each session. Two of the runs were rewarded and 2 were non-rewarded. Accordingly, fMRI images were acquired using a 3-T scanner with a 32-channel head-coil array.

Results: The most prominent activations associated with time perception were in the bilateral prefrontal cortex (middle frontal gyrus), left middle temporal gyrus and inferior parietal lobule. And the most prominent activations associated with reward included the caudate nucleus. In addition to the main effects, the results revealed a significant interaction between the 2 factors in the insula and posterior cingulate cortex (PCC).

Conclusion: Frontal, temporal and parietal activation for timing and caudate activation for reward prospect is in line with previous findings. Our original contribution is the interaction found between reward and timing, namely insula and PCC. These findings suggest that physiological mechanisms controlling the relationship of time perception and reward prospect should at least be related to insula and PCC.

Keywords: time perception, reward, functional magnetic resonance imaging

C-11

Neural mechanisms underlying time perception and reward prospect in major depressive disorder

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Objectives: Major depressive disorder (MDD) is characterized by symptoms of both by negative mood and anhedonia, the lack of interest or pleasure in usually rewarding activities. Associated with these symptoms, patients usually report they feel that time is passing more slowly than normal. Findings suggest that the physiological mechanisms involved in the reward prospect and time perception are quite similar which may also affect the response of depressed patients to reward and time perception. A systematic investigation of the potential interaction between reward system and time perception in MDD patients, is lacking. With the present functional magnetic resonance imaging (fMRI) study, we sought to elucidate the neural processes that are shared and distinct between brain regions responsible for time perception and reward prospect in both healthy subjects and major depressive disorder patients.

Methods: Participants were 20 healthy and 7 major depressive patients. All were right handed. The methods and procedures used in the study had approval from the Ankara University Institutional Review Board. We employed a temporal attention task in which observers had to extrapolate the velocity of an occluded moving object in reward vs. no-reward sessions. In reward sessions the participants gained money reward per correctly done trial. Inside the scanner, the participants performed four 7-minute runs, yielding a total of 32 trials in each session. Two of the runs were rewarded and 2 were non-rewarded. Accordingly, fMRI images were acquired using a 3-T scanner with a 32-channel head-coil array. The group analysis was made by GLM Flex using ANOVA design with group (patient-control), condition (time-control) and reward (yes-no) as factors.

Results: The result of this analysis revealed significant main effect of reward in the middle orbitofrontal gyrus, superior temporal cortex and anterior cingulate cortex. The main effect of condition revealed inferior parietal cortex activity. There was a significant group-reward interaction showing orbitofrontal cortex activity in rewarded sessions. Group-condition interaction was significant in the middle frontal (dorsolateral prefrontal) and anterior cingulate areas. There was also a statistically significant group-condition-run interaction in orbitofrontal cortex. This activation was extending through the orbitofrontal cortex.

Conclusion: The results suggest that MDD patients differentially activate mainly dorsolateral prefrontal, orbitofrontal and anterior cingulate cortex regions which might underlie disturbances related to time perception and reward prospect.

Keywords: time perception, reward, major depressive disorder, functional magnetic resonance imaging

C-12

Dopaminergic modulation of interval timing: a new model

Çevik MÖ

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50 years of research on interval timing yielded four defining properties of this process: First, interval timing obeys Weber's law. Second, unlike circadian timing, interval timing is learned. Third, pharmacological manipulation of dopaminergic activity causes a change in the speed of subjective time. Finally, the experimental manipulations that change the speed of time also change sustained attention. The last three properties suggest that the mechanisms of interval timing overlap with those of learning and attention, and involve dopaminergic modulation. However, it has been reported that the activity mesostriatal dopamine neurons do not persist throughout the timed interval, and that the phasic activity triggered by the onset of the timed stimulus does not predict the subjective duration of the stimulus. In this talk, I will present a new model where phasic dopaminergic activity triggered by the onset of the stimulus prevents the habituation of the stimulus, which can then enhance its own activity via positive feedback and inhibit concurrent stimuli. Finally the dopaminergic activity triggered by the arrival of the reward reinforces each stimulus in proportion with its activity. Timing, expectation and associative learning will be discussed as emergent properties of the model.

Keywords: dopamine, interval timing, bistability

C-13

Time perception and decision-making: a common theoretical approach

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Objectives: Many models explain how brain keeps track of time intervals in the range of seconds to minutes. These models account for the accuracy, precision, and statistical properties of

timing behavior based on different psycho-mechanistic assumptions. It is, however, difficult to differentiate between these models based on behavioral and electrophysiological data due to their common mathematical features. This presentation aims to elucidate the theoretical/conceptual links between different timing models, as well as to introduce a decision model of interval timing (Time-adaptive opponent-Poisson Drift-Diffusion Model – TopDDM) and its variants (Sequential Drift-Diffusion Model).

Methods: Computational and simulation methods were used to evaluate the predictions of different models. Data collected in temporal reproduction and temporal bisection tasks were evaluated in the light of these predictions.

Results: Models of interval timing account for the psychophysical properties of timing behavior based on different processing dynamics. When these models are evaluated in terms of how they explain the psychophysical properties, they can be categorized as suggesting either adaptive decision threshold or adaptive integration to achieve flexibly accurate timing. Our new timing model shows that when drift-diffusion processes (a model of decision making) rely on Poisson-process clock signals, they can also explain the statistical properties of timing behavior. Specifically, this model assumes two independent Poisson processes. The threshold first crossing times of the weighted cumulative sum of these inputs are Wald distributed with a mean around the target interval. When the common Poisson parameter is adjusted to time different intervals, CV remains constant across different target intervals since diffusion is proportional to the square root of the drift, an emergent property of the opponent Poisson process. When this diffusion-based timing process is sequentially coupled with the conventional drift-diffusion process (with a constant diffusion coefficient) such that it maximizes reward in temporal bisection task, this model also explains choice proportions and response times of temporal decisions.

Conclusion: The well-established models of timing can be parsimoniously characterized by the dynamics of few critical functional units (modulation of signal integration or decision threshold). Relying on the same functional units, TopDDM can explain both interval timing behavior and temporal decision-making. Recent electrophysiological studies provide support for evidence integration models and a subgroup of them supports the predictions of TopDDM by exhibiting adaptive temporal integration up to a constant threshold.

Keywords: computational models, drift-diffusion model, interval timing, time perception

C-14

Multisensory interactions and perceived timing

Kafalgönül H¹, Kaya U²

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The integration of information from different senses is central to our perception of the world including the fundamental attributes of space and time. Audiovisual interactions have been particularly well studied in this context. It has been well documented that

auditory stimuli can capture the perceived timing of visual events and this phenomenon is called temporal ventriloquism (Fendrich & Corballis, 2001; Morein-Zamir, Soto-Faraco, & Kingstone, 2003). By taking advantage of temporal ventriloquism, we have recently focused on understanding how information from different modalities are combined for the final perception of event timing. In this presentation, we will talk about two EEG experiments. In the first experiment, we investigated how a single auditory event changes the perceived timing of a concurrent single visual event. We varied the temporal offset between these two events and systematically explored how the perceived visual timing was affected by the temporal offset. In the second experiment, we focused on the auditory influences on the time interval between two visual events. The visual time interval was defined by the time lag between two visual flashes during these experiments. The behavioral results from both experiments indicated significant auditory influences on perceived visual timing. Moreover, EEG results showed significant auditory evoked potentials and interactions over visual cortex. Time-frequency analyses revealed that these auditory influences over visual cortex led to an increase in 4–12 Hz (theta and alpha bands) power. More importantly, we also found that changes in the temporal dynamics of 4–12 Hz power paralleled behavioral data. Together, our results, in combination with accumulating evidence (Samaha & Postle, 2015), support an important role for low-frequency oscillations in perceived timing of events at early stages of perceptual processing.

Support: This work was supported by The Scientific and Technological Research Council of Turkey (TUBITAK Grant 113K547).

Keywords: perceived timing, audiovisual interactions, electroencephalography (EEG), low-frequency brain oscillations

Friday, 27 May 2016

13:45–15:15

PANEL SESSION 4

Cellular imaging in neuroscience: CLARITY, expansion microscopy, optogenetics and neuroimaging in *in-vitro* systems
Chair: Prof. Dr. Gülgün Şengül

C-15

Imaging the mouse spinal cord with CLARITY

Şengül G

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Optical and other imaging techniques in neuroscience covers construction of 2 or 3 dimensional images or observing dynamic processes over time, to reveal cellular morphology or function. Neuroscience has been a pioneering field for new imaging techniques throughout time. In addition to advances in microscopy techniques, recently developed techniques such as cell culture, tissue slices, new fluorescent tracers, indicator dyes, nano-crystals, engineering of fluorescent proteins, optogenetics, it is possible to characterize and manipulate cell morphology. CLARITY (Clear, Lipid-exchanged, Anatomically rigid, Imaging/immunostaining compatible, Tissue hYdrogel) is a technique that makes

tissues transparent, developed by Deisseroth group in Stanford (Chung et al., *Nature Methods* 10:508–513, 2013). With this technique, lipids that block the passage of light are removed from the tissue using ionic detergents and electrophoresis to make the tissue transparent. Biomolecules in the tissue (nucleic acids, proteins and neurotransmitters) stay stable in their normal localizations in a hydrogel environment. This enables us to visualize the connections, local circuits, morphological properties and molecular structures of the cell. Until recently, the only way to visualize the spinal cord in 3D was to do serial sections and make a reconstruction of these. However, tissue sectioning and subsequent imaging of individual sections have various limitations. We have studied the organization and chemo-architecture of the mouse spinal cord in 3D using CLARITY, to reveal new details and be a guide for further cord studies using this technique. C57BL/6J mice were perfused (n=12) perfused with ice cold hydrogel solution, spinal cords cut into 2–3 mm segments and washed with clearing solution until optically transparent. Ten markers were used for immunostaining. Tissue was imaged using multiphoton microscope. Calbindin, calretinin, parvalbumin, CGRP, ChAT, serotonin, glycine, GAD67, NOS and GABA immunohistochemistry was used for revealing the 3D organization and chemo-architecture of the dorsal horn laminae and spinal cord nuclei. With this study, new data regarding the organization of mouse spinal dorsal horn anatomy and its chemo-architecture were revealed with 3D CLARITY imaging.

Keywords: 3D *in vitro* system imaging, chemoarchitecture; CLARITY; cytoarchitecture

C-16

Three dimensional imaging and expansion microscopy of central nervous system

Şendemir Ürkmez A

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Imaging the central nervous system (CNS) is limited by current histological imaging techniques, because these techniques provide only partial information from thin sections. Histological imaging gives the researcher limited spatial information, and therefore is prone to misinterpretation. Besides, the images acquired by an optical microscope are limited with the diffraction properties of the microscope. Techniques like “ultramicroscopy” and “two-photon” or “multi-photon” confocal microscopy give us the chance to image thicker specimens without the need for histological sectioning, therefore allow us to acquire better spatial information for more accurate interpretations. In expansion microscopy, instead of optically magnifying the image, the real specimen is physically enlarged and then imaged. For this purpose, special poly-electrolyte gels are absorbed to the specimen and covalently ligated. After staining with the selected staining technique, the enlarged specimens enable visualization of the targeted area with a higher resolution giving more detail under the optical microscope. The diffraction limit in a conventional microscope is about 250 nm, with expansion microscopy it goes down to 70 nm.

C-17

Experimental platforms which provide neuromodulation for optogenetic treatments

Sokullu E

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The goal of this study is to develop a platform for the design of specific interfaces is to restore mechanism and to contribute to the understanding and treatment of neurodegenerative diseases using optogenetic techniques. Optogenetic tools comprise a variety of different light-sensitive proteins from single-cell organisms that can be expressed in mammalian neurons and effectively control their excitability by allowing to either depolarize or hyperpolarize, and respectively generate or inhibit action potentials in selective populations of neurons, so it may be considered for developing potential treatment strategy for several neurodegenerative diseases. One of the great challenges in this effort is to develop implantable systems that are capable of processing the activity of large ensembles of cortical neurons. This work presents the design, fabrication, characterization, and *in vivo* testing of a neural recording platform with 3D hydrogel encapsulated neuron cells. 3D gel environment composed by hydrogel and provide the neurites to extend out of the gels and form synaptic connections with their neighboring neurons. Action potentials, both spontaneous and resulting from a current stimulus, will be recorded from neurons cultivated in hydrogels on glass surfaces. Optogenetic techniques of this study will be applied on to hydrogel encapsulated and cultivated, transfected induced pluripotent stem cells - IPS. Thus, optical stimulation effects on 3D neural cell culture has been investigated *in vitro*.

Keywords: neurodegenerative diseases, optogenetics, 3d

Friday, 27 May 2016

16:45–17:45

CONFERENCE 2

Imaging the brain, understanding the mind:

A historical & philosophical perspective

Chair: Prof. Dr. Hakan Gürvit

C-18

Imaging the brain, understanding the mind: a historical & philosophical perspective

Güzeldere G

Departments of Philosophy & Psychology, The Mind-Brain-Behavior Program, Harvard University, Cambridge, MA, USA

Studies that relate anatomically distinguishable structures of the brain to distinct mental functions, which peak during the Age of Enlightenment, have an extended history that go back to the Hellenistic Period. The effort to discover correlations between functional brain components and processes, and corresponding states of the mind, on the other hand, is a much

more recent phenomenon. While the most preliminary studies of how cerebral brain metabolism relates to cognitive capacities in real-time measurements were conducted in the late 19th Century, the new revolution in the cognitive neurosciences owes its impetus to the very recently developed imaging technologies, approximately since the 1990s. In light of the history of both structurally and functionally investigating the brain in order to better understand cognition, mind, and self, where can we locate and evaluate our present efforts in the cognitive neurosciences? How should we model the brain as a physical/biological system internally representing an external world via sensation, perception, and thought? And, in light of the new developments in imaging the brain, what can we hope for near-future research in the medical and philosophical mind-sciences? This talk will present a historical and theoretical framework in an attempt to answer these questions.

Saturday, 28 May 2016

09:00–10:30

PANEL SESSION 5

Neurotechnology

Chairs: Prof. Dr. Uğur Halıcı, Assoc. Prof. Dr. İlkey Ulusoy

C-19

Neuroscience and neurotechnology

PhD program

Dalkara T

Department of Neurology, Faculty of Medicine, Hacettepe University Ankara, Turkey

Neurosciences, the initiative to understand man himself (that is his brain) have been a fundamental interest throughout the history. Untangling the human brain and nervous system is one of the most important problems that the 21st century science is trying to solve. Neurological and mental diseases are common throughout the World and their burden to the person and society is high. For the above reasons, parliaments in the EU and US declared the 1990s as “Decade of the Brain” and increased the resources allocated, making neurosciences a leading research area since then. Additionally, the EU initiated the “Human Brain Project,” and the US launched the “Brain Initiative Project” as mega scale ventures in 2013. Revolutionary breakthroughs in neuroscience and neurological disorders require multi-disciplinary approaches in research and education and, hence, mandate the use of progressive technologies as well as education programs. Expectedly, researchers educated in graduate programs that bring the neuroscience and engineering fields together can make significant contributions to neuroscience and neurotechnology. For this purpose, the Graduate School Of Natural And Applied Sciences of METU and the Institute of Neurological Sciences and Psychiatry of Hacettepe University have recently established a joint “Neuroscience and Neurotechnology” doctoral program.

Keywords: neurosciences, neurotechnology, neurological disorders, biomedical

C-20

Neural representations in the human brain: voxel-wise encoding and decoding models

Çukur T^{1,2}

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The human brain contains about 100 billion nerve cells that mediate cognition by processing the plethora of information present in the external world across multiple hierarchical stages. In the case of visual perception, each stage of processing can be viewed as a computational unit that transforms the retinal input image to extract visual features critical for object recognition. There is a longstanding effort in neuroscience to reveal the transformations implemented at each hierarchical stage, and brain imaging methods such as functional magnetic resonance imaging (fMRI) and powerful computational modeling tools are moving us closer to this goal. Functional MRI provides indirect assessments of neural activity across the entire human brain with good spatiotemporal resolution. The collected data can then be mined to build quantitative models that accurately map the transformations at each separate location in the brain. This framework yields predictions of human brain activity during natural vision with unprecedented accuracy. In addition to advancing our understanding of the visual system, this framework also enables mind reading, i.e. inferring the contents of conscious visual perception merely from brain activity.

Keywords: neural representation, functional MRI, computational modelling

C-21

Brain connectivity models: connectivity disturbance in dyslexia

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Dyslexia is a learning disability that makes reading a challenge, despite normal level of intelligence and receiving adequate instructions. The core deficit in dyslexia is attributed to phonological processing. It's been suggested that dyslexia is a disconnection syndrome. In this sense, the major sites of phonological processing in the brain are intact and the interconnection between these areas are disturbed. In this study, the disturbance in dyslectic brains based on effective connectivity models in “pre-reading” and “while reading” stages is investigated, which explains the causal interactions between different regions of the brain. Dynamic Bayesian Networks were constructed for the EEG data in theta, alpha and beta frequency bands to model the effective connectivity patterns of the brain in dyslectic and normal subjects in these bands. Analysis was performed based on the data obtained from two independent experiments, reading a word and a non-word by each subject. As the main objective of the thesis, dyslexic and normal children were classified based on the information obtained from

the underlying effective connectivity models of their brains which reveal the abnormal patterns in the brain that may lead to detection and diagnosis of the condition. Dyslectic subjects were found to have a different effective connectivity patterns in “pre-reading” period, regardless of the reading task and theta frequency band is reported to be the most informative one about the disturbance in the casual influence between two groups in this period. The classification rate of 86.21% were obtained based on “pre-reading” models. the classification rates of 86.21% in reading a word experiment and 81.03% in reading a non-word experiment were obtained in alpha band. Features used to classify two groups are the connectivity weights (obtained from DBN models) that are significantly different between dyslectics and controls. The connection include the ones from both dorsal (which is more activated while reading a word) and ventral (which is more activated while reading a non-word) pathways. This indicates the distruption of them both in dyslectic brains.

Keywords: dyslexia, EEG, effective connectivity, DBN.

C-22

Brain-like computing for investigation of brain

Halıcı U

Neuroscience and Neurotechnology (NSNT), Electrical and Electronics Engineering (EEE), Middle East Technical University (METU), Ankara, Turkey

Artificial Neural Networks (ANNs) are computational models inspired by biological neural networks. ANNs consist interconnected neurons that exchange information. Deep learning is a recent approach used for training ANNs having several processing layers. They have been used successfully in many recent studies to learn features and classify different types of data. However, the number of studies employing deep learning in Neuroscience is very limited. As a research group in METU NSNT and EEE, beside applications like handwritten digit recognitions or automated detection of cancer metastasis in stained slide images of lymph node sections, we are applying deep learning also in areas related to neuroscience. One of our studies using deep learning aims to develop computational methods to scale automatically mouse grimace in videos recorded in experiments in which headache-like and abdominal pain created in mouse by applying pain paradigms. Institute of Neurological Sciences and Psychiatry (INSP) of Hacettepe University (HU) and METU NSNT, having also a joint Ph.D. program, brings together their expertise in neurological sciences and technology in a project for this study. In the project, it is planned to conduct experiments by HU INSP in order to create pain in mouse, to collect video recording of mouse grimace reflecting pain and to scale mouse grimace in video manually by experts. For METU NSNT side, it is planned to develop computational methods based on computer vision and machine learning, especially deep learning, for mice face tracking and for automatic mice grimace scaling in these video recordings collected. Another study employing deep learning is related to Brain Computer Interfaces that is conducted jointly

by METU NSNT and Ankara University Brain Research Center. In this work we investigate deep learning to classify EEG Motor Imagery signals. In our study, a new form of input is introduced to combine time, frequency and location information extracted from EEG signal and it is used in Convolutional Neural Networks (CNN). We also proposed a new deep network by combining CNN and Stacked Auto Encoders (SAE). In this network, the features that are extracted in CNN are classified through the deep network SAE. The studies mentioned above are partially supported by projects TUBITAK115E248 Automatic Evaluation of Pain-Related Facial Expressions in Mice (Mice-Mimic), METU BAP-03-01-2015-01 Analysis of Motor Imagery EEG Signals for Brain Computer Interfaces, METU BAP-03-2016-003, Wireless System for EEG Motor Imagery, METU BAP-03-01-2016-002 Running Artificial Neural Networks and Deep Learning Methods parallel on GPU.

Keywords: brain-like computing, artificial neural network, deep learning, Mouse Grimace Scaling, brain computer interfaces

C-23

Neurons to cognitive computational systems: an engineer's attempt to understand the brain

Özgüz V

Sabancı University Nanotechnology Research and Application Center, Istanbul, Turkey

One of the greatest goal of our century is to understand the working principles of the brain. A better understanding of the operation of the brain will enable to better human life by contributing to the artificial tests of the diagnosis and therapeutics of brain diseases in artificial platforms. The exponential advancements in informatics and data processing technologies provides and unprecedented opportunity to address and solve the complex structure of the brain. One of the goal of global brain projects is to understand the working of the brain and simulate the computational architecture of the human brain using integrated approach to data processing by global collaboration. Although the operation of the human brain can be sometimes considered like a computer, hardware-software relationships, data flow, inseparable sensor and data processing functions, dense feedback loops, and parallel operations describe a dissimilar "architecture". This architecture is completely different than the Von-Neumann class architecture common to many computational platforms in our daily life. There is a huge research interest in computational architectures based on incoming data flow, incorporating efficient non-supervised learning in time, inspired mostly from biological systems. This new class of neuromorphic data processors taking cue from the operation of the brain requires new approaches and technologies for implementation. Neuromorphic data processing systems aims to realize new robotic systems based on human brain architecture and circuit structure by developing ultra low power integrated computing chips and hardware platforms.

Keywords: brain architecture, neuromorphic systems, computational systems

Saturday, 28 May 2016

09:00–10:30

PANEL SESSION 6

Gender differences in neuroscience at physiological and pathological processes

Chair: Prof. Dr. Filiz Onat

C-24

Sex differences in nicotine addiction

Pöğün S¹, Kanıt L²

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Males and females are different not only in reproductive function but also in brain structure and function, cognition, and behavior including addiction. Sex differences in brain and behavior result from complex reciprocal interactions between genes, gonadal sex, hormonal sex, effects of hormones on the brain, experience, learning, social and other environmental influences. Although sex differences are evident in many neurological and neuropsychological disorders, these differences have been overlooked, resulting in serious problems. There are sex differences in vulnerability to addiction in general, and there is growing evidence that this difference is particularly pronounced in psychostimulant abuse. In human subjects, although the influence of different social and environmental pressures on males and females cannot be overlooked, biological factors are also evident and suggest similarities to differences observed in animal models of addiction. During the past four decades, there have been substantial preclinical and clinical data pointing to sex differences in nicotine/tobacco addiction. Tobacco use continues to be a major cause of preventable death. Although the number of smokers is gradually decreasing in developed countries, remaining hard-core smokers are becoming harder to treat. Additionally, the decline has been less pronounced in women than in men. Women have greater vulnerability for smoking-related diseases than men, but are less successful in quitting. Men benefit from nicotine replacement therapy more than women. Studies on rodents point to similar sex differences suggesting the involvement of underlying sexual dimorphisms in biology. Females take shorter to become dependent than males, make fewer quit attempts and can stay abstinent for shorter periods; the rate of relapse is higher in females than males. Our lab has been working on sex differences in the central effects of nicotine during the past 25 years. The talk will provide examples from our biobehavioral studies pointing to sex differences in nicotine action in rats. Recently, we have been investigating individual differences, including sex of the subjects, in nicotine preference in rats that are exposed to voluntary oral nicotine intake, and will also present data on individual differences. We will adopt a translational perspective and provide links to clinical observations based on preclinical studies. Including sex as a factor in both preclinical and clinical investigations is a necessity. Biobehavioral studies help us understand nicotine/tobacco addiction better and develop more efficient and individual based smoking cessation therapeutic strategies. This approach

is not only relevant in showing that differences exist, but also in understanding the underlying mechanisms.

Keywords: nicotine, addiction, sex differences, individual differences, animal models

C-25

Sex differences in absence epilepsy

Onat F

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While epidemiological data suggest a female prevalence in human childhood- and adolescence-onset typical absence epilepsy syndromes, the sex difference is less clear in adult-onset syndromes. In addition, although there are more females than males diagnosed with typical absence epilepsy syndromes, there is a paucity of studies on sex differences in seizure frequency and semiology in patients diagnosed with any absence epilepsy syndrome. Moreover, it is unknown if there are sex differences in the prevalence or expression of atypical absence epilepsy syndromes. Surprisingly, most studies of animal models of absence epilepsy either did not investigate sex differences, or failed to find sex-dependent effects. However, various rodent models for atypical syndromes such as the AY9944 model (prepubertal females show a higher incidence than prepubertal males), BN model also with a higher prevalence in males and the Gabra1 deletion mouse in the C57BL/6J strain offer unique possibilities for the investigation of the mechanisms involved in sex differences. Although the mechanistic bases for the sex differences in humans or these three models is not yet known, studies of the effects of sex hormones on seizures have offered some possibilities. The sex hormones progesterone, estradiol and testosterone exert diametrically opposite effects in genetic absence epilepsy and pharmacologically-evoked convulsive types of epilepsy models. In this session, evidence for the sex differences in absence epilepsy and absence seizure models exhibiting sex-dependent phenotypes will be presented and discussed.

Keywords: epilepsy, animal models, seizure

C-26

Sex differences in the susceptibility and consequences of early life seizures

Akman Ö

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Sexual differentiation of the developing brain starts very early in life, and organizes different molecular signaling pathways and physiologic functions of brain regions that are involved in seizure expression and seizure control in males and females. The main influence on this developing process is exposure to gonadal steroid hormones during sensitive periods of prenatal and early postnatal development. Brain maturation follows different paths in males and females which affect protein expression and func-

tion, neurogenesis and migration, cellular physiology and differentiation and function, or the interactions of the central nervous system with other biological systems or environmental factors. For example, GABA-mediated inhibition favors an earlier maturation in certain sexually dimorphic brain regions of the immature females. Moreover, many morphological sex differences in brain including the number of dendritic segments, connectivity or volumetric differences have been reported. Knowing how these processes differ between the sexes can help us understand mechanisms underlying gender differences in seizure susceptibility and epileptogenesis. Seizures are very common in the early periods of life and may disrupt neuronal differentiation and connectivity, signaling pathways, and the function of various neuronal network. A higher incidence of generalized-onset epilepsy, photosensitive seizures of genetic or unknown etiology, or febrile status epilepticus have been reported in females. In contrast, mild male predominance has been shown in Landau-Kleffner syndrome, West and Lennox Gastaut syndromes, and severe myoclonic epilepsy of infancy. However, very few clinical studies exist on sex-specific outcomes in individuals with early life seizures or epilepsies, due to experimental limitations. Considering the differences of brain maturation in males and females, it would be expected that early seizures should have sex-specific effects. Indeed, few studies have started evaluating the sex-specific effects of early life seizures on neurogenesis, signaling pathways, behavioral tests, or subsequent injury. Recently, we showed that the early life status epilepticus and stress have distinct and sex-specific effects on learning, subsequent seizure outcomes, including anticonvulsant response to phenobarbital. Early life status epilepticus cause more but transient cognitive deficits in males but aggravate the consequences of subsequent status epilepticus females. In this talk, we will discuss the evidence for sex-specific features of the developing brain that could be involved in modifying the susceptibility and consequences of early life seizures.

Keywords: sex differences, seizure, neonatal seizure, status epilepticus

Saturday, 28 May 2016
11:00–12:00

CONFERENCE 3

Chair: Prof. Dr. Şakire Pöğün

C-27

Mapping brain circuits in neuropsychiatric and neurodevelopmental disorders: visiting autism and schizophrenia

Belger A

Professor and Director of Neuroimaging Research in Psychiatry, Professor in the Department of Psychology at the University of North Carolina, Adjunct Associate Professor at the Brain Imaging and Analysis Center at Duke University, USA

Schizophrenia is a complex neurodevelopmental disorder characterized by impairments across numerous domains, including cognition, perception, and emotion regulation. Onset of schizo-

phrenia is predominantly during late adolescence, and often preceded by the emergence of prodromal symptoms. Similarly, autism is also a complex neurodevelopmental disorder that impacts multiple domains of function, as reflected in impairments in communication, perception, motor regulation, social cognition, and affective processing. Unlike schizophrenia, onset of autism is predominantly in very early childhood, typically by age 2. Though now recognized as heterogeneous disorders with distinct developmental trajectories and dissociative features, autism and schizophrenia have apparent overlaps in certain areas of executive and social dysfunction. Advanced brain mapping studies using neuroimaging and electrophysiological methods have been instrumental in revealing complex regional and network-level abnormalities in these disorders. I will review recent findings from functional neuroimaging, resting state connectivity and electrophysiological recording studies advancing our understanding of the complex neural dysregulations and their associations with heterogeneous symptom profiles in individuals with schizophrenia and autism. I will then present data on familial and genetic high-risk individuals, indicating potential neurobiological vulnerabilities that may represent early risk markers and potential intervention targets.

Saturday, 28 May 2016
13:45–15:15

PANEL SESSION 7

Neurobiology of language

Chair: Dr. Mustafa Seçkin

C-28

Aphasia from history to present: Wernicke-Lichtheim house revisited

Gürvit H

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Although the idea that distinct mental faculties, and language thereof, have distinct cerebral anatomic addresses can be traced back to phrenology of Gall, the classical age of brain-language relationship starts after Broca's dictum "nous parlons avec l'hémisphère gauche" in 1861. Wernicke having reported a different aphasic syndrome in 1871, had shown that language is not a homogeneous entity occupying a specific cerebral center, but has specialized components residing in distinct neuroanatomical addresses. Moreover, assuming that those different components of a particular mental faculty should have somehow been anatomically connected, he had envisaged the first connectivist model of the brain ever. This model resembles a table: Wernicke table. Lichtheim in turn, in 1885 reported different aphasic syndromes as compared to Broca and Wernicke combined, whose common denominator was the impairment of word/sentence repetition, in which the repetition ability was intact and the underlying lesions had distinct neuroanatomic localisations. The new connectivity model now resembles a house: Wernicke-Lichtheim house. Meanwhile, although Pick had already reported a case with slowly progressive aphasia, the field of aphasiolo-

gy was destined to be confined to acute aphasia due to stroke for the next 90 years. Having Geschwind founded the new discipline of behavioral neurology in 1960s, the modern age of brain-behavior relationship starts. In the new age after Mesulam revitalized the concept of slowly progressive aphasia in 1982, aphasia due to neurodegeneration also becomes one of the main scopes of aphasiology: Primary progressive aphasia. During the modern age, essentially due to the paradigm shift, which states the large-scale neurocognitive networks or the neural architecture of cerebral connectivity as the main interface of the brain-behavior relationship as the predominant paradigm, new floors were introduced into the house: Wernicke-Lichtheim-Heilman Mansion. It is no more the privilege of a neuropathologist to gain access into this mansion. Thanks to the new imaging techniques, it is already a public museum that can be wandered around by modern sophisticated neuroimaging methods.

Keywords: language, aphasia, neuroanatomy

C-29

Cognitive mechanisms of language disruption in neurodegenerative aphasia

Seçkin M

Behavioral Neurology and Movement Disorders Unit, Istanbul Faculty of Medicine, Istanbul University, Istanbul, Turkey

Our unique faculty of language can be disrupted as a result of damage to the language network in the brain. In previous models of aphasia based on stroke studies, language comprehension and production have been theorized to be carried out by two circumscribed areas in the brain. The cortical area located in posterior portions of the left superior temporal gyrus (Wernicke's area) was described as a language node responsible for comprehending words and sentences. The left inferior frontal gyrus (Broca's area), was shown to be involved in language production and comprehension of complex grammatical sentences. However, atypical correlations between lesion sites and language deficits in stroke patients have been shown by recent lesion studies. Some patients with damage to these traditional language nodes did not show typical features of Wernicke's or Broca's aphasia. Furthermore, due to the variability in blood supply, some regions in language network (i.e. anterior temporal lobe) can be more resistant to cerebrovascular accidents. Thus, these regions can be spared in stroke aphasia. However, neurodegenerative aphasia, namely, primary progressive aphasia (PPA) may disrupt any region in the language network. In PPA patients, neurodegeneration of anterior temporal lobe disrupts the linkage between words and objects, in particular in the semantic subtype. Disruption of word-object association can be assessed with high sensitivity using novel techniques such as eye movement tracking. Word-object matching paradigms in eye tracking experiments have successfully revealed that blurring of intra-category borders (taxonomic blurring) may be the main mechanism of word comprehension deficits in neurodegenerative aphasias. Patients with PPA may not differentiate words from the same category (i.e. cat and dog). On the other hand, unlike Wernicke's aphasia, comprehension deficit can be

selective for words and sentence comprehension can be spared in PPA. Therefore, studying language network in PPA provides a unique opportunity to understand the mechanisms of the specific components of language.

Keywords: neurodegeneration, stroke, primary progressive aphasia

C-30

The functional neuroanatomy of language

Torun Ş

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The current imaging of language-brain systems in working state has paved the way for a more elaborate understanding of the functional neuroanatomy of language within individuals both with typical language development and acquired or developmental language disorders. Recent developments related to language-brain relations involving perspectives from various disciplines such as cognitive neuroscience, neuropsychology and computational neurolinguistics has invalidated the models restricting the localization of language in the brain towards a single hemisphere and certain locations such as 'speech center' or 'comprehension center'. According to the modern neuroscientific viewpoint, the functional neuroanatomical organization of language is more widely distributed in the brain. It involves pathways formed by axons extending to frontal, parietal and temporal lobes, and brain areas mutually connected by these pathways. In line with the progress and innovation related to the knowledge of micro-macro neural structures and mechanisms executing language functions; new terms and concepts such as 'anterior/posterior language areas, dual stream model, parallel loops, sound-meaning interface, audio-visual integration, phonological mapping, local processing, bihemispheric processing, neural circuits, semantic retrieval, modular organization, language networks, multifunctional networks, distributed global networks' instead of 'Broca's area-Wernicke's area' have started to gain widespread coverage in the respective literature. Though current approaches assess language processing in the brain in a mutually connected manner with substantially detailed stages in terms of language components, it is inevitable that they contain certain features to be called as modern localizationist. However, this approach targets 'the brain language systems involving neural processes and networks related to basic components of language' instead of focusing on 'the correlation between the language function and anatomical structure'. This up-to-date perspective is closely interested in the inquiry of how language processes in the brain are performed along with where they are carried out. Taking into account the dorsal and ventral language processing streams assumed to perform the language functions in current models, the structural components of language in the brain forms a large-scale network dissipating to both hemispheres could be mentioned. This network involves anterior brain regions including inferior frontal gyrus (anterior language areas) and superior temporal gyrus, certain parts of middle temporal gyrus, anterior tem-

poral gyrus, and posterior brain areas including inferior parietal gyrus and angular gyrus (posterior language areas). The recent language-brain maps elaborating the functional neuroanatomy of language also include many anatomical sub-regions in both hemispheres. These regions take part in the arrangement of sensory-motor integration related to various language components.

Keywords: brain, language, functional neuroanatomy, neurobiology, language processing

Saturday, 28 May 2016

13:45–15:15

PANEL SESSION 8

Evaluation of material specific memory disorder in the temporal lobe epilepsy with different methods

Chair: Prof. Dr. Lütfü Hanoğlu

C-31

The legend of material specific memory disorder in the temporal lobe epilepsy as a lateralizing factor

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Memory disorder in Temporal lobe epilepsy (TLE) is a well-defined phenomena, which is first defined material specifically (specificity) by Milner et al. This phenomenon is mainly explained as following, different brain lobes are in charge of processing different types of memory materials. According to this theory in the human memory, verbal/vocal and nonverbal/visual materials are processed separately (“material specific”) in the right and left temporal lobes region specifically producing a whole. Non the less some suspicions are rising in the recent years, whether the material specific model is actually as basically and inclusively valid as it is has seen or not. Classical view and research findings always shows the intention of groups, but still today, it is not clear in single patient basis what kind of approach one should embrace, about a patient is about go under a surgery and his lesion side, his neuropsychometric findings and his memory profile. In this research it will be reinvestigated the material specificity phenomena in the light of our clinical data.

Keywords: memory, material specificity, neuropsychology, temporal lobe epilepsy

C-32

Activities in the prefrontal cortex during verbal and nonverbal memory encoding and retrieval processes: an fNIRS study

Yıldırım E

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Objectives: The widely accepted material-specific memory model is relies on the framework that verbal memories are medi-

ated by the left temporal lobe, while non-verbal memories are mediated by the right temporal lobe, though there are some questions about this framework (Hanoğlu et al., 2014). Sometimes, it is required the surgical removal of the epileptic focus in TLE patients. In these cases, if the lesion is near the language or memory-related brain regions, neuropsychological assessment and WADA procedures are implemented to determine the functional lateralization of these cognitive functions. The function of the procedure is to predict risk for degree of material-specific memory decline after ipsilateral temporal lobectomy. Due to risks associated with the angiography procedure and the shortage of amobarbital, researchers are looking into non-invasive ways to determine language and memory laterality—such as fMRI, TMS. fNIRS have been more preferable functional imaging technique recently because of some practical reasons. fNIRS technique has been used in this study with the aim of refocusing of both material-specificity theory and developing an alternative, more secure and convenient method instead of WADA procedure. The assessment of the activities in the prefrontal cortex during verbal and nonverbal memory encoding and retrieval processes with fNIRS is the another aim of this study.

Methods: Twelve voluntary healthy subjects participated in the study between ages 20–40. All subjects were informed about the experiment protocol and informed consent was obtained before the applications. The participants are seated in a comfortable chair one meter away from a computer screen at an eye level in a dimly lit quiet room. The first half of the participants performed computerized verbal memory test before nonverbal memory test, the other half performed in reverse order. There was 30 minutes break between the encoding and the retrieval phases. During this time subjects were exposed to other cognitive tasks unrelated to the study. Functional hemodynamic responses obtained from right and left VLPFC during the test (fNIRS, 16 channels), were compared separately for recording and retrieving phase. The data were analysed by ANOVA for repeated measures.

Results: Each left and right prefrontal hemodynamic responses obtained during an encoding and retrieval memory phases were analysed separately, compared to verbal and nonverbal memory conditions.

Conclusion: The findings are discussed in terms of the material-specific memory model and clinical use of functional near-infrared spectrometer.

Keywords: material-specific memory, functional infra-red spectrometry, neuropsychology

C-33

Evaluation of memory lateralization using functional MR in temporal lobe epilepsy

Metin B

Department of Psychology, Üsküdar University, Istanbul, Turkey

A substantial number of epilepsy patients do not respond to conventional medical treatment and therefore become candidates for epilepsy surgery. Anterior temporal lobectomy is widely used for

treatment of temporal lobe epilepsy. However the method also carries a risk for post-operative amnesia. To evaluate the risk of amnesia, WADA test has been accepted as the gold-standard procedure. One disadvantage of WADA is that it is an invasive test and therefore is not easily applicable. An emerging non-invasive method is functional MR (fMR). In this procedure, the activation patterns of hippocampi during memory task are evaluated to determine which side is more dominant. This information is used to predict the risk of post-operative amnesia. A number of studies have indicated that the fMR findings are consistent with WADA findings. In our lab, we use an encoding paradigm that the patients complete inside the scanner. In half of the paradigm patients are instructed to memorize words and in the second half they are instructed to memorize houses. The results are analyzed using standard software such as SPM and applying medial temporal lobe masks. As a result we calculate separate lateralization indices for verbal and non-verbal memory. In this talk i will aim to summarize fMR methods currently used in the world, including ours, to estimate memory lateralization. In addition I will evaluate advantages, disadvantages and success rate of fMR in estimating memory lateralization.

Keywords: fonksiyonel MR, anterior temporal lobektomi, temporal lob epilepsisi, WADA

Saturday, 28 May 2016

16:45–17:45

CONFERENCE 4

Chair: Prof. Dr. Nihal Apaydın

C-34

Unconscious and conscious processing of somatosensory stimuli in the human brain

Villringer A

Max Planck Institute for Cognitive and Brain Sciences, Leipzig, Germany

The processing of strong (suprathreshold) somatosensory stimuli in the human brain is well studied. Previous BOLD fMRI and MEG&EEG studies have shown stimulus-related brain activity in primary and secondary somatosensory cortex as well as in a fronto-parietal network. What happens to subthreshold stimuli that are never consciously detected? We show that subthreshold stimulation (of finger nerves) goes along with a negative BOLD signal in SI, SII, and SMA. It furthermore inhibits processing of subsequent somatosensory stimuli on the same as well as the adjacent finger. We also show that subthreshold stimulation induces an SEP after 60 ms (P1), however, thereafter no further SEP component is seen. Interestingly, we observe a transient increase of background rhythms in the alpha frequency range after subthreshold stimulation, a finding which may explain the behavioral inhibition of the somatosensory system. We furthermore find that spatial attention can enhance P1 induced by subthreshold stimulation similarly as for suprathreshold stimulation. As P1 is modulated by prestimulus alpha power we tested whether the effect of attention (on sub- and suprathreshold stimulation) is mediated by its effect on prestimulus alpha. While our analysis shows an interaction between spatial attention, alpha

rhythm, and evoked activity, our findings speak against alpha rhythm as a mediator of attention. Rather, background alpha rhythm seems to serve the behavioral goal of the given task.

Saturday, 28 May 2016

18:00–19:30

PANEL SESSION 9

Neuropsychological assessment in dementia: from traditional methods to neuroimaging; from theory to practice

Chair: Prof. Dr. Banu Cangöz

C-35

Neuroimaging in diagnosis of dementia

Kızıl Özel TE

Geropsychiatry Unit, Department of Psychiatry, Faculty of Medicine, Ankara University, Ankara, Turkey

Despite technological improvements in medicine, diagnosis of dementia largely depends on clinical symptoms and neuropsychological evaluation. For most of the dementia etiology accurate diagnosis is only possible by pathological examination. However neuroimaging methods like computed tomography, magnetic resonance imaging and positron emission tomography are widely used for early diagnosis, as well as the differential diagnosis of several causes of dementia. The pattern of regional brain dysfunction in functional neuroimaging methods like PET or SPECT and the brain atrophy in structural neuroimaging methods like CT or MRI are clues to diagnosis. Therefore, neuroimaging is suggested at the initial evaluation in all diagnostic algorithms of dementia. Firstly, structural neuroimaging methods especially MRI are preferred, but CT can also be performed due to the patient's characteristics (claustrophobia, some contraindications etc.). The most significant finding is medial temporal atrophy in patients with dementia due to Alzheimer type dementia (ATD). However, the study results highlight that only progressive atrophy is a specific sign for the diagnosis of ATD. Metabolic changes may precede structural brain changes. (18F) Fluorodeoxyglucose-FDG-PET shows temporal, parietal and most notably, posterior cingulate hypometabolism in ATD and has a good discriminatory power (sensitivity and specificity in the range of 85–90%). In addition to that, *in vivo* amyloid imaging by PET is also available, however this method is still being used for research purposes only.

Keywords: Alzheimer type dementia, CT, dementia, PET, SPECT, MRI

C-36

Role of neuropsychological assessment in dementia

Cangöz B¹, Özel Kızıl TE², Baskak B2, Baran Z¹

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Neuropsychological assessment (NA) is concern with relation between impairment of brain and cognitive functions. Dementia is defined deterioration of intellectual faculties, such as memory,

attention, concentration, and judgment, resulting from a progressive organic disease. It is sometimes accompanied by emotional disturbance and personality changes. The purpose of NA in dementia are: 1) to measure of cognitive processes objectively and quantitatively by neuropsychological tests; 2) to play a supportive role for diagnosis and/or differential diagnosis of dementia, 3) to supervise/monitor to the treatment objectively. In the NA patients with dementia test scores are compared with healthy group equivalent by age, gender and education level. In this context, a psychometric properties of neuropsychological tests are very important. These tests are generally developed by classical test theory. According to this theory, same functionally standard test items are typically administered to each person, and an aggregate score across items (e.g., mean or percentage correct across items) is thought to provide the best of estimate of each person's true cognitive ability. According to point of view we are interfered from a test score to an individual's cognitive functions. In order to sufficient of neuropsychological test by psychometrically: 1) Should be to completed to cultural adaptation processes, 2) Should be determined normative values (according to age, gender and education), 3) Should be completed validity and reliability studies, 4) If it will be using in a clinical purposes for diagnosis and/or differential diagnosis, cut-off score should be determined for adopted culture. If a neuropsychological test has not got to above properties, score which has been taking by the test are not scientifically trustworthy. In the ideal NA battery for dementia must be consist of tests which are measured to main cognitive dimensions (attention, memory, visuo-spatial functions, language and together with general cognitive screening test, praksi, depression scale for geriatric population and daily living activities scale. Conducting high-quality researches on dementia requires knowledge about theoretical framework. NA is not enough to develop a theory of dementia. Thus, we should include different level measures (behavioral, biological, physiological, molecular, functional) in our theories/models. We should also resist the enticing urgent to engage in biological or molecular reductionism. When we used integrative approach that demonstrate the relations between different measurement levels, we may provide more fruitful dementia theories/models. This view is to be fitted interdisciplinary neuroscientific approach and its nature. In the following part we have presented two sample multidisciplinary research of neuroscience which represents to this approach.

Keywords: Alzheimer type dementia, dementia, neuroimaging techniques, neuropsychological assessment

C-37

Frontal activity measured by f-NIRS during emotional working memory in Alzheimer type dementia

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Emotional working memory (EWM) is suggested as a working memory (WM) type, distinguished to process emotional stimuli, and may or may not be spared in Alzheimer type dementia (ATD). Ateş et.al. (2014) compared patients with ATD and

healthy elders (HE) on verbal EWM performance and accompanying prefrontal cortex activity. Twenty ATD patients were recruited from the Geriatric Psychiatry Unit at a university hospital along with 20 HE individuals. One-back task was administered in three emotional load conditions (using neutral, positive and negative emotional word lists). Prefrontal oxyhemoglobin (oxyHb) concentrations were measured simultaneously by a 24-channel functional near infrared spectroscopy device. Correct response rates were similar in two groups in all conditions. Reaction times were comparable in the EWM-positive condition but longer in the ATD group in EWM-neutral and negative conditions. In the HE group, emotional words had no significant effect on EWM; there were no significant correlations between the reaction time, prefrontal activity and EWM performance. On the other hand, emotionally positive compared to neutral words led to greater activation in the left ventral prefrontal cortex (VPFC) in AD group. When compared to HCs, activity in the VPFC was significantly higher in ATD patients during the EWM-positive word condition. Finally, we found that positive words facilitate EWM performance in patients with ATD. Activity in VPFC may be the functional correlate of this phenomenon.

Keywords: Alzheimer type dementia, working memory, emotional working memory, fNIRS

C-38

Examination of emotional information processing in Alzheimer's type dementia with fMRI

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Alzheimer's type dementia (ATD) is a progressive neurodegenerative disease occurring with ageing. Due to memory related processing is affected at the first stages of the disease. However, emotional memory is generally preserved in the early stage. FMRI studies give valuable information related to affected brain areas in ATD. The purpose of Baran et.al. (2014) is to determine the BOLD signal activation patterns during emotional processing among health young (HY), healthy elder (HE), mild cognitive impairment (MCI) and ATD groups with respect to brain areas; and to examine activation patterns for ATD (N=44). Pictorial (from International Affective Picture System) and verbal (adjectives) emotional stimulus sets were presented in a block design manner which are consisted of pleasant, unpleasant and neutral. Finally, emotional pictures and words caused to task related activations in the brain areas known for emotional processing such as amygdala, hippocampus and medial prefrontal areas. Tasks also produced task-unrelated deactivations in the anterior and posterior networks known as Default Mode Network (DMN). Activations resulted by the picture set were both more intense and prevalent than the activation resulted by the word set. While the emotional pictures produced more activation in the right amygdala than left one in all group, there was not such a lateralization observed for the emotional words. Between group comparisons showed that activation patterns in amygdala, hippocampus and limbic structures were decreasing

from HY, HE, MCI to ATD group. However for the word set, activation pattern was increasing in medial prefrontal area from HY to ATD group. While DMN activation pattern was rising from HY and HE groups to MCI group, in ATD group it almost diminished in the anterior area. For emotional pictures, emotional processing is preserved in ATD group due to observed amygdala activation. With ageing, as the role of frontal lobe increases, the role of subcortical structures decreases. DMN activation indicate between group differences more clearly and consistently than the other task-related activations. DMN activations decrease in more detectable manner both in anterior and posterior areas in ATD with respect to other groups. Thus, DMN activation pattern may be provide the clinician more reliable information in the diagnosis of ATD.

Keywords: Alzheimer type dementia, default mode network, mild cognitive impairment, ageing, emotional information processing, FMRI

Saturday, 28 May 2016

18:00–19:30

PANEL SESSION 10

Possible biomarkers of cognitive impairment in Parkinson's disease from normal cognition to dementia

Chair: Prof. Dr. Lütfü Hanoğlu

C-39

A neuropsychometric, clinic and behavioural approach to cognitive impairment in Parkinson's disease

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Even in the early stages of Parkinson's disease (PD), one can identify some poor performance in the cognitive functions and also some symptoms like apathy, anxiety, depression and abnormal behaviours in some patients. Besides in the course of PD dementia will present in a high probability of %40–60. Recently a transition period to PD is defined as mild cognitive impairment (MCI). Recent findings also suggest that PD might have different subtypes, which progress with different impairment patterns according to their clinical, cognitive and behavioural characteristics. That's why recently in PD finding a biomarker that indicates and includes the progress of PD form MCI to dementia is a scientific region of interest. In this research it will be examined the cognitive impairment process in the axis of neuropsychometric tests and behavioural/clinical characteristics.

This study is supported by the Scientific and Technical Research Council of Turkey (TUBITAK) with the scope of the research project No. 214S111.

Keywords: dementia, mild cognitive impairment, neuropsychology, Parkinson

C-40

Event related oscillatory responses of Parkinson's disease patients during visual oddball paradigm

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Objectives: The analysis of event related EEG oscillatory brain dynamics is one of the essential methods used to analyse the deficits of functional brain activity of the patients with cognitive impairment (Başar ve Güntekin, 2008, 2013). There are limited number of studies which analyzed the functional brain activity in patients with Parkinson's disease (PD) with or without cognitive deficits. The aim of the present study is to analyze the Event Related Oscillations of Parkinson patients without dementia, Parkinson patients with mild cognitive impairment, Parkinson patients with dementia and healthy controls during visual oddball paradigm.

Methods: In this symposium the preliminary results of a three year project will be presented. 10 Parkinson patients without cognitive deficits, 11 Parkinson patients with cognitive deficits (7 of them were mild cognitive impairment, 4 of them were dementia) and 11 healthy controls were included in the study. EEG was recorded from 32 electrode locations. Simple light and visual oddball paradigm was administered to each participant during EEG recordings. Event related oscillatory responses in delta (0.5–3.5 Hz), theta (4–7 Hz), alpha (8–13 Hz), beta (16–24 Hz) and gamma (28–48 Hz) were analysed for each subject and for each location. Grand averages were evaluated for each group and for each frequency band.

Results: The observation of grand averages showed that the patients with Parkinson's disease had a decreased delta responses in comparison to healthy controls during cognitive task. This abnormality was more obvious for the patients who had mild cognitive impairment and/or dementia. Furthermore, there were differences between patient groups and healthy controls in the alpha, beta and gamma frequency responses.

Conclusion: The preliminary results of the present study showed that there were differences in the event related oscillatory responses of the Parkinson's disease patients in comparison to healthy controls. The results of the present project with an increased number of subjects would be one of the pioneer studies showing the abnormalities in the functional brain activity of the patients with Parkinson's disease with and without cognitive impairment.

Acknowledgments: This work (grant number 214S111) was supported by the Turkish National Science and Research Council (TUBITAK).

Keywords: EEG, Parkinson, dementia, event related oscillations, oddball paradigm

C-41

Possible biomarkers of cognitive processes of mild cognitive impairment and dementia in Parkinson's disease: examination of structural changes in the brain magnetic resonance images using brain segmentation and parcellation methods

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Objectives: Parkinson's disease (PD) is one of the neurodegenerative diseases. Structural and functional changes occur in the brain tissue at the beginning and course of the disease. It is possible to monitor the quantitative effect of degeneration with some methods called brain segmentation and parcellation on the magnetic resonance (MR) images, which are processed by using some computer programs. For this purpose, clinical and experimental studies have been performed by comparing volume, and cortical and pial surface areas between the individuals and groups in T1-weighted MR images. In this study, the relation between structural and functional changes is examined by evaluating the images, which are collected from different stages of Parkinson's diseases.

Methods: 1-mm consecutive images with sagittal orientation, and which are obtained according to T1W 3D Pre Sense protocol with 3 Tesla MR machine, will be processed in brain analysis software called BrainSuite. After the procedure, BrainSuite gives volume, thickness and surface area data of the various parts of the brain. Comparisons will be done between control group and PD group according to the data which is related with the gyrus in frontal lobe and the structures of hippocampus and amygdala. Moreover, comparisons will be performed according to the stages of the disease in PD group.

Results: As a result of the performed quantitative analysis, it is expected that the cortical thickness and surface area will decrease in PD group and this value will decrease in compliance with the stages of disease in PD group. It is also expected to have a relation between EEG and clinical findings and structural changes.

Conclusion: It is expected that cortex thickness and surface area will decrease in PD group when it is compared with the control group. In this study, it is aimed to reveal possible degenerative effects, which may occur in various parts of cortex due to PD. The relation between structure and function will be examined as well.

Acknowledgments: This work (grant number 214S111) was supported by the Turkish National Science and Research Council (TUBITAK).

Keywords: Brain MRI segmentation, brain parcellations, dementia, neurodegenerative disease, Parkinson's disease

Sunday, 29 May 2016

09:00–10:30

PANEL SESSION 11

Brain connectivity networks in neurologic and psychiatric disorders: structural and functional magnetic resonance imaging findings

Chair: Prof. Dr. Tamer Demiralp

C-42

Multimodal imaging of brain networks through magnetic resonance imaging techniques

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Magnetic Resonance Imaging (MRI) provides valuable information on various aspects of brain structure and function through various neuroimaging modalities it provides. While hemodynamic responses of the brain can be captured by means of blood oxygen level dependent (BOLD) signal yielding functional activation maps in functional MRI (fMRI), diffusion weighted MR imaging (dMRI) can provide significant information about white matter structures allowing the estimation of major tracts *in-vivo*. Temporal correlations among hemodynamic activities of various gray matter areas further provides information about the dynamic network activities of the brain during task and rest conditions. By means of these MRI based modalities, which allow imaging of both structural and functional connectivities, the field of brain connectome studies made rapid and important steps in last years. While initial studies were focused on specifying local changes in brain activations or connectivities, a growing literature aims to develop multivariate techniques for the comparison of whole-network patterns. Another important course of the connectivity studies, on which our group focuses, is the detection of functional connectivities during resting-state and their modulation under specific task or non-specific stimulation conditions. These measurements of brain networks can be complemented by measuring the perfusion and metabolite concentrations in specific brain regions through Arterial Spin Labeling (ASL) and Magnetic Resonance Spectroscopy (MRS), respectively. This wide range of multimodal neuroimaging techniques and methods for their concomitant measurement and analysis provide new possibilities for the investigation of normal brain function, especially during complex and less-assessed processes such as cognition or emotion, and therefore also in the evaluation and/or diagnosis of neurologic and psychiatric conditions leading to cognitive or emotional symptoms. Istanbul University, Hulusi Behcet Life Sciences Research Laboratory has been built with support of Ministry of Development (project #2010K120330) as a multidisciplinary research center to host large-scale research facilities. The Neuroscience Unit of the Laboratory contains a 3 Tesla MRI system including the related attachments for fMRI measurements and MRI compatible Electroencephalogram (EEG) amplifiers. In last 1.5 years since the system started to operate, a range of multidisciplinary neuroimaging studies have been carried out based on various basic and clinically oriented questions.

The following three talks in the panel entitled “Brain Connectivity Networks in Neurologic and Psychiatric Disorders: Structural and Functional Magnetic Resonance Imaging Findings” will present some of our clinical studies on Parkinson patients with mild cognitive impairment, on temporal lobe epilepsy and on obsessive-compulsive disorder.

Keywords: functional connectivity, resting-state networks, fMRI, dMRI

C-43

Multimodal magnetic resonance imaging in neurodegenerative disorders

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Objectives: Neurodegenerative diseases including Alzheimer’s and Parkinson’s diseases are increasing in prevalence and are among most debilitating neurological conditions. In Parkinson’s disease (PD), non-motor symptoms accompany motor symptoms at early stages, and cognitive impairment result in highest function loss. Cognitive impairment in Parkinson’s disease may be mild as in mild cognitive impairment (PD-MCI) or severe (Parkinson’s disease dementia), yet there is no reliable biomarker for the diagnosis of these conditions. In this study, multimodal magnetic resonance imaging (MRI) data of PD and PD-MCI patients are investigated as potential biomarkers.

Methods: Resting-state functional MRI data from 20 PD patients (10 PD-MCI, 10 PD) diagnosed according to UK-PD Society Brain-Bank criteria were collected by a 3T MRI scanner (Philips-Achieva, The Netherlands) using a T* weighted echo-planar (EPI) sequence. Resting-state networks (RSNs) were obtained by the decomposition of the group data into 30 components by applying independent component analysis (ICA) in GIFT toolbox. Inner-product of the individual network maps with the group mean revealed the expression of each network in each patient as a scalar value. The combination of RSNs that best discriminate PD-MCI from PD patients was obtained by using logistic regression analysis. Additionally, brain perfusion was measured by arterial spin labeling (ASL) data acquired with multi-inversion time (TI) pulsed arterial spin labeling (pASL) sequence. Cerebral blood flow (CBF) analyses were performed in MATLAB. For MR spectroscopy, 1H MRSI data were acquired by using a SENSE accelerated 3D PRESS sequence and analyzed by LCModel program.

Results: Logistic regression analysis yielded maximum separation of both groups with 2 independent components (χ^2 :11.59, df=2, p=0.003) (left fronto-parietal and para-hippocampal gyrus/hippocampus networks). The para-hippocampal gyrus/hippocampus component revealed a negative ($r=-0.33$, p=0.08) and left fronto-parietal network showed a positive correlation ($r=0.411$, p<0.05) with global cognitive screening test (ACE-R). In ASL, CBF in precuneus of the PD-MCI patients displayed a significant decrease compared to PD patients (p<0.05). In

MRS, glycerophosphocholine (GPC)+phosphocholine (PCh)/(Creatine(Cr)+phosphocreatine(PCr)) ratio was higher in the thalamus of the PD patients compared with other investigated regions (p<0.05), while the PD-MCI patients had higher glutamate(Glu)+glutamine(Gln)/(Cr+PCr) ratio in cingulate gyrus and precuneus compared with cerebral gray matter, and lower N-acetylaspartate(NAA)+N-acetylaspartylglutamate (NAAG)/(Cr+PCr) ratio in cingulate gyrus compared with the cerebral white matter.

Conclusion: Findings point out that multimodal imaging of functional, spectroscopic and perfusion MR has the capacity to discriminate between PD and PD-MCI patients and can potentially yield a neuroimaging biomarker for PD-MCI and PDD.

Study is supported by the Ministry of Development, project #2010K120330

Keywords: mild cognitive impairment, Parkinson’s disease, fMRI, MRS, ASL

C-44

Electrophysiological ictal patterns and fMRI resting state networks in patients with temporal lobe epilepsy

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Objectives: Temporal lobe epilepsy (TLE) is considered as a neural network disease. Brain functions achieved by distant brain areas can be affected due to the propagation of the epileptic activity, and neurocognitive impairment is frequently observed in TLE. Large-scale neurocognitive networks of the brain can be revealed by applying functional connectivity analyses on functional magnetic resonance (fMRI) images collected during resting state. Presence of “switch-of lateralization” and “bitemporal synchrony” known as unusual propagation patterns in ictal electroencephalogram (EEG) of TLE patients are defined as signs of bilateral seizure activity, and are associated with bilateral epileptogenesis. In this study, fMRI resting state networks (RSNs) of the TLE patients were investigated to reveal the differences between the network characteristics of the patients with and without unusual propagation patterns.

Methods: Eight TLE patients showing at least one seizure with unusual propagation pattern and 11 TLE patients showing unilateral lateralized ictal activity during whole seizure in ictal scalp EEG during video-EEG monitoring were recruited from the outpatient clinic in the Neurology Department of Istanbul Faculty of Medicine. MRI was performed on a 3 Tesla MRI scanner (Achieva, Philips, The Netherlands) with SENSE-Head-32 coil. T1-weighted MPRAGE sequence was employed as high

resolution anatomical scan, and T2*-weighted echo planar imaging (EPI) sequence was used for fMRI measurements. After preprocessing the data using SPM8 software (<http://www.fil.ion.ucl.ac.uk/spm/software/spm8/>), RSNs were obtained with independent component analysis (ICA) in Group ICA fMRI Toolbox (GIFT). Eleven out of twenty components related with six different RSNs were further analyzed. Differences of RSNs between two patient groups were compared with voxel based t-test.

Results: In the default mode network (DMN), a cluster of 116 voxels including left precuneus (PC) and left posterior cingulate cortex (pCC) showed increased functional connectivity in the TLE patients with unusual seizure propagation compared with control group (cluster-level FWE corrected $p = 0.011$). Patients with unusual propagation pattern showed furthermore widely distributed bilateral manifestations in MRI, PET and neuropsychological evaluations.

Conclusion: PC/PCC are known as DMN's central structures that play role in functions related with memory, learning, attention and emotion with respect to their dense connections with limbic and para-limbic medial temporal structures. Increased functional connectivity in the DMN left PC and pCC in TLE patients with unusual seizure propagation is considered to reflect a compensatory mechanism against more prominent cognitive impairment in this group.

This study is supported by the Ministry of Development, Turkey, project #2010K120330.

Keywords: temporal lobe epilepsy, functional magnetic resonance imaging, resting state networks, ictal EEG patterns

C-45

fMRI findings in obsessive compulsive disorder

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Obsessive compulsive disorder (OCD) is a common debilitating disorder characterized by recurrent intrusive thoughts (obsessions) and/or repetitive behaviors or mental acts (compulsions). Studies that provide an insight on brain regions associated with OCD are conducted with brain imaging techniques, in particular functional magnetic resonance imaging (fMRI), which allows the measurement of resting state functional connectivities and task related activations. fMRI studies indicate particularly default mode and executive control network alterations in patients with OCD. Furthermore, numerous studies reported increased activity in orbitofrontal cortex (OFC), anterior cingulate cortex (ACC) and ventral subcortical regions and decreased activity in dorsolateral prefrontal cortex (DLPFC), dorsal ACC and dorsal part of the caudate nucleus. Based on recent findings on the possible role of the parietal areas in the pathogenesis of OCD, present study investigates responses to a task that strongly activates cingulo-fronto-parietal attention network in addition to resting state networks in fMRI. Our study included 22 unmedicated patients with

OCD without any psychiatric comorbidity and 22 healthy controls. All participants underwent fMRI scans during resting state and multi-source interference task (MSIT), which reliably activates the cingulo-fronto-parietal circuits associated with attention. Experiments were performed on a 3T MRI scanner. Data were preprocessed using SPM8 software. Resting state functional connectivity networks were obtained with independent component analysis using GIFT toolbox. Resting state networks of both groups were compared by using voxel based t-test. Task-related cortical brain regions were determined using general linear model (GLM) in SPM8. Patients with OCD showed decreased functional connectivity in the medial frontal region (BA9: medial frontal gyrus, superior frontal gyrus) associated with ventral component of executive control network during rest (FWE corrected $p=0.058$). During interference task condition, patients had significantly lower activation in areas including the precuneus, left supramarginal gyrus, left caudate nucleus and left supplementary motor area (BA6) (FWE corrected $p=0.016$). These findings support the hypothesis that widely distributed large-scale brain systems, including dorsal brain areas (e.g. supplementary motor area, precuneus, supramarginal gyrus), in addition to orbitofrontostriatal regions, might be involved in the pathophysiology of OCD that includes affective and cognitive components. Our results are in line with the current model of OCD pathophysiology based on the imbalance between a hyperactive ventral "affective" and hypoactive dorsal "cognitive" circuits. The results also suggest that abnormal connectivity in the executive network might play a crucial role in the neurobiology of OCD.

This study is supported by the Ministry of Development, Turkey, project #2010K120330.

Keywords: resting state, fMRI, MSIT, obsessive compulsive disorder

Sunday, 29 May 2016

09:00–10:30

PANEL SESSION 12

Validity of animal models related with neuropsychiatric disorders

Chair: Prof. Dr. Nurhan Enginar

C-46

The forced swimming test for screening antidepressant activity

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The forced swimming test developed by Porsolt et al. (1978) is one of most widely used model for screening antidepressant activity in rats and mice. When forced to swim in a basin without the possibility to escape, animals show a progressive reduction of active behaviors and develop a characteristic immobile posture and passively float making only small movements to keep their heads above water. Immobility interpreted as "behavioral despair" induced by inescapable experimental situations has been suggest-

ed to identify with depression in humans. Typical and atypical antidepressant drugs decrease immobility and increase escape-directed behaviors. Although the test is proposed to have good reliability and predictive validity for evaluating antidepressant activity, relatively low sensitivity to antidepressants acting on serotonin and 'false' positive responses with drugs that are considered to be devoid of real antidepressant activity are drawbacks of the model (Borsini and Meli, 1988). Additionally, some researchers highlight the acquisition and/or memory consolidation in the test and propose that the immobility behavior is an adaptive response rather than effects of despair or depression (Reul, 2014). Indeed drugs which have been reported to give 'false' positive effects in the test disrupt learning and memory in animals. Interestingly, antidepressants found effective in decreasing immobility have also amnesic effects, possibly arising from their anticholinergic potency. There have been many modifications of the forced swimming test to increase the sensitivity, specificity and reliability for the assessment of the antidepressant activity (Petit-Demouliere et al., 2005).

Keywords: forced swimming test, antidepressant activity, validity, reliability

C-47

Parkinson's disease and animal models

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Parkinson's disease is characterized by dopaminergic neuronal loss in substantia nigra pars compacta. It affects 1% of the population older than 60 years and various animal models have been developed in order to investigate this disease. One of the most frequently used methods is intranigral injections of 6-OHDA. With apomorphine injection and rotation testing, the neuronal loss can be detected to some extent. The animals that fail to pass the test are eliminated from the experiment. In order to validate the method brains have been dissected and 16 µm coronal sections have been taken in frozen microtomes, staining has been accomplished with TUNEL technique and the sections have been examined under Stereo Investigator v 7.5. The most serious difficulty encountered while using this method has been targeting the small area substantia nigra. There has not been adequate studies that investigate rigidity either. Intranigral injections of MPTP and rotenone have also been tried to produce Parkinson's disease. These neurotoxins produce more depressive behavior than motor dysfunction (Santiago RN et al). 6-OHDA injection into the medial forebrain bundle has also been tried. Although this has been an easier place to target, its relevance to the actual disease has been limited. Some groups use ip injection of Haloperidol and produce catalepsy. This model does not include most of the symptoms other than catalepsy. Santiago RN et al, Depressive-like behaviors alterations induced by intranigral MPTP, 6-OHDA, LPS and rotenone models of Parkinson's dis-

ease are predominantly associated with serotonin and dopamine, *Progress in Neuro-Psychopharmacology & Biological Psychiatry* 34:1104-1114 (2010).

Keywords: Parkinson, neurotoxin, validity

C-48

Validity and reliability of animal models for the assessment of the antidepressant and anxiolytic effect

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Pathophysiology of many psychiatric diseases including depression and anxiety has not been clearly elucidated yet. Experimental studies, which are conducted with animal models in order to better understanding psychiatric diseases and developing new therapeutic approaches, is extremely important. Particularly better understanding of neurobiology of diseases has critical importance enabling to examine the potential treatment approaches at behavioral level in intact organisms. At this point basic questions are whether it is possible to model complex psychiatric disorders such as depression or anxiety in every aspect or certain aspects therefore can be modeled. Depression is a highly heterogeneous disease, which can vary widely from patient to patient clinically. Furthermore, it is well known that some basic symptoms of the disease can emerge contrary. Yet similarly, individual differences contrasts can be observed in psychomotor activity and appetite status. In the light of these information, it is questionable how much the experimental depression models generated in animals can reflect a certain disease-specific symptom group or endophenotype. Similar issues are also valid for experimental modeling of psychiatric disorders like anxiety, which has highly wide spectra and numerous sub-types. Accordingly, it is not possible to generate psychiatric diseases like depression and anxiety where behavioral and thought system of human race is affected, comprising cultural, intellectual attributes in animals properly. However, despite all the stated constraints, examining psychiatric diseases at certain levels is only possible by animal models. The most important point with respect to the quality of the studies for the researchers and the real contribution of the obtained findings to science is the validity, reliability of the models used and their applicability to the clinic. Although the number of the criteria related with the validation of experimental animal models has increased today it is necessary to review at least 3 criteria; face validity; construct validity and predictive validity. Accordingly, it is necessary that (1) the behavioral phenotype in animals must be similar to the clinical symptoms, (2) effective medicines which are used in the treatment employed at the clinic to be effective in the animals model generated, on the other hand the molecules which are known to be ineffective for that particular disease to be ineffective in the model, too, (3) triggering of the factors known to play role in the development of the disease, in the animals (etiological validity) and (4) developing the neurobiological processes similar to the disease neurobiology in the animal, too.

Keywords: validity, reliability, depression, anxiety

C-49**Molecule studies effective in epileptogenesis process in experimental models of epilepsy**

Ateş N

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Epileptic seizures is an important disorder caused by increased neuronal activity depends on disruption of the excitation/inhibition balance in the brain. Understanding of the mechanisms underlying of epileptic seizures is crucial in terms of development of new treatment options. Investigating of the molecules (marker) that showed significant change in peripheral and central system during seizures is one of the aimed purposes. Here we presented the results of our studies with experimental and genetic model of epilepsy conducted in our laboratory for this purpose. In generalized tonic-clonic seizures induced with PTZ, we have founded significantly increment in the levels of IL1 β , IL6, TGF2, TNF α and galanin which are related with inflammation. Pretreatment with endogen peptides such as leptin, gherlin and NPY in the same seizure model, the level of this proinflammatory cytokines were found to be decreased. Studies on how adenosinergic modulation affects the level of these cytokines is under investigation. In our other study conducted with genetically absence epileptic WAG/Rij rats, compare to control animals we did not found significant differences in the promoter regions of genes TNF α , IL1 β , IL6, IL10 and SNP; this results therefore shows that the reorganization of the new neuronal networks underlying epileptogenesis are not at the level of gen polymorphism. On the other side proteomics research in the area of epileptogenesis, in terms of finding a new target molecules have been increasing. In our proteomics study in absence epilepsy, we have found that the level of ERp57/ PDIA3 protein expression in the regions of thalamus and parietal cortex of WAG / Rij rats with genetic absence epilepsy were significantly low compared to control rats. These results clearly show that the decrement of ERp57 may play an important role in the development of epilepsy and other neurodegenerative diseases, therefore, show that ERp57 molecule may be a target molecule for pharmacoproteomic and pharmacogenomic research.

Keywords: epilepsy, ERp57, pentylentetrazole, cytokine, WAG/Rij

 Sunday, 29 May 2016

11:00–12:00

CONFERENCE 5

Chair: Prof. Dr. Eyüp Sabri Akarsu

C-50**Neuroimaging infrastructure**

Atalar E

National Magnetic Resonance Research Center (UMRAM) and Aysel Sabuncu Brain Research Center, Bilkent University, Ankara, Turkey

Neuroimaging is a field of study for structural and functional imaging of the brain and the nervous system. There are several

imaging methods that can be used for this purpose. The main ones can be listed as x-ray-based Computed Tomography (CT), radioactive radiation based Positron Emission Tomography (PET), ultrasound, and optical diffusion tomography. However, this talk will be on the Magnetic Resonance Imaging which can be considered as the main neuroimaging method. The infrastructure available in Turkey to conduct magnetic resonance imaging based neuroimaging research will also be discussed. MRI is a method that enables high-resolution functional and structural imaging of the brain. In this method, the magnetization of the nuclei of atoms under high magnetic field and its resonance is used. Abundance of hydrogen atoms in the body is the main reason of the success of this method. One can not only obtain the hydrogen atom density distribution of the body but also the interaction of these atoms with its environment using this imaging technique. The research on this imaging method plays an important role in the neuroscience. More than 40 years of magnetic resonance imaging research continues on improving the image quality, increasing the speed and developing new contrast mechanisms. National Magnetic Resonance Research Center (UMRAM), provides infrastructure for the researchers working on the development of magnetic resonance imaging technology. Besides, perhaps the most important function of UMRAM is to serve to the neuroscience community. In order to meet the changing needs, the center tries to keep the imaging equipment hardware and software up to date, provide technical support necessary for the optimum use of this complex imaging technique. The center moved to Aysel Sabuncu Brain Research Center of the Bilkent University in April 2016. A 1.5 tesla MRI machine is expected to serve at the center soon. Although there is an infrastructure for the imaging of medium-sized animals such as pigs and sheep, the ability to image small experimental animals can be done in non-ideal conditions but there are efforts for purchasing equipment necessary for this purpose. The infrastructure serving our country and neuroimaging studies in infrastructure framework will be described in the context of this talk.

 Sunday, 29 May 2016

11:00–12:00

CONFERENCE 6

Chair: Prof. Dr. Halise Devrimci Özgüven

C-51**fNIRS based neuroimaging for assessment of treatment response in schizophrenia**Ayaz H^{1,2,3}

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Functional Near-Infrared Spectroscopy (fNIRS) is an emerging brain activity monitoring technique that can measure localized cortical oxygenation changes. Due to its portable, safe and low-cost nature, fNIRS has become increasingly popular for functional neuroimaging studies. Recent generation of fNIRS sensors

that we have built are miniaturized to the size of smart-phones, battery-operated and wireless. Hence, allowing participants to be completely mobile and untethered during the continuous recording of brain dynamics in more natural and minimally intrusive settings. fNIRS measures hemodynamic changes in the brain similar to functional magnetic resonance imaging (fMRI), but limited to outer cortex and with lower spatial resolution. However, unlike it, fNIRS is quiet (no operating sound), provides higher temporal resolution and participants are not restricted to a confined space or are not required to lie down. These qualities pose fNIRS as an ideal candidate for potential clinical deployment in psychiatric settings including diagnostic, treatment assessment and complementary treatment applications. This presentation will provide an outline of a series of pilot studies aimed to assess fNIRS' potential in discriminating both pharmacological and non-pharmacological therapeutic approaches used in schizophrenia in a collaborative effort of Drexel University, Shanghai Jiao Tong University and Shanghai Mental Health Center. Previous studies with fNIRS and fMRI demonstrated impaired activity in prefrontal cortex (PFC). Here, we describe our recent studies in which we evaluated the anterior prefrontal cortex function of schizophrenic patients during execution of cognitive tasks. The first study is a cross-sectional comparison with healthy matched controls, and results replicated the widely reported dysfunction and hypoactivation of anterior prefrontal cortex in the clinical group. Furthermore, the neural efficiency index that represents behavioral performance normalized

by the relative brain activity during the respective task was calculated. In the longitudinal study, change in PFC neural efficiencies of patients at the beginning of a drug regimen to one-month follow up session correlated favorably with clinical outcome measures. Results highlight the potential use of brain activity changes for early prediction of drug response in outpatient clinical settings before changes are observed in behavioral performance. In the final study, the effect of Transcranial Magnetic Stimulation (TMS), a non-invasive method used to excite or inhibit cortical activity for clinical intervention, has been assessed with simultaneous use of fNIRS. Since fNIRS is using light and not affected by the magnetic field, it is also an ideal neuroimaging choice for concurrent monitoring of TMS related brain activations and assessment of neurostimulation effect on the brain. In this last study, prefrontal cortex was targeted with various TMS stimulation paradigms (Single Pulse, High Frequency, intermittent Theta Burst, and Sham) and the evoked responses were measured simultaneously with fNIRS to evaluate its ability for monitoring the effect for comparison of the interventions and potentially dosing the neurostimulation. Results demonstrated that High Frequency Stimulation produces a larger and more detectable response than comparable iTBS trains. Preliminary results from current studies collectively confirm that fNIRS can be effectively used to monitor the prefrontal cortex of Schizophrenic patients and potentially provide a biomarker for objective assessment of the intervention.

Oral Presentations

(O-01 — O-35)

O-01

Is it default if it is easy?

Elif Kurt¹, Çiğdem Ulaşoğlu Yıldız¹, Ani Kıcık², Hasan Bakay³, Başar Bilgiç⁴, Raşit Tükel¹, Tamer Demiralp⁵

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Objective: In fMRI studies, specific regions of the brain are termed as default mode network (DMN) because they synchronously increase their activity during resting state compared to explicit cognitive task conditions. Beside task-positive networks, which increase their connectivity during tasks, DMN is remarkable as a task-negative network, which is the reason why it is associated with abstract mental states such as day-dreaming, internally directed thought and thinking about the past or future. In this study, the functions attributed to DMN above were re-evaluated by investigating the modulation of DMN depending on task difficulty. For this purpose, control (CC) and interference (IC) conditions of Multi-Source Interference Task that activates cingulo-frontal-parietal attention-network were investigated.

Methods: 22 healthy volunteers (28±8.2years) participated in the study. During task, three numbers appeared every two second, where one was different from other two, and subjects responded by pressing the button corresponding to the different number. During control trials, target number always matched its position (eg.100), but not during interference trials (eg.331). Task was performed in two scans, where four blocks of control trials alternated with four interference blocks. MRI was performed on a 3T MRI scanner. Preprocessing and other analyses were performed using SPM8. fMRI responses for each condition of each subject were obtained by using general linear model. Results of second-level analysis with significance level of $p < 0.05$ (cluster-level-FWE-corrected) were reported.

Results: Significant activation increase was found in five clusters including (1) medial frontal gyrus, (2) posterior cingulate, precuneus, (3-4) bilateral inferior, middle temporal gyri, (5) angular gyrus during CC compared to IC and in two clusters including (1) right inferior, middle occipital gyri, (2) left inferior, middle occipital gyri, left superior parietal gyrus during IC compared to CC.

Conclusions: Our findings show that regions showing increased activation during easy control compared to cognitively difficult

interference conditions are regions of DMN, which suggests that the structures of DMN are not only active during rest, but retain their activity even during difficult cognitive conditions compared to more difficult ones. In this context, we conclude that attributing these structures to a default mode is not accurate, instead DMN may be responsible for the mental resource management appropriate for the task. In conclusion, the functions of DMN may be better understood when they are evaluated in the task context rather than with task vs rest comparisons.

This study was supported by the Ministry of Development, Turkey, project #2010K120330.

Keywords: default mode network, fMRI, multi-source interference task, mental resource management

O-02

Decreased stuttering during simultaneous lower limb motor movements: an fMRI case study

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Objective: This study presents a case who has developmental stuttering dramatically improved during walking. The study aims to investigate the neural basis of the improvement in stuttering with an fMRI task, in which the subject spoke during simultaneous foot movements similar to those during walk.

Methods: A.A., bilingual, 27-years-old female suffering from developmental stuttering participated voluntarily in this study. Prior to the fMRI scan, stuttering was evaluated using 'Stuttering Severity Instrument for Children and Adults-3' during speaking with and without simultaneous lower limb movements. The fMRI task consisted of three sets of blocks (1) speaking (S), (2) lower-limb movements (LM) and (3) speaking with simultaneous lower-limb movements (SLM) with 10s-breaks. Each of the S and SLM blocks included five questions. A.A. answered each of these questions in 12s by speaking overtly. In LM block, she moved her feet for 50s. The task was performed in two scans, each lasting 5:34 mins. MRI was performed on a 3T-MRI-scanner with SENSE-32-channel-head-coil. A T1 weighted 3D-TFE sequence was employed as anatomical scan and a T2*-weighted EPI-sequence was used for fMRI measurements. Preprocessing and other analyses were carried out using SPM8 software (<http://www.fil.ion.ucl.ac.uk/spm/software/spm8/>). The differences between conditions were statistically compared using general linear model.

Results: In the behavioral analysis, stuttering severity and percentage of total disfluency were 19 (mild) and 8.4 in SLM condition, respectively. In S condition, stuttering severity and percentage of total disfluency were 44 (very severe) and 19.3, respectively. In fMRI analysis, SLM set showed significant difference compared to S and LM sets in two clusters which show activation increase at areas including right putamen, globus pallidus, insula (3734 voxel) and left middle temporal gyrus (1656 voxel) ($p < 0.05$ cluster-level FWE-corrected).

Conclusion: Even though neuroimaging studies show that basal ganglia are responsible for stuttering, the etiology is still unknown. There is neuroscientific evidence showing that cortical motor systems related with upper limb movements are linked to cortical speech-communication systems. It is proposed that lower limb motor system may also be linked to speech-communication system. Our findings show that simultaneous lower-limb movements improved stuttering temporarily in A.A., and this improvement was associated with increased activation in right basal ganglia and insula.

This study was supported by the Ministry of Development, Turkey, project no 2010K120330.

Keywords: basal ganglia, functional imaging, insula, lower limb movements, speech fluency, stuttering

O-03

Investigation of cerebellum's activity related with implicit motor learning during a serial reaction time task

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Objective: Neuroimaging studies of motor sequence learning have shown that cerebellar activation decreases with learning. To investigate cerebellum's contribution to early and late phases of implicit sequence motor learning, present study utilized functional magnetic resonance imaging (fMRI) measurements during a serial reaction time task (SRTT) that relies on implicit learning of a motor sequence.

Methods: Seven healthy participants (4 female) (age: 29.28 ± 7.2) performed SRTT during fMRI scanning with a T2* weighted echo-planar (EPI) sequence in 3T MRI scanner (Philips-Achieva, The Netherlands). Blocks of sequential condition (SC), in which a hidden 12-element sequence was repeated, and random condition (RC) were repeated three times in the first and third sessions yielding 6 blocks in each session. In second session, subjects were trained with 3 sequential blocks. Mean reaction times and accuracy percentages in first and third sessions were compared using ANOVA test. Comparison of fMRI data between conditions and sessions was

performed in SPM8 (<http://www.fil.ion.ucl.ac.uk/spm/software/spm8/>). Cluster-level FWE-corrected ($p < 0.05$) results were reported. Clusters showing significantly decreased activity in each condition were defined as regions of interest (ROI) specific to SC and RC after removal of intersection area. Correlations between mean activations in SC (ROI-I) and RC (ROI-II) and behavioral variables were tested.

Results: SC reaction times decayed stronger between first and third sessions ($p < 0.05$). Response accuracy increased with training ($p < 0.001$) and significantly stronger for SC ($p < 0.001$). In fMRI, training induced activation decrease in an area of 131 voxels ($p < 0.05$) covering the lobules V-VI of right anterior and superior posterior cerebellum in SC and in an area of 274 voxels ($p < 0.001$) covering lobules VI-VII for RC. Mean ROI-I activation in first session negatively correlated with response accuracy in RC of the first session ($r = -0.796$, $p = 0.032$).

Conclusion: Our findings indicate that activity of right cerebellum lobules V-VI increased during early-learning while reduced during late-learning phase. Negative correlation between activity of these structures and response accuracy to random stimuli during early learning phase suggests the interference of the learned sequence on responses to random events. Implicit motor sequence learning effect is detected in lobules associated with sensorimotor functions, while early-phase RC activation was in cerebellar regions associated with cognitive processing. It is concluded that implicit learning of the motor sequence hidden behind the complex visuo-motor task in SRTT leads to fulfilment of the task with less cognitive effort with help of cerebellar circuits.

Supported by the Ministry of Development-Turkey, project #2010K120330

Keywords: implicit motor sequence learning, implicit memory, cerebellum, fMRI

O-04

Investigation of the resting-state networks of the brain in adult patients with attention deficit hyperactivity disorder

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Objective: In this study, changes of resting-state networks (RSNs) obtained with functional MRI (fMRI) were evaluated between attention deficit hyperactivity disorder (ADHD) patients and healthy adults. By this way, we aimed to shed light on neural mechanisms underlying adult ADHD and to identify the changes induced in RSNs by the administration of the psychostimulant drug (methylphenidate).

Methods: Twenty-four adults with ADHD and twenty healthy subjects participated in this study. MRI scans were performed on a 1.5 T MRI scanner (Philips, Achieva, The Netherlands) at NPIstanbul Neuropsychiatry Hospital with SENSE Head-8 coil. Functional imaging was performed using gradient-echo echo-planar imaging (TR=2640ms, TE=40ms, voxel size=3.5×3.5×4 mm, FOV=224×224 mm). Scans of ADHD patients were performed in two separate conditions, before and 60–90 min after drug administration. Preprocessing of the functional analysis was conducted by using SPM8 (<http://www.fil.ion.ucl.ac.uk/spm/software/spm8/>) running under MATLAB (The Mathworks Inc., USA). RSNs were obtained via independent component analysis using GIFT (Group ICA fMRI Toolbox) toolbox. Binary masks were obtained by thresholding ($z > 1.5$) the RSNs of the control group to perform comparisons in a common space. Significance of changes in RSN components among groups and conditions was tested with t-test.

Results: Six RSNs consisting of a total number of fifteen sub-components were obtained by independent component analysis. Default mode (DMN), salience (SN), executive control (ECN) and visual networks (VN) of the adult ADHD patients displayed decreased functional connectivity. While the psychostimulant drug (methylphenidate) changed the task-positive SN, ECN and VN towards normal connectivity, no significant improvement was obtained for the task-negative DMN, in which the posterior cingulate cortex (pCC) further decreased its connectivity.

Conclusion: In contrast to previous reports that focused on DMN changes in ADHD, our study demonstrates that neurocognitive networks related with executive control and salience (ECN, SN) and visual processing (VN) displayed reduced functional connectivity in adult ADHD. While methylphenidate reduces the dysregulation of DMN in childhood ADHD, important part of DMN was not affected but the intrinsic connectivity of pCC further decreased by the administration of the psychostimulant. In contrast, psychostimulant induced connectivity increase in networks related with attention and executive control and visual cortex suggests the modulation of attention control circuits to compensate for the dysfunction in DMN, which is insensitive to the use of the drug.

This study is supported by the Ministry of Development-Turkey, project #2010K120330 and the IU-BAP project #20344.

Keywords: ADHD, fMRI, resting state networks, default mode network, salience network

O-05

Examination of default mode networks in children with attention deficit and hyperactivity disorder by independent component technique

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Objective: Resting state functional magnetic resonance is a functional imaging technique which allows mapping of brain networks which shows functional activations while the brain is not busy with anything (i.e. resting state). Default Mode Network (DMN) regions including of Medial prefrontal cortex (MPFC), posterior cingulate cortex (PCC), bilateral inferior IPLs draw attention in functional magnetic resonance imaging studies. In this study, the default mode network was obtained and investigated in children with attention deficit hyperactivity disorder (ADHD) performing independent component analysis (ICA) technique.

Methods: Functional and anatomical images which are obtained from age range (9–16) of fifteen children with attention deficit hyperactivity disorder (ADHD) and 15 typically developed (TD) children were preprocessed with statistical parametric mapping (SPM) programme. After pre-processing steps functional images were separated of twenty independent components performing of Matlab-based GIFT toolbox. 20 Components belonging of two groups were analyzed statistically with one and two sample t-tests. In both ADHD and TD groups, only one component which can be best detected simultaneous neuronal activation of PCC and bilateral IPL regions including of DMN was used and the other components are insignificant.

Results: Independent component (IC) which is detected to represent of DMN regions was revealed significantly difference ($p < 0.001$) for ADHD and TD groups in one-sample t-test results of both two groups. Compared to the TD and ADHD groups with two-sample t-test, PCC and IPLs regions which are components of DMN and some of other brain regions such as thalamus, hippocampus were significantly different.

Conclusion: ICA based analysis of resting state fMRI images revealed the differences of functionally active regions in the brain between the two groups. Thus, the detection of independent components allows to understand the basis of neurological disease.

Keywords: attention deficit and hyperactivity disorder, resting-state functional magnetic resonance imaging, default mode networks, independent component analysis.

O-06

fMRI investigation of neural activity associated with morality

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Objective: The neural correlates of morality have been associated with the default network for its role in mental simulation. However, little is known about how the moral content of a stimulus is initially processed, and how this processing is influenced by moral valence. The aim of this research is to investi-

gate neural correlates of detection of moral salience and the consecutive processing of moral content.

Methods: The study, which involved 22 young adults, entails investigation of neural activity associated with morality using fMRI. In this task, participants read a brief vignette, then completed the vignette by selecting one of two related sentences during fMRI. The correct, most semantically related sentence, and the incorrect sentence options involved immoral, moral or neutral statements. The processing of moral salience was implicit to the task. Neuroimaging data were analyzed using partial least squares method.

Results: Analysis of RT data revealed that semantically correct neutral statements were the fastest to process and immoral statements were the slowest. In the partial least squares analysis, the first latent variable dissociated both the moral and immoral conditions from the neutral. Moral and immoral response selection engaged dorsal anterior cingulate, medial prefrontal and posterior cingulate cortex, the temporoparietal junction, and anterior insula. A second latent variable dissociated the immoral from moral conditions. For the immoral condition, the temporal unfolding of neural activity was different from the temporal unfolding of the neural activity for moral condition. Selection of the immoral responses engaged the temporoparietal junction and right superior temporal sulcus at the initial phases; and anterior insula and medial frontal regions later.

Conclusion: These results suggest a contribution of the salience network to moral processing, in addition to the default network, and emphasize studying moral cognition within the framework of dynamic network interactions.

Keywords: moral cognition, neuroimaging, social cognition, default mode network, salience network

O-07

Optical coherence tomography findings in Parkinson's disease

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Objective: The aim of this study is to investigate if there is a relationship between severity of idiopathic Parkinson's disease (IPD) and retinal nerve fiber layer thickness (RNFLT).

Methods: This study was established by enrolling the datas of 25 patients with IPD and 29 healthy controls prospectively. Hoehn and Yahr (H-Y), Unified Parkinsons Disease Rating Scale (UPDRS) and Mini Mental State Exam (MMSE) were performed in the IPH group. Retinal Thickness (RT) and RNFLT were imaged by Fourier domain Optical Coherence Tomography (OCT) in the IPH group. Retinal thickness was measured in the central retinal (RTc), nasal (RTn) and temporal (RTt) segments.

Nasal (RSLTn), nasal superior (RNFLTns), nasal inferior (RNFLTni), temporal (RNFLTt), temporal superior (RNFLTts) and temporal inferior (RNFLTti) retinal nerve fibre layers were measured and mean retinal nerve fiber layer thicknesses was calculated (RNFLTg).

Results: In this study, there were 25 patients (17 male, 8 female) with Parkinson's disease and 29 healthy person (19 male, 10 female). The mean age was 70 (50 to 82) in IPH group, 68 (59 to 78) in control. There was no statistically difference between two groups regarding spherical equivalent, axial length (AL), Central Corneal Thickness (CCT). In the case group, IOP and VA values were lower than the control group at a statistically significant level. Central (RTc), nasal (RTn) and temporal (RTn) thicknesses were observed thinner in case group than those of control group. There was no statistically significant correlation between the severity of IPH and these results.

Conclusion: Our study endorses the previous research findings that the role of RNFLT in the diagnose of IPD. In our study, unlike other studies, RTn was found thinner in IPH group. A cutoff RNFL thickness can be found, thanks to larger further studies, which would be an important part of the diagnosis criteria of IPD.

Keywords: Parkinson's disease, retinal nerve fiber layer, optical coherence tomography

O-08

Compact organ electrophoresis system (CORES): easy, fast, cheap organ electrophoresis

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Objective: Organ electrophoresis is a laboratory method becoming common with its use for transparency processes in brain tissue. Infrastructure for standard procedures has not been formed yet. Especially control of heat produced by electrophoresis, voltage given to the electrodes, resistance and speed of liquid circulation create difficulty for researchers. CorES is a electrophoresis system developed by our research team and it provides easy, fast, cheap working opportunities for researcher.

Methods: This technique work supported by TUBITAK as a research and development project was performed in Pamukkale University laboratory. The system design performed by the research team was formed as a whole include electronic control unit, liquid tank, temperature control unit of the tank and electrophoresis chamber. The control unit software was produced according to feedback principle to keep the system stable using information of temperature and circulation rate received from system through the sensors. In this way, circulation rate, temperature values and current given to the electrophoresis chamber can be monitored and controlled via the touchscreen.

Processing operations can be monitored through the transparent areas on both sides of the electrophoresis chamber that specially designed and produced by 3D printer and cage, putting the tissue in it, can be attachable and detachable in the electrophoresis chamber. In this way, the tissue is prevented being damaged during placing and withdrawal of it. Corrosion and particle collection is reduced to a minimum because of the envisaged electrodes for electrophoresis is produced using platinum wire. Temperature control unit is a sensitive, controlled design and does not require compressors, unlike the commonly used systems it is capable of both heating and cooling process from liquid tank base. Materials used in the manufacture of CORES were provided making a market research to hold the system cost minimum.

Results and Conclusion: As a result of rat brain tissue electrophoresis experiments made with CORES, offering a whole apparatus necessary for the tissue and organ electrophoresis, transparency was observed quickly. Patent applications and trial version studies for the introduction of the system to researchers are in progress.

This study is supported by TUBITAK (Project number: 1005-114S407)

Keywords: electrophoresis, tissue, organ, clearing, brain, nervous system

O-09

Brain protective effects of intravenous immunoglobulin through inhibition of complement activation and apoptosis in a rat model of sepsis

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Intravenous (IV) immunoglobulin(Ig) treatment is known to alleviate behavioral deficits in the experimentally induced model of sepsis. To delineate the mechanisms by which IVIg treatment prevents neuronal dysfunction, an array of immunological and apoptosis markers was investigated. Sepsis was induced by cecal ligation perforation (CLP) in rats. The animals were divided into five groups; sham, control, CLP+saline, CLP+immunoglobulin G IgG (250 mg/kg, iv), and CLP+immunoglobulins enriched with immunoglobulin M-IgGAM (250 mg/kg, iv). Blood and brain samples were taken in two sets of experiments after CLP to see the early (24 hrs) and late(10 days) effects of treatment. Total complement activity, complement 3(C3) and soluble complement C5b-9 levels were measured in sera of rats using ELISA-based methods.

Cerebral complement content was analyzed by Western Blot. Immune cell infiltration and gliosis were examined by immunohistochemistry using cluster of differentiation 3, CD4, CD8, CD11b, CD19 and glial fibrillary acidic protein antibodies. Apoptotic neuronal death was investigated by TUNEL staining and Western Blot-based semiquantitative evaluation of brain homogenates by bax and bcl-2 antibodies IV IgG and IgGAM administration significantly reduced systemic complement activity but increased serum C3 and soluble C5b-9 levels. Likewise, Western Blot data showed slightly increased C5b-9 expression and significantly reduced C1q expression in brain samples of IgGAM-treated but not IgG-treated septic rats especially in the first day of administration. No cerebral cellular infiltrates were observed in treated and nontreated septic rats. By contrast, IV IgG and IgGAM treatment induced considerable amelioration in glial cell proliferation which was increased in non-treated rats. IgG and IgGAM treated rats exhibited significantly reduced numbers of apoptotic neurons and cerebral expression levels of bax and bcl-2 as compared to non-treated rats. We suggest that IV IgG and IgGAM administration ameliorates neuronal dysfunction and behavioral deficits by reducing apoptotic cell death and glial cell proliferation. IgGAM treatment might be suppressing classical complement pathway by reducing C1q expression.

Keywords: sepsis, neural dysfunction, immunology

O-10

The effect of metformin on paclitaxel induced neuropathic pain model in rats

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Objective: In this study the effects of metformin which is used for antidiabetic efficacy on paclitaxel induced neuropathic pain was investigated. The AMP kinase antagonist metformin has been using as an antidiabetic agent for Type II diabetes. In this study metformin was used as an analgesic and fixed the allodynia induced by paclitaxel on experiment animals. Furthermore, besides the clinical improvement of metformin treatment this study showed that it is also useful for reversal of nerve damage.

Methods: For this purpose 220±10 weighted 42 Albino Wistar female rats were divided into 5 groups and after the determination of basal pain threshold with Randall Selitto analgesiometer test apparatus, paclitaxel was intraperitoneally administered (2.0 mg/kg) for total 4 times 4 of 5 groups every other day (0., 2., 4., 6.). On 30th day metformin was administered at 100, 200 and 400 mg/kg doses to different groups for treatment and the tests were repeated on 7, 14, 21, 30 and 50. days.

Results: From every experiment group brain (Motor cortex, M1), spinal cord (L4–L5), peripheral nerve and muscle samples

were taken and pathological assessments were completed. there wasn't any finding could be assessed pathological in peripheral nerve and muscle regions. But in brain and spinal cord region paclitaxel has created significant findings. While in the examined brain region the control group score was 0 in the paclitaxel group the score was 1.63 ± 0.92 . While in the examined spinal cord region the control group score was 0.17 ± 0.41 in the paclitaxel group the score was 1.63 ± 0.52 . after different doses of Metformin administration in spinal cord the pathologic scores have improved and at 400 mg/kg Metformin dose 0.80 ± 0.45 score has obtained.

Conclusion: Considering the metformine doses used for the study, it was understood that 400 mg/kg dose is the most beneficial dose in paclitaxel induced neuropathic pain. While 400 mg/kg dose of metformin could reverse the pathology caused by paclitaxel and the allodynia differentials the 200 mg/kg just reversed the allodynia. At 200 mg/kg mg/kg dose there was an improvement but there wasn't any enough pathological improvements obtained. But in 400 mg/kg dose of metformin there was a clinical improvement also pathological improvement in spinal cord was determined. After the usage of different doses of metformin the pathological scores were improved in brain but there wasn't any meaningful improvement at the other doses.

Keywords: neuropathic pain, metformine, paclitaxel, allodynia

O-11

Investigation of antidepressant-like effect of dipyrone in female and male mice using chronic unpredictable stress model

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Objective: Central prostaglandins, endogen opioids and cannabinoids, TRP channels and descending serotonergic-noradrenergic pathways, levels of cytokines are known to contribute to dipyrone's analgesic effect. These systems also affect mood disorders. Pain and depression are comorbid diseases in most cases. Depression increases pain and pain increases depression. In this study we aimed to investigate if analgesic drug dipyrone also has an antidepressant-like effect.

Methods: Depression like effect is performed by unpredictable chronic mild stress (UCMS) model in both sexes of Swiss albino mice (n=60). Cage change, reversal of light-dark cycle, tilting the cages, wet floor, empty cage, foreign material on the floor, listening to predator sounds were used as light stress at different times for six weeks. Dipyrone applied 100 and 200 mg/kg intraperitoneal beginning from the third week. As behavioral tests sucrose consumption, rota-rod, porsolt and elevated plus maze were performed at seventh week to evaluate

the antidepressant-like effects of the drug. Changes in the external appearance of the animals were evaluated numerically and weights were recorded for 7 weeks. Results were analyzed by unpaired Student's t test, $p < 0.05$ was considered significant.

Results: Significant changes were observed at the external appearance of both sexes of stressed mice, but no differences were observed at weights compared to controls. Significant depression-like effect was seen at rota-rod and porsolt tests in stressed male and female mice compared to control. In sucrose and plus maze tests significant depression-like changes were seen in only stressed male mice. In the rota-rod test dipyrone (100 and 200 mg/kg) showed significant antidepressant-like effects in both genders. Dipyrone doses showed antidepressant-like effects only in stressed males in sucrose test while in porsolt test in stressed females.

Conclusion: With UCMS model, depression-like effect seems to occur in terms of the external appearance, learned helplessness and motor function in both sexes. However, in terms of sucrose preference and behavior in the plus-maze, it can be said that UCMS gives different results according to gender. Antidepressant-like effects of dipyrone in the porsolt test and sucrose preference showed different responses in both sexes. Rota-rod test provided responses from both sexes, but plus-maze test did not. Therefore effects of the drug are related to gender. In conclusion, this study showed us that dipyrone causes antidepressant like effects on both genders with gender-related differences. The mechanisms of gender-differences and methodology needs to further investigation.

Keywords: dipyrone, depression, chronic unpredictable stress model, behavior tests, mouse

O-12

Scopolamine induced convulsions in fasted mice after food intake: evaluation of c-fos expression in hypothalamus

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Objective: Previous studies have shown that 24 hour fasted mice, treated with scopolamine, develop clonic convulsions soon after food intake. c-fos expression increases in different brain regions after pentylenetetrazol seizures, and in arcuate nucleus after 24 hour fasting in mice. Studies shows that seizures and fasting effect c-fos expression, so in this study we aimed to investigate c-fos expression in hypothalamus, in scopolamine induced convulsion in fasted mice after food intake.

Methods: Male Balb-C mice (n=48) used in this study. Mice divided into two groups as satiated and fasted (24 hour).

Animals were injected with saline or scopolamine (3 mg/kg, i.p.). Twenty minutes later we give food pellets, 30 minutes later brains removed and sectioned for c-fos immunohistochemistry. The percentage of c-fos immune cells determined in two randomly chosen hypothalamic sections. We used paired samples t-test for body weight loss, ANOVA followed Tukey test for onset of convulsions, Fisher's exact test for incidence of convulsions and independent samples t-test for c-fos immune label cells.

Results: Mice lost 15.6% of initial body weight after 24 hour fasting ($p < 0.001$). Scopolamine treated fasted animals develop (87%) convulsion ($p < 0.001$), 5.6 ± 2.3 min after food intake. There was no difference between saline treated fasted and satiated animals. c-fos expression did not change by scopolamine treatment in satiated animals but increased insignificantly in fasted animals. We did not observe any significant difference in saline treated fasted animals after food intake. c-fos expression in scopolamine treated fasted mice, which develop convulsion after food intake, was decreased significantly ($p < 0.05$).

Conclusion: We observe that fasting for 24 hour did not effect c-fos expression in hypothalamus. In C57/BL6 mice, fasting for 24 hour enhance c-fos expression in arcuate nucleus, dorsomedial and ventromedial hypothalamus. In present study c-fos expression decreased significantly in animals with convulsion at 30th minutes. In pentylenetetrazol evoked convulsions, c-fos expression in the cingulate, piriform cortices and the dentate gyrus increase 1 hour after injection. In 4-aminopyridine induced epilepsy, highest level of c-fos expression was detected in hippocampus at 3th hour, but the level decreased to the control level by 5 hour following injection in rats. Different animal kind, strain or timing could be cause of difference on these findings. With present study, decrease of c-fos expression in scopolamine induced convulsions in fasted mice after food intake, shown for the first time. To elaborate this issue we planned further studies. This study is supported by TUBITAK (108S037).

Keywords: scopolamine, convulsion, c-fos, mice, hypothalamus

O-13

Emoji icons' effects on selective attention response

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Objective: Human engagement with digital communication, especially through social media, has risen in recent years. Individuals use wide range of emoji icons while using social media to express their concurrent emotional status easily. Icons give opportunity to convey their feelings with facial expression otherwise is not possible with linguistic cues. Event related potentials (ERPs) reflect brain activity during sensory, motor or cognitive processing with a high temporal resolution. The oddball paradigm is the most common used experimental par-

adigm in cognitive electrophysiology. The P3 potential occurred in response to targets in the oddball paradigm and it is assumed to reflect selective attention and memory updating processes. The current study set out the understand emoji icons effects on selective attention response.

Methods: 14 healthy volunteers (10 men, 4 women) ages between 19 and 32 are recruited in this study. ERPs were recorded from 12 electrodes (international 10–20 electrode system) with visual oddball paradigm. The visual stimuli duration was 0.5 s, and the interval between two consecutive stimuli was 2 s. All stimuli were presented in the center of a 14" computer screen in a random manner. 3 different emoji icons as emotionally positive, negative and neutral were used as target stimuli in our oddball paradigm. The target stimuli frequency was 0.20. Amplitudes and latencies of ERPs of each target stimulus groups were measured and analyzed with repeated measure of ANOVA.

Results: The reaction time of response to emotionally negative icons was shortest ($p = 0.041$), and longest to emotionally neutral icons ($p = 0.012$). P3 potential amplitudes were significantly lower in response to emotionally neutral icons compared to other groups ($p = 0.007$). On the other hand, P3 potential latencies did not differ significantly among the groups ($p > 0.05$).

Conclusion: Our results indicate that emoji icons affect the selective attention response significantly. As being emotionally positive or negative, an icon can lead to P3 potential amplitudes to increase and reaction time of motor responses to decrease.

Keywords: emoji icons, event-related potentials, P3 potential, reaction time

O-14

An fNIR Hyperscanning study on brain-brain interactions of a dyad during a joint sentence reading task

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Objective: In this study, behavioral synchrony and inter-brain coherence between participants were investigated during simultaneous reading of Turkish sentences with different auditory coupling (i.e., Self, Both, Other) and sentence conditions (i.e., match, mismatch).

Methods: 11 male-male pairs (age range: 19–32) participated in this study. The participants synchronously read matching and mismatching sentences. Mismatching sentences differed only by one lexical item that was located towards the middle of the sentence. An audio setup including audio mixers, headphones, microphones and recording computer was used in order to record participants' speech and to modulate the direction of the auditory feedback (i.e., Self, Both, Other) available

to each co-speaker. Dynamic Time Warping (DTW) was used to analyze the recorded speech and to measure the level of asynchrony. In addition, the hemodynamic activity at the prefrontal cortex (PFC) of each participant was simultaneously measured by a continuous wave functional near-infrared spectroscopy (fNIRS). The raw signals were filtered for artifacts and converted to oxy- (HbO) and deoxyhemoglobin (HbR) levels using Modified Beer-Lambert Law (MBLL). In this study, deoxyhemoglobin (HbR) signals from participant pairs were analyzed by Wavelet Transform Coherence (WTC) to quantify inter-brain coherence among the participants.

Results: The results indicated that there was a significant difference among the levels of auditory coupling in terms of asynchrony values across all participants, $F(2,82)=3.380$, $p<.05$, $\eta^2=.076$. Pairwise comparisons indicated that there is a significant difference between Self and Other. In addition, in terms of wavelet transform coherence (WTC), two-way repeated-measures ANOVA with sentence condition (i.e., match, mismatch) and auditory coupling condition (i.e., self, both and other) showed that there was a significant difference among the levels of auditory coupling condition, $F(2,316)=7.228$, $p<.01$, $\eta^2=.044$. There was no interaction effect between auditory coupling and sentence conditions. The pairwise comparisons showed that Self resulted in significantly lower coherence than Both and Other.

Conclusion: The results bear similarities to the findings of Cummins et al. (2013) where they find a difference between Self and other conditions (i.e., Both, Other). Inter-brain coherence was higher in match than mismatch sentences and was smallest in Self. Further, in match condition, the inter-brain coherence increases as the auditory coupling increases in the order of Self, Both and Other but, in mismatch condition, it is lowered in Other. These findings are suggestive patterns for behavioral and neural coupling mechanisms of synchrony among people.

Acknowledgements: This study is supported by TUBITAK Grant 115E281.

Keywords: fNIRS, hyperscanning, neurolinguistics, two-person neuroscience

O-15

Analysis of cognitive functions in attention deficiency-hyperactivity disorder with functional near infrared spectroscopy

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Objective: Functional near infrared spectroscopy (fNIRs) is a noninvasive optical imaging technique which unable the measurements of the oxy-hemoglobin and deoxy-hemoglobin (metabolic) changes associated with cognitive activity. The proposed system uses fNIRs to detect hemodynamic changes arising from an auditory oddball task at prefrontal cortex. In this paper, we aimed to investigate cognitive functions of children who suffer from attention deficiency and hyperactivity disorder (ADHD) with fNIRS system recordings acquired from prefrontal cortex during presented auditory oddball cognitive tasks.

Methods: This study was realized 10 children with ADHD and 10 healthy children (7–12 ages). Hemodynamic changes were recorded with fNIRs electrodes (16 channels) which placed forehead during auditory oddball task. The 'oddball' paradigm which contains two stimuli (target and standard) was presented in random order by headphones. In this auditory oddball task, we gave a task to children for press a button in response to the target stimulus. The signals for target stimulus were recorded from 16 channels.

Results: Peak to peak (p-p) measurement of HbO₂ signal and area of the under the curve are calculated for each channel. Comparisons of group data with independent Student t test, HbO₂ data of patients group was statistically lower than control group's [p-p (patient 0.10 ± 0.03 ; control 0.20 ± 0.14 , $t=-3.85$, $p<0.000$), area of the under the curve (patient 0.4 ± 0.42 ; control 1.44 ± 1.28 , $t=-4.3$, $p<0.000$).

Conclusion: We revealed that the blood oxygenation is lower in children with ADHD at prefrontal cortex. We are thinking, this results may be basic for investigate the acceleration of the brain blood flow which could be useful in ADHD treatment.

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Keywords: functional near infrared spectroscopy, attention deficiency and hyperactivity disorder, auditory oddball task, prefrontal cortex

O-16

Context-dependent lightness affects perceived contrast at threshold and suprathreshold levels

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Objective: Contrast is an important feature for performance on many visual tasks such as object identification, speed or motion detection (Kilpeläinen, Nurminen, & Donner, 2011). Perceived contrast of a grating depends on the luminance of its background. On the other hand, context often causes a large difference between luminance and its perceptual counterpart,

brightness (e.g. simultaneous brightness contrast). Thus, characterizing different effects of luminance- and context-dependent brightness on contrast is critical. In this study we investigate how context-dependent brightness affects contrast judgments using a variant of Adelson's checkerboard illusion stimulus (Adelson, 1995).

Method: Two series of behavioral experiments were conducted. In the first series, we measured the perceived contrast of gratings using several different implementations of a method of adjustment paradigm. Participants reported the contrast of rectified gratings with incremental and decremental suprathreshold contrasts superimposed on equiluminant target regions, for various levels of frequency, background luminance and brightness, and photometric contrast. In the second series of experiments, we measured the contrast detection thresholds using a 2-IFC procedure.

Results: Results show that gratings superimposed on equiluminant but perceptually brighter target regions were perceived to have higher contrast than those superimposed on perceptually darker target regions (N=6). However, this pattern was only valid for incremental contrast, not for decremental contrast. In addition, we found that detection threshold is lower for the gratings superimposed on equiluminant but perceptually brighter target regions (N=6).

Conclusion: Our results show that context-dependent brightness of the target region, not only its luminance, influences the perceived contrast of gratings both at threshold and suprathreshold levels. These findings unveil the significant effect of context-dependent brightness on contrast perception, thereby provide evidence that contrast perception does not depend only on the photometric quantities of the image formed on the retina, and that context-dependent factors also play a role. Hence it is possible that the visual system first estimates the lightness of the background, then uses this value for further contrast estimations.

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Keywords: context, contrast, lightness, luminance

O-17

Examination of WISC-R profiles of the gifted children

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Objective: The aim of this study is to determine the profiles of the gifted children of which evaluation made by using Wechsler Intelligence Test for Children (WISC-R) and decided that they are gifted.

Method: This study was conducted on 173 children, including 66 girls and 101 boys and their age was between 6–15 (7.68±1.91) who are decided gifted children in Olgu Psychological Counseling Centre between 2013–2016. In the

study, Verbal Intelligence Quotient was determined by the sum of the standard scores got from verbal subtests (General Knowledge, Similarities, Arithmetic, Comprehension, Digit Span), Performance Intelligence Quotient was determined by the sum of the standard scores got from performance subtests (Picture Completion, Picture Concepts, Block Design, Object Assembly, Coding Digit Symbol) and Total Intelligence Quotient was determined by the sum of verbal and performance intelligence scores. As part of analysis, demographic information and WISC-R subtests scores of the children was examined and descriptive analysis was made on score differences between WISC-R intelligence quotient and on subtests. According to the subtest scores, most developed and weakest features of participants was determined.

Results: In this study, 86 children (%49.7) have intelligence quotient between 120–129, 54 children (%31.2) have intelligence quotient between 130–139, 33 children (%19.1) have intelligence quotient 140 and more was found. Verbal Intelligence Quotient was found as 125.42±9.8 (98–146), Performance Intelligence Quotient was found as 131.70±10.2 (108–155), Total Intelligence Quotient was found as 131.13±7.9 (120–151). These findings appear that participants are much more better on performance than on visual-motor area. The performance scores on visual spatial reasoning, three dimensional thinking, depth perception (block design), ability of conceptual and logical argumentation (similarities) are higher than the ability of learning a new task, focus attention, visual memory (coding digit symbol) and reasoning, problem solving and focus and maintenance attention as using intangible number concepts (arithmetic).

Conclusion: Changing communication styles reflect on intelligence test profiles. In the standardization study for Turkish sample, WISC-R factor structure showed strong verbal factor on different age groups. In this situation, test turns into general intelligence test. But in present study, appearing strong performance factor may be related to changing communication styles.

Keywords: WISC-R, intelligence scale, gifted children

O-18

Tractography methods applied to cerebral white matter using DtiStudio in patients with attention deficit hyperactivity disorder

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Objective: Attention deficit hyperactivity disorder (ADHD) is a common neuropsychiatric disorder of childhood and persists during adult age, affecting millions of people. In recent years, diffusion tensor imaging (DTI) has become the method of choice to investigate white matter (WM) pathology in ADHD disorders. Tractography based on diffusion tensor imaging

allows visualization of white matter tracts. In this study, aimed to describe of reconstruct five major white matter tracts.

Methods: A group of 10 children with ADHD were recruited along with 8 age-matched healthy controls for comparison. Neuroimaging was performed using a 1.5 T Siemens Aera scanner. DTI data were acquired using single-shot echo-planar imaging. All DTI datasets were processed offline using DTIStudio software (available at www.MRISstudio.org). A multi-ROI approach was used to reconstruct tracts of interest which exploits existing anatomical knowledge of tract trajectories. Fiber tractography (FT) reconstruction of the cortico-spinal tract (CST), inferior and superior longitudinal fasciculus (ILF, SLF), the forceps major and minor were performed using DTIStudio software. For 3D tract reconstruction, the fiber assignment by continuous tracking (FACT) method. Fractional anisotropy (FA) for each tract was measured.

Results: Averaged sizes of fibers and FA values were significantly higher in the control group compared to the group with ADHD while no difference is found for CST.

Conclusion: Tractography based on DTIStudio can provide sensitive information on integrity of intra-WM structures in ADHD.

Keywords: Diffusion tensor imaging, tractography, DtiStudio, FACT, ADHD

O-19

Effects of long term swimming exercise program on ECoG activity of WAG/Rij rats with absence epilepsy

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Objective: To examine the effects of 15, 30 and 60 min/day regular swimming exercise for 3 months on epileptic activity in WAG/Rij rats with absence epilepsy

Methods: 35 male WAG/Rij rats were divided into 5 groups randomly. Experimental groups were exposed to swimming exercise for 15 min/day, 30 min/day and 60 min/day, respectively. Control group was not administrated any applications, the sham group was kept in shallow water 60 min/day during the experiment. After the experiment, ECoG recordings of all animals were taken for 2 hours. Total number and cumulative length of spike-wave discharges (SWD) were analysed.

Results: No significant difference was found between control and sham groups. Both of the number and cumulative length of SWDs were significantly decreased in all of the experimental groups compared to control and sham groups ($p < 0.001$). We couldn't find any statistical difference between 3 different daily exercise programs ($p > 0.05$).

Conclusion: Long term regular swimming exercise for 15, 30 and 60 min/day decreases total number and cumulative length of SWDs in ECoG recordings of the rats with absence epilepsy.

Keywords: absence epilepsy, ECoG, swimming, exercise, SWD

O-20

Differential effects of acetylcholine and atropine on vibrotactile responses of neurons in the hindpaw representation of rat S1 cortex

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Objective: Current understanding of attentional mechanisms lacks information within the tactile modality. To investigate the attentional modulation of tactile signals, we studied the contribution of cholinergic receptors on vibrotactile responses of cortical neurons in the rat primary somatosensory cortex.

Methods: We recorded from 20 S1 neurons in the hindpaw representation of 8 anesthetized Wistar Albino rats. After mapping the receptive field of each neuron, spike activity was measured before, during, and after vibrotactile stimuli (bursts of 5-, 40-, and 250-Hz suprathreshold sinusoidal displacements; duration: 0.5 s, amplitude: 50 μ m), combined with pressure microinjection of 200 μ M acetylcholine (ACh), 100 μ M atropine (non-specific muscarinic receptor antagonist) or aCSF (sham condition) at nanoliter volumes. Average firing rates were calculated for three periods: before stimulus (Rb), onset period (first 100 ms of stimulus) (Ro), entire stimulus duration (Rd). Responsivity to mechanical stimuli was also calculated by subtracting Rb from Ro and Rd.

Results: 3-way ANOVA (factors: stimulus frequency, cortical layer, drug vs. sham) showed significant main effects of vibrotactile frequency on Rd only in ACh application (p -values = 0.02 and 0.27 for ACh and atropine, respectively) and main effects of layer on (Rd-Rb) for atropine data (p -value = 0.005). Since the distribution of cholinergic receptors throughout the cortex is not homogenous, we performed paired comparisons between the drug and sham conditions for all time periods defined earlier at each cortical layer (III, IV, V, and VI). Atropine significantly decreased the activity represented by Rd, Ro, Rd-Rb, Ro-Rb in layer V and VI, whereas ACh significantly increased the activity represented by Rd and Rd-Rb only in layer V. Moreover, responsivity to mechanical vibrations did not change although the background activity (Rb) increased in layer III and IV by ACh, and decreased by atropine only in layer IV.

Conclusion: These results imply the differences of local connectivity in cortical layers. Enhancement of activity due to mechanical stimulation in ACh application and suppression of this activity by atropine are restricted to the deeper layers. This is probably due to the fact that layer V and VI receive major cholinergic input from basal forebrain and send information to

motor cortex and back to thalamus. Consistent with existing literature, the observed effect of muscarinic receptor-mediated responses in deeper layers of S1 suggest that they have an important role in the sensorimotor component of attention.

SUPPORT: Boğaziçi University BAP no: 13XP8

Keywords: somatosensory, touch, attention, cortex, vibration, microinjection

O-21

Investigation the effects of chronic mobile phone radiation and melatonin used for protection purpose on the brain by using different methods

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Objective: Investigation the effects of chronic radiation emitted by third generation mobile phones and melatonin used for protection purpose on the brain was aimed in this study.

Methods: 24 male Wistar albino rats were divided into 4 equal groups. Throughout in 90-day experiment, there was no application performed to control group. The second group was exposed to 2100 MHz radiation for 30 minutes. Subcutaneous melatonin was enjected to the third group. Subcutaneous melatonin enjection was applied 40 minutes before radiation and then radiation was exposed for 30 minutes to the fourth group. At the end of the experiment, brain tissues were taken from subjects which was sacrificed under high-dose anesthesia and measured. Light and electron microscobic monitoring methods were applied. Hematoxylin-Eosin, Cresyl violet, NMDA-receptor 2B, Calpain-1, Caspase-12 stainings were performed and ultrastructural analyses were examined. Brain tissues were also examined by Western blot analyse for NMDA-receptor 2B and Calpain-1 primary antibodies. Besides brain weight, Purkinje cells number and H Score analyses were examined by statistically.

Results: With the application of radiation; dilatation around the neurons, decreased neurons on hippocampal CA1 and CA3 regions relatively, displacement the Purkinje cells and dark neurons findings were seen as a result of histochemical stainings. Radiation also activated the NMDA-receptor 2B / Calpain-1 / Caspase-12 pathway which is known to adversely affect the memory also Endoplasmic reticulum stress and apoptosis were triggered by this pathway. NMDA-receptor 2B and Calpain-1 findings were also supported by Western blot analyses. Pre-increased protein synthesis before apoptosis was identified by electron microscopy.

Conclusion: In conclusion, mobile phone radiation caused some structural changes on the brain and negative impact on memory but melatonin was insufficient to demonstrate the protective effects.

Keywords: radiation, melatonin, brain, memory

O-22

Relation of exercise with hypothalamic-pituitary-adrenal axis and cholinergic system in diabetic cognitive disorder

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Objective: Cognitive disturbance is one of the central nervous system complications of diabetes. Chronic exercise improves cognition in diabetics, although involving pathophysiological processes are need to be revealed. In the present study, the relation of the effect of chronic swimming exercise on spatial learning/memory performance with cholinergic system and hypothalamic-pituitary-adrenal axis is investigated.

Methods: Thirty-two Wistar adult male rat were assigned into 4 groups: control (n=6), exercise (n=6), diabetes (n=10), and diabetic exercise (n=10). Diabetes was generated with a single dose of streptozotocin (50 mg/kg, i.p.) in diabetes and diabetic exercise groups. Animals in exercise and diabetic exercise groups were subjected to swimming exercise for 1 hour/day in 5 days of the week for 6 weeks. At the end of sixth week, learning/memory performances of all animals were assessed by using Morris' water maze test. Afterwards, animals were sacrificed and serum adrenocorticotrophic hormone and corticosterone, and hippocampal acetylcholine and acetylcholinesterase levels were analyzed.

Results: The induction of diabetes led to a weight loss ($p<0.05$), whereas no weight loss was observed in exercised diabetic animals ($p>0.05$). In diabetes group, the time spent for finding the escape platform was lower than other groups in training sessions of the Morris' water maze test ($p<0.05$). Similarly, in the probe trial, the animals in diabetes group spent less time in the target quadrant and displayed less crossings over the platform area as compared to other groups ($p<0.05$). Hippocampal acetylcholine level was increased and acetylcholinesterase level was decreased in diabetes group ($p<0.05$). Serum adrenocorticotrophic hormone and corticosterone levels were lower compared to other groups in the control group ($p<0.05$).

Conclusion: According to the results of the present study, chronic swimming exercise improves the learning and memory performance in diabetic rats and cholinergic system involves in the mentioned improvement. Furthermore, the hypothalamic-pituitary-adrenal axis is not associated with exercise-induced cognitive improvement in diabetic rats.

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Keywords: acetylcholine, acetylcholinesterase, diabetes, exercise, hypothalamic-pituitary-adrenal axis, learning and memory

O-23

Investigation of the effects of glutamate stress in B35 cell lines on graphene oxide sheets

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Objective: Graphene, a monolayer of sp²-bonded carbon atoms, is a quasi-two-dimensional (2D) material with unique electrical and chemical properties. In terms of the biomedical applications of graphene and graphene oxide (GO), nervous system would be an ideal breakthrough model, because neural cells are electro-active. Glutamate is one of the important neurotransmitters in the central nervous system (CNS) and it plays a vital role in neural pathways. Extreme glutamate concentrations may cause excitotoxicity, which is defined as the pathological process by which nerve cells are damaged or killed by excessive stimulation. The aim of this work is to investigate whether culture of CNS neurons on GO has any neuroprotective effect toward glutamate stress.

Methods: B35 neuroblastoma cells were grown in DMEM F12 containing 10% fetal bovine serum. Graphene oxide powder was coated onto glass slides as a thin film. B35 cells were cultured on graphene oxide (GO) sheets. Cultivated cells on glass slides were used as the control group. After 24 hours of cell culture, L-glutamic acid induced excitotoxicity was applied on B35 cells on both surfaces. After 24 hours of post-stress culture, morphologies of cells were examined by scanning electron microscopy (SEM). Cell viability was measured by MTT assay.

Results: The effects of glutamate stress on cell viability were visible as early as 1 hour on both surfaces. The cell viability of B35 cells on GO sheets was higher than on glass slides, and cells recovered from the stress within 6 hours on GO surfaces while viability on glass surfaces was lower than 54% after 24 hours. Cell morphology and toxicity measurements also supported this observation.

Conclusion: We demonstrated that glutamate is toxic to B35 cells above the concentration of 100mM. The culture on GO

increases the resistance to glutamate stress on B35 cells, and helps fast recovery. This study aimed to show the potential use of GO, with the increasing knowledge about the role of glutamate, as a therapeutic biomaterial helping the treatment for excitotoxicity induced neurodegenerative diseases.

Keywords: B35 cell line, excitotoxicity, glutamate stress, graphene oxide

O-24

The *in vitro* degenerative effect of Ankaferd BloodStopper on primary sensory neurons

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Objective: Ankaferd BloodStopper (ABS) is an herbal extract which is licensed by the Ministry of Health and used as hemostatic agent. The neural function problems in ABS usage after surgical and dental procedures are reported. This study aims to research degenerative effect and mechanism of ABS on peripheral neural cells in “The model of neuron culture from mouse dorsal root ganglion”.

Methods: Preparing Neuron Culture: After anesthetizing mice with ketamine/xylazine, they are sacrificed with cervical dissection. Dorsal root ganglia are removed under microscope in an aseptic condition. Cell differentiation is done with collagenase+ trypsin+mechanical trituration and purification is done with percoll density gradient. The cells obtained from these procedures are plated to 35 mm glass petri dishes. Neuron culture are incubated for 48 hours under the moist condition which has 5% CO₂ circulation at 37 °C. Propidium iodide (10 µg/ml) is added to culture to monitor dead cells and Calcein AM (1 µM) is added to monitor the living cells. Microscopic visualization: “Zeiss Cell Observer”, a microscopic visualization system allowing visualizing at desired mode and density with developed camera-computer and special software setup that can hold neurons under physiological conditions, is used. Mozaix mode is chosen for visualizing the living and the dead neuron cells. Groups: - First Group is added ABS (2.5%), - Second Group is added Caspase-3 inhibitor (100 µM) first and ABS (2.5%) one hour later, - Third Group is added Caspase-6 inhibitor (100 µM) first and ABS (2.5%) one hour later, - Control Group is added physiological saline (PS).

Results: In the beginning of the study, 243, 231, 175 and 249 living neurons are observed in first, second, third and fourth group, respectively. In the groups (I-II-III) added ABS, the neurons detected as living before application is observed dead completely after 12 hours. It is also observed that 5 cells become dead and 249 cells become alive in the control group which is applied PS. For the purpose of determining whether there is a difference between groups in terms of rates of living neuron, the rate comparison is done with “Z test”. As meaningful statistical difference is not found between experimental

groups in terms of rates of living neuron, the difference of control group from each three groups is found meaningful statistically ($p < 0.01$).

Conclusion: 1. ABS causes degeneration of sensory neurons, 2. Caspase-3 and Caspase-6 enzymes don't exist in the pathway of neurodegeneration, 3. Neurodegenerative effect of ABS should be taken into account in the clinical usage.

Keywords: dorsal root ganglion neuron, Ankaferd BloodStopper, degeneration

O-25

Investigation of the telomere length in schizophrenia patients and their siblings: is schizophrenia a premature ageing syndrome?

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Schizophrenia (Sch) is a psychiatric disease affecting about 1% of the population and causes serious disability. Several disorders associated with ageing are more common in Sch than in the general population, and appear in earlier in life. There are several clinical overlappings between Sch and premature aging syndromes, suggesting that Sch as a syndrome of accelerated aging.

Objective: The aim of our study was to analyze telomere length, which is one of the most significant molecular biomarker of ageing, in Sch and their siblings who share similar genetic and environmental factors. Correlation between telomere length and different clinical variables were also assessed.

Methods: This study consists of 230 participants gathered in three separate groups; "patient group" (n = 99); "sibling group" siblings of patients not diagnosed with Sch (n = 49); and age,gender matched "control group" (n=82). Peripheral blood DNA samples were obtained from AUBRC Cell Line Biobank. The measurement of telomere length was performed by RT-qPCR, and each sample was analyzed in duplicate. Since our data didn't show normal distribution, non-parametric tests were used for statistical analyses.

Results: Patients, siblings and controls were significantly different in terms of telomere length (median: [aTL[kb/diploid genom] patient: 78.53; sibling: 93.60; control: 87.45, $p < 0.001$). In particular, telomere length of patients were significantly shorter than both siblings ($p < 0.01$) and control ($p < 0.000$). Groups were significantly different from each other in terms of

GAF symptoms scores ($p < 0.000$) and GAF disability scores ($p < 0.000$). A significant positive correlation was found between telomere length and both GAF symptoms score ($r = .21$, $p < 0.00$) and GAF disability scores ($r = .23$, $p < 0.001$). Patients were significantly different from both siblings and controls in CAPE scores. Although not statistically significant, CAPE scores of siblings were higher than controls. When the whole group was analyzed, negative correlation was found between telomere length and CAPE positive symptoms ($r = -.22$, $p < 0.01$) and CAPE negative symptoms subscale ($r = -.19$, $p < 0.01$). All groups were compared in terms of laboratory parameters (fasting blood glucose, fasting insulin, HOMA-IR, systolic and diastolic blood pressure, waist circumference, BMI) and these parameters correlation with telomere length was analyzed. Frequencies of insulin resistance and hypertension that increase with age, were higher in patients. But no correlation was found between telomere length and these parameters.

Conclusion: This preliminary findings support telomere dysfunction which is the indicative of early aging in schizophrenia.

(This study was supported by TUBITAK grant no: 215S151)

Keywords: premature aging, sibling, schizophrenia, telomere

O-26

The investigation of BDNF gene 196 A/G (Val66Met) polymorphism in Alzheimer disease

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Objective: Sporadic Alzheimer's disease is a progressive condition that is characterized by deficit in a close episodic memory, language, visual-spatial-executive functions and frequently accompanied by late-onset neuro-behavioral abnormalities. Although the most important risk factor for the development of AD is age, especially in early age cases are inherited autosomal dominant genetic predisposition. Furthermore, the different genetic susceptibility for the disease is also in question. BDNF is a neurotrophin family secretory growth factor protein which is located in the periphery and the brain, encodes from BDNF gene. The previously studies has been shown that, the BDNF expression in many regions of the brain is reduced in Alzheimer's patients, and the 196 A/G polymorphism of BDNF gene to cause expression Methionine in place of Valine, at position of 66 in BDNF protein. The relationship with AH and val66met polymorphism, has been studied frequently in recent years, and there are conflicting results. The aim of this study, was to determine relationship between BDNF gene polymorphism and AH is among Turkey patients.

Methods: In our study 184 patients and 133 controls, admitted to the neurology clinic of Gaziosmanpaşa University in the years 2013–2015, had been diagnosed with Alzheimer's accord-

ing to the criteria in NINCDS and ADRA, and received an informed consent form from patients and/or their relatives, were included. The stage of the disease is determined by MMT; according to this test 19–23 points from mild dementia, 18–10 as moderate, 9 and six points were considered advanced stages of dementia. Genomic DNA was extracted from patients and controls blood samples. Genetic analyses were performed by RT-PCR using the TaqMan allelic discrimination assay. The obtained data from the study were analyzed using by SPSS software version 16.0. The genotype and allele distributions were compared by using Fisher's exact chi-square (χ^2) test and p-values smaller than 0.05 were considered significant.

Results: We not determined a significant difference between patients and healthy individuals for BDNF Val66Met polymorphism regarding its frequency ($p>0.05$). Results also revealed that there is not any significant association between the frequency of BDNF Val66Met polymorphism, and age, gender distribution, and development of different stages of dementia ranging from mild to advance in Alzheimer's patients ($p>0.05$).

Conclusion: To conclude, any association between AD and Val66Met polymorphism was not observed in the volunteers participating in either all groups and/or when individuals were separated into subgroups depending age, gender distribution and stage of disease.

Keywords: Alzheimer disease, BDNF, Val66Met

O-27

Maternal long-term high-fructose intake induces autism behaviors in rat offspring

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Objective: Despite the excessive literature on the autism spectrum disorders (ASDs), its etiology still remains unclear. Numerous risk factors including genetic, infectious, metabolic, nutritional, and environmental have been reported in previous studies. In the present study, we aimed to investigate whether maternal metabolic stress may induce behavioral, biochemical and histological changes in rat offspring. To elucidate the relationship between chronic maternal metabolic stress and neurobehavioral pathology, we used an experimental rat model of non-alcoholic fatty liver disease (NAFLD) reported previously (Erbaş et al. 2015).

Methods: Sprague Dawley female rats were randomly distributed into two groups: control (n=6) and NAFLD (n=6). To perform fatty liver disease, NAFLD group received 30% fruc-

tose enriched water for 12 weeks while naive group received only tap water. After 12 weeks, control and NAFLD females were caged with a fertile male for 3 days during oestrus period. Then, pregnant NAFLD rats received 30% fructose supplemented water and regular chow throughout pregnancy, delivery and until offspring's weaning. On P21, forty littermates (10 male control, 10 female control, 10 male NAFLD and 10 female NAFLD) were separated and housed in same sex and same study group cages with ad libitum access to standard food and tap water. Behavioral evaluations were performed at P50. Statistical analyses were performed using two-way ANOVA and two-tailed independent t test.

Results: ANOVA results of the behavioral tests (three-chamber social test, passive avoidance learning test and apomorphine-induced stereotypy test) revealed significant differences among the groups [$F(39.3)=7.42, p<0.005$], [$F(35.3)=105.97, p<0.0005$] and [$F(35.3)=4.15, p<0.05$], respectively. Intriguingly, while control groups demonstrated a significant preference for social novelty by spending more time with the unfamiliar rat, male NAFLD rats spent same time in both chambers ($p>0.05$). Also, passive avoidance learning test revealed that NAFLD rats had significantly shorter latency period than those of controls ($p<0.05$). Apomorphine-induced stereotypy test results showed significantly higher stereotypy score in the male NAFLD group compare to control ($p<0.05$) whereas no significant difference was found between the female groups. Histologically, hippocampal CA1 and CA3 regions revealed significant alterations such as gliosis and neuronal cell death in NAFLD groups compare to controls. Biochemical measurements of the brain levels of TNF-1, neuregulin 1, NGF-1, GAD67, 5HIAA and IGF-1 showed significant differences among the groups.

Conclusion: These results suggest a possible link between the chronic maternal metabolic stress, such as long-term fructose intake, and neurodevelopmental disturbances in the offspring.

Keywords: autism, fructose, gliosis, metabolic stress, NAFLD, social test

O-28

Serotonin induces nociceptive firing and CGRP release via 5-HT₃ receptors in rat meninges

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Objective: Migraine is a common neurological disease characterized by recurrent severe headache. In addition to trigemino-vascular system, the serotonergic system also plays a key role in the migraine pathophysiology, because of different 5-HT receptors may have different roles. There are very few studies that 5-HT caused pain. Therefore, in the current project we aimed to investigate the actions of serotonin on nociceptive firing and calcitonin gene-related peptide (CGRP) release in rat meninges.

Methods: Isolated skulls obtained from adult Wistar rats were divided into 2 halves (n=18, totally 36 hemiskulls). Using suction electrode, nociceptive firing in trigeminal nerve was recorded, for this, serotonin (20 μ M) or sumatriptan (20 μ M) was applied alone or serotonin with the 5-HT_{1B/1D} antagonist GR-127935 (10 μ M), and the 5-HT₃ antagonist MDL-72222 (30 μ M). Different hemiskull preparations were applied alone serotonin or with MDL or alone capsaicin (1 μ M) as a positive control to be determined CGRP levels released from trigeminal nerve and enzyme immunoassays (EIAs) was used. Data were analyzed with paired t-test using Origin 8.5 software.

Results: While sumatriptan did not induce nociceptive firing ($p>0.05$), serotonin induced both strong nociceptive firing and CGRP release in trigeminal nerve endings ($p<0.05$). While out of antagonists tested only MDL-72222 prevented CGRP release and the nociceptive firing induced by the serotonin. Notably, the CGRP release was induced by capsaicin as a positive control ($p<0.01$).

Conclusion: Our findings showed that serotonin causes pain via its ionotropic 5-HT₃ receptors and by stimulating CGRP release in peripheral trigeminal nerve terminals in rat dura mater. In future, 5-HT₃ antagonists may be used to provide a relief from the migraine pain.

Keywords: serotonin, 5-HT₃, CGRP, migraine pain.

O-29

Motor and cognitive changes in Parkinson's disease model induced by unilateral injection of AAV-mediated alpha-synuclein overexpression

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Objective: Lewy bodies are pathognomonic findings of Parkinson's disease (PD). Lewy bodies consist of alpha-synuclein (a-syn) aggregates, which are known as both trigger and indicator of neuronal death pathways. In this study, we aim to establish motor and cognitive impairments that are observed in PD by an animal model of unilateral injected adeno-associated virus vector (AAV, serotype 6) mediated a-syn overexpression in substantia nigra (SN) and in dentate gyrus (DG). In this context, behavioral and histopathological changes that occur due to the overexpression of alpha-synuclein will be studied.

Methods: Female Sprague-Dawley rats (200–250 g) received stereotactic injections of AAV-mediated a-syn (n=12 only DG, n=12 only SN, n=12 SN+DG together), AAV-mediated green fluorescent protein (GFP; n=12 DG, n=11 SN, n=12 SN+DG) or saline (n=4 DG, n=4 SN, n=6 SN+DG) unilaterally.

Additionally, 14 animals used as naïve controls. The cylinder test for assessment of motor asymmetry, novel object recognition test for assessment of memory; elevated plus maze for assessment of anxiety, sucrose preference for assessment of anhedony were carried out. After tests, animals were sacrificed at the end of the 17th week. The intensity of a-syn aggregates and GFP were evaluated by western blot analysis.

Results: A-syn and GFP overexpression in each injection site were showed by western blot analysis. In cylinder test; all SN a-syn injected animals used less contralateral forearm compared to control animals however, only in SN+DG a-syn group reached statistical significance ($p<0.05$). In NOR test, DG a-syn group spent less time with the novel object compared to control ($p<0.001$) and the other a-syn injection groups (SN $p<0.05$, SN+DG $p<0.01$). In EPM, SN a-syn group spent less time in open arm compared to SN GFP ($p<0.01$). Additionally, SN a-syn group consumed less sucrose compared to SN GFP ($p<0.001$).

Conclusion: In this animal model, we showed motor asymmetry together with anhedony and increase of anxiety occurred depending on a-syn overexpression in SN. Moreover, a-syn injection to DG resulted as a negative effect on memory and caused difficulty in recognition of novel object. This animal model may be a promising model to study motor and cognitive dysfunction in PD.

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Keywords: AAV-mediated gene transfection, alpha-synuclein, hippocampus, Parkinson's disease, substantia nigra

O-30

Investigation of the relationship between subliminal stimuli and making a choice

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Objective: Many of the marketing companies have desired the people to be affected by their subliminal stimuli. Recent studies have provided evidence that subliminal priming with the metabolic effects such as thirst or hunger influences individuals' attitudes, choices, and behaviors. Yet, these studies used real or fabricated beverage names. We used a neutral subliminal message in our study not to enter into consumer behavior field. Therefore, we wanted to observe whether thirsty volunteers might choose thirst-quenching beverage without using a real brand name.

Methods: 28 healthy subjects participated in our study (18–30 age range). Participants attended four visual experiments, which lasted 3–4 minutes and EEG data were acquired simultaneously to measure event related potentials (P300). A short break was given after two studies and salty foods were con-

sumed by the participants during break and the other two experiments were completed. Third level of participants were evaluated by a short survey. Subliminal messages were given to the participants with priming and the masked priming. The order of the visuals was random for each subject. Duration of the all stimuli was 200ms, except the masked priming visual, and the interstimulus interval varied between 1.500ms and 400 ms. Subliminal message which appeared on the screen was prepared according to the masked priming technique. After completing EEG session, participant was taken to area outside of the recording chamber. There were four cardboards on the wall of this area as "A", "B", "C" and "D". Participants were told that there were beverages behind cardboards and the feeling of thirst would be quenched by one of these. Participants were asked to make a choice.

Results: P300 amplitude means distributed normally, so amplitudes are analyzed by paired t test and statistically significant difference was found. There was a significant difference between before thirsty ($3.01 \pm 0.93 \mu\text{V}$) and after thirsty ($4.75 \pm 0.91 \mu\text{V}$) (values are given as mean \pm S.E.M, $p < 0.05$).

Conclusion: According to our results, metabolic needs augment the subliminal stimuli which affect our choices. Therefore, we think that people are affected by subliminal stimuli and this effect is augmented by the feeling of thirst.

Keywords: electroencephalography, subliminal priming, event related potentials, neuromarketing, consumer choice

O-31

A computational model for subcortical oscillations during working memory tasks

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Objective: Working memory can be defined as a theoretical framework that represents the capability of maintaining and processing information during a delay period where prior stimulus is not presented. The prefrontal cortex acts as an executive controller in working memory tasks, decision-making, comprehension and learning by providing a control over behavior in accordance to prior information and future goals. Since working memory is an active system with limited capacity, incoming information is needed to be processed, loaded and cleared from the memory buffers with appropriate timing. It is also known that different frequency bands are associated with different computations carried out by working memory. Three well-known examples of this are: the storage of new information correlates positively with oscillations in the beta-gamma (30–120Hz) band, theta-band (4–8Hz) oscillations are directly linked to maintenance of information while ignoring irrelevant stimulations, and clearance of memory is associated with alpha-

band (8–13Hz) oscillations. In this work, the effect of subcortical structures on working memory processes is investigated with a computational model.

Methods: The proposed study here aims to identify mechanisms and factors responsible for the decision over the sensory stimuli where the decision depends on the level of dopamine within the basal ganglia network and the balance between the direct and indirect pathway. Simulated populations (posterior/prefrontal cortex, striatum (D1 and D2 dopamine receptors, fast-spiking interneurons), globus pallidus external/internal segments, subthalamic nucleus, thalamus) are realized with point neuron model. Each neuron model are built up with respect to spiking regime and frequency-current relation of neurons from the corresponding regions. Connection probabilities between each population are chosen as to be compatible with brain imaging studies. During simulations, connections between pre- and post-synaptic neurons evolve according to spike timings between each pair by a Hebbian learning rule.

Results: Simulated model successfully shows that depending on the level of dopamine, subcortical oscillations form a gating mechanism where oscillations in a specific band is related with a specific working memory computation (load, maintain, ignore distracter stimuli, clear).

Conclusion: Proposed model may be a step forward to understand the underlying mechanism of working memory and working memory deficits caused by unbalance in dopaminergic system.

Keywords: basal ganglia, computational model, subcortical oscillations, working memory

O-32

The effect of subliminal and supraliminal angry human face visual expressions on the choice

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Objective: Our aim is to investigate the effect of subliminal and supraliminal angry human face visual expressive on the choice made by different gender.

Methods: In this research, 30 volunteers, 18 women and 12 men participated. Human face visuals were designed graphically using Face Gen Modeler 3.5.3 Suite as four neutral face image (non-emotional expression). One of the neutral face image prepared by adding facial fierce appearance as prob stimuli. Face stimuli are randomly shown consistent with odd ball paradigm by 70% neutral, 30% probe. Firstly, visuals were displayed subliminal 17 ms, the second part of experiment was presented supraliminal 500 ms duration simultaneously event related potentials (ERP) were recorded. Probe stimulus was placed between two neutral face stimuli that reduced resolution

visuals called “priming effect”. At the end of the ERP readings, neutral versions of the all images shown to the volunteers and asked to point out angry images during the experiment. Subliminal and supraliminal prob’s N170 amplitudes were recorded and compared to whether more effective than neutral visuals or not. The effect of subliminal and supraliminal probe visuals were compared by making volunteers choose. In addition, whether the gender factor would change both subliminal and supraliminal results or not was statistically compared.

Results: Selection rate of the probe which was shown as supraliminal was found as 100% in females and 83% in males whereas, the selection rate of the probe which was shown as subliminal was found as 27, 8 % in females and 8, 3 % in males. N170 amplitude were detected in Fz, Cz, Pz, Oz, T5,T6 electrodes and analysed using Mat Lab software. N170 amplitudes of fore-told electrodes were compared in arithmetic mean±standard deviation in terms of μV . Student t-test was performed to compare data groups. In addition, when N170 amplitude results of woman were compared to men there was statistical difference found in T5 (-3.73 ± 0.5 vs -1.54 ± 0.6) and T6 (-5.82 ± 1.7 vs -0.64 ± 0.5) electrodes for subliminal stimulus. Regarding supraliminal stimulus, N170 amplitude results of woman in Cz (-5.62 ± 1.1 vs -2.0 ± 1.4) electrode was found to be statistically different than men ($p<0.05$).

Conclusion: Numerous brain scanning methods indicate that different brain structures can give distinctive degree of responses according to different emotional stimulus. Within the concept of our research, in accordance with N170 recordings, were found to be higher in female volunteers.

Keywords: subliminal, supraliminal, N170, face recognition

O-33

Portable, multifunction actigraphy design

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Snoring disorder is generally analyzed with polysomnography and polygraph in the sleep laboratory at the hospitals. these appliances allow experts to examine the physiological data which is taken from the patients. Today, existing devices which are generally having high cost, not particularly well suited to protable and no enough ergonomic use. However, it is also observed that in some cases they have contained insufficient information in diagnosis and analysis. The main object of the developed device is ergonomic use, portable, suitable use at home, and get the low cost device which containing new technologies. The proposed device can record oxygen saturation (SPO₂), AC pulse signal, nasal airflow and snoring sound of the patients. Recording can be made throught the night. The recorded pyhsiological data can be again analyzed in a developed computer program by the experts and doctors. The experts with the help of the pre-screening information, there is

no need to patients’ sleep laboratory results. Separation of recorded data from each patient results can be provided classifiers such as Support Vector Machines (SVMs) processed through a developed computer interface which makes it possible to obtain more accurate results for patients. Another features of the computer interface is able to extract to snore sound features. So the experts are able to take more detailed results of sounds. The one of the most prominent features of the device is using the sensors and microcontrollers that running at low power mode, so the device can be working throughout the night without any kind of energy supply, can record the all of the physiological data.

Keywords: portable snoring devices, actigraphy device, portable sleep device

O-34

Decomposition of EEG signals using independent component analysis before EEG source localization

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Objective: Brain Imaging is an interdisciplinary study which depends on non-invasive medical imaging technics such as fMRI, SPECT, PET or EEG. Imaging by EEG signals, despite its low spatial resolution, is preferred to other methods because of its high temporal resolution. But during EEG recordings, unwanted artifacts such as EMG, ECG, equipment and environmental signals are added to EEG signals which can lead to faults in diagnosis. Noisy EEG signals are decomposed first to isolate real signals from artifacts, before they are used to locate signal sources by reverse-problem solution techniques to help doctors in diagnosis.

Methods: Real EEG signals in existing dataset, is analysed using EEGLAB software and Independent Component Analysis (ICA) techniques in this study. Electrodes are located on true positions on a head model before signals are analyzed by ICA. Sources must be independent to get good results using ICA. EEG signal is decomposed into independent components with the help of mathematical models. SOBI, JADE and Infomax methods implemented separately and EEG signals are analysed. Then 2 dimensional scalp maps of independent components are plotted and signals are interpreted. In 2D scalp maps, panoramic head plots can be seen. Fourier transform and power spectrums of the components are computed and analyzed at the last step.

Results: Artifacts superimposed on EEG signals become apparent as scalp map plots are analyzed. For instance, high activity on the frontal part of head is observed as expected, when the subject blinked eyes. Besides, artifacts like muscular and heart beat created different scalp maps. It is easy to detect signals with various frequency-amplitudes by Fourier analysis. Interpreting obtained independent components along with

scalp maps and frequency-magnitude graphs will simplify artifact decomposition.

Conclusion: Advanced signal analysis and filtering methods are used to decompose EEG signals from artifacts before epileptic EEG source localization problem in this study. Artifact sources superimposed on EEG signals are determined and meaningful results obtained by creating scalp map and frequency-magnitude graphs. This is a required preliminary study before epileptic EEG signal source localization problem. It is planned to classify and then filter artifacts from epileptic EEG signals to map brain. We thank The Swartz Center for Computational Neuroscience for providing EEGLAB software.

Keywords: EEG, independent component analysis, preprocessing

O-35

Reducing traub model to exponential integrate and fire neuron model: a computational study

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A very basic look towards describing a neuron's behavior is that, a neuron integrates noisy synaptic input and fires when membrane potential reaches a certain threshold. That is, spikes can be treated as the outcome of single neurons behavior. Behavior under threshold potential level determines how and when a neuron fires an action potential. It would help a lot computationally to eliminate spike generating mechanism from the subthreshold mechanism. Unfortunately, these two parts are not completely independent of each other. For example, spike generating Na current contributes to the membrane

potential at subthreshold potential levels, and K current has slow inactivation, so when a neuron returns to subthreshold levels from a spike, K current would continue to inactivate for a while (refractory period). In addition, neurons usually involve other currents that modulate its activity (AHP, A etc). At the cost of losing these contributions, the famous exponential integrate and fire (EIF) model (a version of the integrate and fire model) is constructed to better approximate the dynamics of realistic neurons. This model, in addition to leak current term, involves an exponential term that mimic the effect of Na contribution near threshold. It is shown that, the EIF model matches spike times and subthreshold dynamics of the model with spike generating currents under noisy input. By this means, EIF model provides a good match for the full model and reduces the computation time to a large extend. Most of the experimentally obtained neuron models, in addition to the spike generating leak, Na and K currents, involve additional currents. Among these, the h-current is of particular importance as it is widely used by many neurons for displaying an important property known as post inhibitory rebound. In this work, the possible integration of hyperpolarization-activated depolarizing h-current to the EIF model was considered. We reduced a full neuron model (Traub neuron model) with leak, Na, K and h-currents to the one without spike generating Na and K currents. The resulting 4-equation model is reduced to the one with two-equations EIF model. We compared the reduced model with the full model under noisy excitatory and inhibitory synaptic input and shown that results of the reduced model closely match that of full model. Finally, a second current, AHP current, to the reduced model was integrated and show that, EIF model still matches the spike dynamics of the full model under noisy input.

Keywords: reduction, traub neuron model, exponential integrate and fire neuron model, adaptation current, noise

Poster Presentations

(P-01 — P-99)

P-01

Heschl's transverse gyri: anatomy and morphological variations

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Objective: Heschl's gyrus is the primary auditory cortex in human. It is located in the posterior part of the area on the superior surface of the temporal lobe or, the planum temporale. The number and shape of this gyrus may differ. Demonstration of Heschl's gyrus is important for the evaluation of patients with auditory symptoms. In this study, we aimed to investigate the number and shape variations of the Heschl's gyrus on normal subjects by using MR imaging technique.

Methods: Eighty hemispheres in 40 subjects were evaluated. Of these subjects, 18 were patients with headache, evaluated in our MR imaging unit, and 22 healthy volunteers. Inclusion criteria for patients and volunteers were: 1) No history of neurologic disease, head trauma and cranial surgery and, 2) completely normal brain MR imaging findings. Edinburgh handedness inventory was applied to subjects for the determination of hemispheric dominance. Informed consent was obtained from all subjects. After the routine sequences, three dimensional transverse T1-weighted fast field echo (FFE) images were obtained. For the analysis, reformatted images in three orthogonal planes were used. Two radiologists were evaluated the images. The shape of the gyrus was classified as omega or heart shaped according to coronal and sagittal images. As well, the number of the gyrus in each hemisphere was noted.

Results: Of the 80 hemispheres evaluated, single gyrus was present in 67 (84%) and two gyri were present in 13 (16%). Three or more Heschl gyri was not seen. Of the total 93 Heschl's gyri, 79 (85%) were omega shaped and 14 (15%) were heart shaped. Number and shapes were analyzed according to right/left and dominant/non-dominant hemispheres as well.

Conclusion: Our study shows that, among normal subjects, number and shape of the Heschl's gyrus may show variations. In clinical investigations that the identification of this gyrus is needed, such as functional MRI studies, these variations should not be overlooked.

Keywords: Brain, anatomy, Heschl's gyrus, MR imaging

P-02

Importance of bioinformatic tools and whole genome sequencing in diagnosis of craniosynostosis

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Craniosynostosis is defined as premature closure of calvarial sutures. Brain development defects, intracranial pressure elevation, and calvarial shape disturbance are consecutive affects of craniosynostosis. Genetic factors significant play role in craniosynostosis. Birth prevalence is 3–6 per 10.000 live births. The classification of craniosynostosis is based on the shape of calvaria and involved suture. Bioinformatic tools and whole genome sequencing methods can be used for diagnosis of disease. According to other methods, to diagnosis of disease is very cheap and economic with using bioinformatic tools and whole genome sequencing methods. Next-generation sequencing has a potential to dramatically accelerate biological research, by enabling the comprehensive analysis of genomes, transcriptomes and DNA-protein interactions to become inexpensive, routine and widespread.

Keywords: Craniosynostosis, bioinformatic tools, whole genome sequencing, next generation sequencing

P-03

Reward processing deficits in ADHD during a spatial attention paradigm: an fMRI study

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ADHD is associated with motivational deficits and the basis of such deficits could be related to problems with perceiving environmental reinforcements and regulating performance according to feedback. In this study we tested 16 healthy children and 19 children with ADHD using a cued spatial attention paradigm in the scanner. In addition, all parents filled in Turgay ADHD questionnaire that asks all 18 DSM questions for DEHB symptoms. According to the cued spatial attention paradigm test ADHD group was less accurate than controls for both rewarded and non-rewarded conditions ($U=87.5$, 95.5; $z=2.14$, 1.88; $p=0.03$ and 0.06 respectively). The neuroimaging results showed significant group by reward interactions for cue related activations in anterior thalamus. In this cluster controls showed greater activation for reward predicting cues as compared to cues predicting absence of rewards while for ADHD group activations were greater for cues predicting absence of rewards. For feedback related activations significant reward by

group interactions were found in caudate head and frontal eye field. For controls absence of rewards produced greater activations than presence, while for ADHD group reverse pattern was observed. The activation difference in anterior thalamus and frontal eye field between rewarded and non-rewarded conditions was correlated to inattention scores. These results indicate that ADHD is associated with problems in integrating reward contingency information to orienting and regulatory phases of attention and these reward processing problems are related to inattention symptoms.

Keywords: ADHD, fMRI, motivation, reward processing, spatial attention

P-04

Association of nitric oxide synthase 3 gene promoter polymorphism in autistic spectrum disorder

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Objective: Autism, autism is a sub-group of autism spectrum disorders, which are classified as a heterogeneous neurodevelopmental disorder and its emerging symptoms occurs in the first three years of life. Autism is associated with oxidative stress and nitrosative stress mechanisms. Nitric oxide (NO) is free oxygen radical. High concentrations of NO occur nitrosative and oxidative damage in the brain and thus may play a role in the development of autism. NO, is generated by nitric oxide synthase (NOS) and it effects neurodevelopmental processes in the central nervous system. In this study, we aimed to investigate the relationship between autism and NOS3 gene -786 T>C (rs2070744) polymorphism.

Methods: 30 autistic patients (25 boys, 5 girls) and 30 healthy controls (25 boys, 5 girls) were enrolled. Autism diagnosis was performed using DSM-V criteria in the Erciyes University School of Medicine, Department of Child Psychiatry. All of the genetic studies were performed in Erciyes University Genome and Stem Cell Center (GENKOK). DNA was isolated from whole blood samples of the all participants. Genotypes were determined by Polymerase Chain Reaction (PCR) and Restriction Fragment Length Polymorphism (RFLP) method.

Results: According to the statistical analysis, there were no difference between the case and controls in terms of gender. Polymorphism was statistically significant between the groups. ($p < 0.05$).

Conclusion: High concentrations of NO occurs nitrosative and oxidative damage in the brain. High NO levels are associated with autism. Because of the difference between the groups we can suggest that this polymorphism may have an effect in autism. We can recommend that further studies are needed with oxida-

tive stress markers, plasma NO levels and gene expression with a larger sample groups in autism.

Keywords: autism, autism spectrum disorders, NOS3, polymorphism

P-05

Investigation of the association of aggression and DRD4 gene expression in autism spectrum disorders

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Objective: Autism spectrum disorder (ASD) is defined as a complex neurodevelopmental disorder. It is known that a genetic origin exists in the etiology of autism. DRD4 encodes the D4 subtype of the dopamine receptor and dopaminergic system has role in human behavior, such as aggression. This study aims to investigate the relation between aggression and the expression of the DRD4 gene in autism.

Methods: According to the DSM-V followed-up with diagnosis of ASD or first diagnosed of ASD patients are included in the study. Totally 40 ASD patients (20 autism patients, 20 atypic autism patients) and 50 control samples were enrolled in this study. This research is supported by TUBITAK (Project Number: 114S742). This study was conducted in Genome and Stem Cell Center, in Erciyes University. RNA isolation was extracted from whole blood samples of patients and controls by TRIzol. The quantitative Real-time Polymerase Chain Reaction was used for DRD4 gene expression.

Results: When the DRD4 gene expression of autism group compared to atypic autism group and control group, the expression values were found to be statistically high and significant ($p < 0.05$). Also, DRD4 gene expression is found statistically significant and high in atypic autism patients compared to control group. Considering the results of the comparison between DRD4 gene expression of ASD patients with aggression and ASD patients without aggression, there is no significant difference observed.

Conclusion: The relationship between ASD and DRD4 has been shown in earlier studies. However, studies about DRD4 gene expression of autism patients are severely limited. There are some studies demonstrated that some DRD4 gene polymorphism may be a prognostic biomarker for children with ASD. To our knowledge, there is no prior study that shows the relationship between the aggression and DRD4 gene expression in ASD.

Therefore, expression of this gene should be studied with larger study group. Especially, different studies, which investigate the relation with this gene and its related signal pathway, should be planned to reveal its role on ASD.

Keywords: autism, autism spectrum disorders, DRD4, expression, gene

P-06

Effects of pentraxin 3 on mechanisms of development of nociceptive pain patients with diabetic polyneuropathy

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Objective: Diabetes mellitus (DM) is a worldwide epidemic disease with many long term complications. Neuropathy is the most common neurologic complication of DM and the lifetime incidence of neuropathy in patients with type 2 DM is approximately 50%. DM can predominantly or entirely affect only small myelinated (Aδ) fibers or unmyelinated C fibers. Involvement of large myelinated fibers and small-nerve-fiber may the earliest detectable sign of the neuropathy. The underlying mechanism of diabetic polyneuropathy (DPN) is extremely complex and likely related to metabolic and inflammatory process individually or superimposed on ischemic nerve lesions. In this study, we aimed to investigate the plasma levels of Pentraxin 3 (PTX3) and Thioredoxin binding protein 2 (TBP2) in patients with DPN with or without neuropathic pain and to compare their results with the healthy subjects.

Methods: This study included twenty-seven consecutive type 2 diabetic patients with symmetrical pain and/or numbness in the feet and 24 healthy age- and sex-matched controls who had no risk factors for neuropathy or neuropathic pain as a control group. All patients fulfilled ADA (American Diabetes Association) criteria for the diagnosis of DM12. In all patients bilateral posterior tibial, common peroneal motor nerves and bilateral sural and superficial peroneal sensory nerves with left median, ulnar motor and sensory nerves were studied. Blood was collected from the patients and control subjects. Plasma are separated from whole blood. In plasma samples of subjects, concentrations as pg/ml of PTX3 and Thioredoxin binding protein was analyzed by using enzyme-linked immunosorbent assay (ELISA).

Results: Plasma levels of PTX3 and TBP2 were compared between patients and controls and it was found that Pentraxin 3 level was significantly higher in DPN patients ($p=0.03$). Also, patients with an LANNS score of <12 had significantly higher

PTX3 levels comparing with controls ($p=0.006$), while patients with a score of ≥ 12 have no difference ($p=0.34$).

Conclusion: Our results showed that PTX3 may contribute possible mechanisms of development of nociceptive pain. These results shed light on understanding of the pathways leading to discrimination between neuropathic pain and nociceptive pain. Finally, lower plasma PTX3 levels of the patients with a score of ≥ 12 than the patients with an LANNS score of <12 are discriminative for diabetic neuropathy differently possible other systemic inflammatory diseases in type 2 diabetic patients.

Keywords: diabetic neuropathy, pentraxin 3, diabetes mellitus

P-07

The anti-depressant-like effect of acute trans-/cis-zeatin isomer injection on female rats

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Objective: Zeatin, a plant growth hormone with an adenosine-like structure, was previously shown to be effective against neurodegeneration on partial Alzheimer's Disease models on animals. Although there isn't enough information on the metabolism or the effective pathways of zeatin and zeatin-riboside isomers in animal cells, it is known that trans-zeatin and trans-zeatin-ribozide act via A2A receptors. The involvement of A2A receptors was reported on several psychiatric disorders including schizophrenia and anxiety. Moreover, A2A receptors are known to be in close interaction with D2 receptors. Therefore, our goal was to investigate the direct or an indirect effect of zeatin forms on the pathways associated with depression on a model of female rats at metestrus.

Methods: In our study, forced swim test (FST) was used as a depression-like model on female rats. The trans-/cis-zeatin isomer mixture (tcZ, %95 trans-zeatin, %5 cis-zeatin) was dissolved in distilled water and was administered intraperitoneally(ip) as a maximum 300 µl solution depending on the weight of the animal. The female rats at their estrus were selected and divided into four groups(control group and 2 mg/kg, 5 mg/kg, 10 mg/kg dose groups, n=8) and were habituated for 15 minutes 24-h prior to the test. Next day, the rats at metestrus received either solvent injection (control group) or tcZ mixture (experimental groups) 30 min. prior to the 5-min test. The immobility durations were then estimated and the statistical differences were analyzed by one-way ANOVA and post-hoc Tukey-Kramer tests. One week after FST, the rats received a second injection 30 min. prior to locomotor activity (LA) test to understand whether tcZ creates a sedative effect on female rats at metestrus. The resulting total movement distance (cm),total mobility duration(s),total immobility duration(s) and total movement duration(s) were estimated and statistically analyzed.

Results: Our results indicate that 10 mg/kg tcZ injection decreases the immobility in FST significantly compared to the

control group ($p < 0.05$). On the other hand, 2 mg/kg tcZ resulted in a slight but significant increase in the immobility duration ($p < 0.05$). 5 mg/kg zeatin injection did not create a significant difference in immobility ($p > 0.1$). There was no statistically significant difference between groups in the LA test results ($p > 0.5$).

Conclusion: To our knowledge, it was demonstrated for the first time in literature that 10 mg/kg tcZ administration has an anti-depressant-like effect on female rats as the decrease in immobility at this dose is not caused by sedation. Further chronic studies are required and planned to fully analyze the effect of zeatin isomers., i.e. the immobility-increasing effect observed for the lowest dose group.

Keywords: zeatin, depression, forced swim test

P-08

Central effect of intranasal oxytocin on chronic stress applied rats and modulation with the bodyweight

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Stress which has various effects on physiological, neurochemical and behavioral parameters also activates stress system and modulates food intake and energy consumption. Understanding the progression of obesity and its effects on the stress response is of vital importance because obesity is increasingly becoming an important public health problem in today's world. Because of the anxiolytic, anorexigenic effects and being the common ground concerning the hypothalamus, the role of oxytocin on control of these mechanisms can not be disregarded. In order to investigate effect of bodyweight on stress response using chronic stress applied rats and variation of this effect with the oxytocin administration, cold-immobilization stress was applied for 5 days to rats ($n=40$) which were fed with either standard or high fat diet (HFD) and half of the animals were given oxytocin intranasally. Stress response is evaluated according to serum and saliva cortisol levels as well as elevated plus maze scores. Accordingly, the stress response of obese animals were higher and anxiolytic effect of oxytocin was prominent in control group whereas the effect was designated as weak for obese animals. In addition, prefrontal cortex and hypothalamus oxytocin receptor (OxTR) protein levels were designated using western blot analysis. While OxTR protein levels in prefrontal cortex was found to be invariable according to the bodyweight and exogenous oxytocin administration, levels for hypothalamus was found to be changing according to feeding type and oxytocin administration. As a result, peripheral and central effects of oxytocin, which is a well known anxiolytic peptide according to literature can variate with the feeding type and developed obesity in animals fed with HFD might act like a stress factor and mask the foretold anxiolytic effects of oxytocin. According to these results, enlightening the cen-

tral effect mechanisms of oxytocin is of vital importance in order to cope with stress and growing problem of obesity and its modulation

Keywords: Bodyweight, chronic stress, oxytocin, oxytocin receptor

P-09

The relationship between theory of mind and neurocognitive functioning in schizophrenia

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Objective: Schizophrenia is characterized by severe disabilities and can often be seen in all societies. Theory of Mind (ToM) is essential for social interaction. It makes interpreting complex social behaviours possible. Patients with schizophrenia fail in understanding the mental states of others and themselves which causes the symptoms of schizophrenia. In addition to this, considering the relation between schizophrenia and the impairments in neurocognitive performance, in our study we aimed to investigate the relationship between ToM and neurocognitive functioning in schizophrenia.

Methods: 32 patients with schizophrenia from Dokuz Eylül University Faculty of Medicine took part in the study. Participants were evaluated with Positive and Negative Syndrome Scale (PANSS) and Reading Mind in the Eyes Test (RMET). Additionally, a neuropsychological test battery was applied to the patients: Rey Verbal Learning Test, Wisconsin Card Sorting Test, Digit Span Test, Controlled Word Association Test, Auditory Consonant Trigram Test, Visual Reproduction Test, Stroop Test, Trail Making Test, Category Fluency Test, Digit Symbol Test. The relations were evaluated with Pearson correlation coefficient analysis.

Results: A positive correlation was found between RMET and Wisconsin Card Sorting Test (WCST) total correct percentage ($r=0.577$, $p=0.001$) and subtests of Rey Verbal Learning Test that are the number of words recalled in the first trial ($r=0.634$, $p=0.001$), number of words recalled in the fifth trial ($r=0.58$, $p=0.001$), the number of words recalled between first and fifth trials ($r=0.709$, $p=0.001$), delayed recall of Rey ($r=0.67$, $p=0.001$) and accurate recognition of Rey ($r=0.549$, $p=0.001$). Likewise, Auditory Consonant Trigram Test ($r=0.493$, $p=0.004$), immediate ($r=0.408$, $p=0.020$) and delayed recall of Visual Reproduction Test ($r=0.431$, $p=0.014$), Visual Reproduction Test total score ($r=0.437$, $p=0.012$), Stroop test color naming time ($r= -0.365$, $p=0.04$), Stroop test interference ($r= -0.526$, $p=0.02$) and Category Fluency Test total score ($r= 0.485$, $p=0.005$) showed correlations with RMET.

Conclusion: While some researchers consider social cognition to be independent from neurocognitive functions, others defend

that poor ToM performance in schizophrenia is a byproduct of cognitive functioning disorders. In this context, the majority of neurocognitive tests showed correlations with RMET. Overall, verbal learning and memory, short-term memory and working memory and executive functioning were found to be correlated with RMET in our study. Moreover, as ToM functions are thought to be influenced by the clinical status of the patient, there are studies arguing differentiation of positive and negative symptoms. Accordingly, such a relationship didn't exist in our study.

Keywords: neurocognitive functioning, schizophrenia, theory of mind

P-10

Brain responses to semantically and syntactically anomalous sentences. What is different? – Evidence from Turkish

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Objective: Traditionally, lexical-semantic conflicts were associated with a centro-parietal negativity occurring approximately 400 ms post stimulus onset and morpho-syntactic conflicts with a later parietal positivity, P600. However, the dichotomy of 'semantic N400 and syntactic P600' has recently been challenged and is still a matter of debate. This study aims to contribute to this discussion by investigating the role of language typology on ERP effects and in particular potentials elicited by the lexico-syntactic content in verbs with three suffixes in Turkish. Turkish has a complex inflectional system, where most grammatical relations are realized at morpheme level.

Methods: Six hundred stimulus sentences consisting of five words were presented visually to native Turkish speaking participants. Four variations were used: correct sentences, sentences with a morphosyntactic subject-verb agreement violation, sentences with a semantic expectancy violation and sentences with a combined morphosyntactic and semantic violation. Electrophysiological data were recorded from nine scalp electrodes. The dependent measures were analyzed with repeated measures analysis of variance (ANOVA).

Results: For all of the conditions a biphasical pattern (N400 and P600) has been observed through all of the channels. Contrary to the standard view, we obtained a similar biphasic pattern in reaction to all three conditions — an N400 followed by a P600 effect.

Conclusion: The results show that the centro-parietally-maximum topography in the semantic violation paradigm is much the same as the "syntactic P600". We hypothesize that, when perceiving a semantic anomaly in a morphosyntactically complex language the semantic anomaly might lead to misperception of well-formed suffixes overwhelming syntactic cues, causing the

well-formed syntactic cues to appear ill-formed (see Kim & Osterhout, 2005). In pro-drop languages like Turkish, subject-verb agreement can be interpreted as correct when the subject is dropped, because the morphemes supply verbs with person, number, tense etc. The presence of an N400 effect in these sentences support the view that 'the processing of rule-based linguistic knowledge correlates with an N400 when the consequences of a rule misapplication are interpretive' (Choudhary et al., 2009:3019). We therefore hypothesize that the N400 effect might also reflect conflict resolution (inhibiting the subject in this case). The results in this study indicate that, the neural language processing architecture is not only sensitive to various sentence types but also to language typology. The similar biphasic pattern found in this study in all three conditions challenge the classical interpretation of the N400 and P600 effects in semantic and syntactic violation paradigms.

Keywords: N400, P600, sentence processing

P-11

Analysis of the dominant visual area in the perception of threat stimuli

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Objective: Previous research has shown attentional bias to threat inducing stimuli in both human and non-human primates. This bias could be observed in visual stimuli such as threatening animal figures and angry faces, as well as auditory stimuli such as angry sounds. Attentional bias and decreased reaction time to threat stimuli increases the survival rate of the organisms. However, previous research about the reaction times to threat stimuli and neutral stimuli revealed conflicting results. In this study, our initial aim is to measure and compare the reaction times to different stimuli that are presented at the centre of the screen. In the second part of the study, we present threat inducing stimuli from different visual fields and try to understand which of the visual areas is more sensitive to these visual stimuli. Thus we try to differentiate peripheral areas based on their attentional bias to threat.

Methods: Initially threat-inducing and neutral stimuli were presented to the participants via computer based programs, at the centre of the screen. The reaction times to these stimuli were recorded and compared. In the second part of the study, similar stimuli were presented from different peripheral visual fields and reaction times were recorded for the attention to threat stimuli. The presentation of the stimuli and reaction time analysis were made using JAVA programming language. SPSS was used for further statistical analysis. The participants were right-handed university students (age 18–24) with no previous history of neurological problems.

Results: Our results showed that participants reaction times are shorter for the threat stimuli (compared to neutral) when presented from the centre of the screen. In the second part of the

study we found that reaction times to threat stimuli differed significantly based on the visual field it is presented from.

Conclusion: Our results support that human visual attention showed bias to threat stimuli. Moreover, separate visual areas have different dominance in attention to threat stimuli. We believe that, it is mostly related to the evolution of the bipedal posture in human.

Keywords: Visual area, visual perception, threat

P-12

The effect of post-learning sleep deprivation on spatial memory in mice

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Objective: Making lasting (spatial) memories in the brain is thought to occur during the memory consolidation process of sleep. Studies investigating the effect of sleep deprivation on the consolidation process suggest that a specific time period of sleep is needed after learning. The aim of this study is to determine this sensitive time period using a hippocampus -dependent spatial memory test (Morris water maze, MWM, Ethovision-Noldus).

Methods: The study was performed with 30 male BALB/c mice aged 2 month and separate groups of mice (n=10) were sleep deprived (SD) in one of the two after the last training session the mice were deprived of sleep for 3 hours (SD1), in the second group after the last training session and a waiting period of 3 hours the mice were deprived of sleep for 3 hours (SD2) and the last group was Non-sleep deprivation (NSD) control group that were used for comparison with the two SD groups. Repeated-measures ANOVA was used to analyze the changes in Distance Moved (DM) and Escape Latency (EL), and the time spent in the target quadrant to the ratio of the total time spent expressed as a percentage value (probe trial, PT) were analyzed using oneway ANOVA and compared between the groups. Statistical significance was set at P<0.05.

Results: We found that 3 h of sleep deprivation significantly impaired memory in SD2, but did not impair in SD1 when compared to NSD control group. We found that DM and EL reduced across training trials between NSD and SD1 and that it was not significant (p>0.05), but these parameters statically was higher in SD2 (p<0.05). In SD2, PT was found statistically lower than SD1 and NSD (p<0.05).

Conclusion: Our findings indicate a specific 3-h critical period, extending from 3 to 6 h after last training, during which sleep deprivation impairs hippocampal spatial navigational function in MWM. It is likely that spatial memory is impaired because sleep loss overlaps with these critical time windows where molecular signaling pathways are known to be important for memory consolidation.

Keywords: learning, sleep deprivation, spatial memory

P-13

Reduction of glufosinate threats against neurons

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Objective: Glufosinate (GLF) ((RS)-2-amino-4-(hydroxyl (methyl) phosphonoyl butanoic acid, phosphinothricin), is originated from bacteria and used widely in agriculture as herbicide. GLF inhibits glutamine synthase by toxicity of fungi and bacteria as well as break the ammonium detoxification and homeostasis. GLF cause loss of memory from moderate to heavy and neurotoxicity such as convulsion. In addition, it causes degenerative changes in hippocampal region of brain. Gabapentin [1- (aminomethyl) sikloheksanasetik acid] is a medication used to treat epilepsy. It is a lipophilic structural analogue of the inhibitory neurotransmitter γ -aminobutyric acid (GABA). Nifedipine is a calcium channel blocker also show efficacy as antimineralocorticoid. It is a medication used to manage angina, high blood pressure, Raynaud's phenomenon. Aim of this study is to prevent the neuronal damage and neurotoxicity due to glufosinate by aid of nifedipine and gabapentin and identify the doses of neuroprotective.

Methods: Neural cultures were obtained from Ataturk University, Department of Medical Pharmacology. Neural cultures were kept in culture medium (CO: 5%, 37 °C, 95% moisture, Fetal bovine serum 10%+Neurobasal medium+B2, 1/1000 antibiotics). Then, neural cultures were divided into 8 application groups. 1. Control: Only neural cultures (NC), 2. GLF: NC+1 μ m glufosinate, 3. GLF+N1: NC+1 μ m Glufosinate+1 μ m nifedipine, 4. GLF+N10: NC+1 μ m Glufosinate + 10 μ m nifedipine, 5. GLF+G30: NC+1 μ m Glufosinate+30 μ m Gabapentin , 6. GLF+G3: NC+1 μ m Glufosinate+3 μ m Gabapentin, 7. GLF+N1+G3:1 μ m Glufosinate + 1 μ m nifedipine, 3 μ m Gabapentin, 8. GLF+N10+G30: NC+1 μ m Glufosinate +10 μ m nifedipine +30 μ m Gabapentin. Experiment was terminated by adding MTT solution. Neural culture was monitored by spectrophotometre ar 570 nm wavelength and subjected to variance analysis.

Results: There was significant differences among application (p<0.01). Survival rate was decreased 46% based on glufosinate application. When combination use of nifedipine and gabapentin in higher doses was applied, survival rate of neural culture was observed as 94%. In addition, single use of gabapentin in 30 μ m dose resulted in 93% survival rate.

Conclusion: Based on our results, combination use of nifedipine and gabapentin can be suggested to lover the toxicity Glufosinate.

Keywords: gabapentin, glufosinate, neurotoxicity, nifedipine

P-14

Regulation of c-Fos expression in CART synthesizing neurons in lateral hypothalamus by forced swim stress

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Objective: In the central nervous system, CART mRNA and peptides are expressed most intensely in the hypothalamus. CART peptides synthesized in lateral hypothalamus (LHA) and perifornical area (PeF) are known to regulate hypothalamic-pituitary-adrenal (HPA) axis and sympathetic nerve system activity which are activated in stress response. There is a substantial literature which shows that CART has significant effects on the HPA axis and sympatho-adrenal system activity. Intracerebroventricular and intraparaventricular administration of CART peptide increase CRH, ACTH and corticosterone levels in the blood. Also intracerebroventricular and intracisternal CART peptide injection also increases heart rate, blood pressure, sympathetic nerve system activity and adrenalin levels in blood. Studies show that various physical stress procedures regulate CART expression in the brain. Forced swim stress elevate CART peptide expression in hypothalamus. Up to date, studies show that CART is one of the major transmitters in acute stress response which regulates both HPA axis activity and sympathetic nerve system activity. Purpose of this study is to show regulation of c-Fos expression by psychological stress response in CART synthesizing neurons in LHA and PeF which regulate HPA axis activity and sympathetic nerve system activity.

Methods: Adult female Sprague-Dawley rats were used in the study. Rats were divided into two groups as control and stress (forced swim stress) groups (n=5). Rats were forced to swim in water at 25 °C, in a Plexiglas cylinder (diameter: 30 cm, height: 50 cm), for two consecutive days between 09:00 and 10:00 am. On the second day two hours after the final exposure to stress, rats were perfused by %4 formaldehyd. Rats were sacrificed by decapitation. Forty micrometer thick coronal sections of LHA and PeF were cut by cryostat. The neurons were examined by light microscope, 20x magnification. Only c-Fos protein marked, only CART peptide marked, c-Fos and CART protein double marked neurons were counted.

Results: The difference between c-Fos protein marked, CART protein marked, c-Fos and CART double marked neurons were examined by independent sample t-test and SPSS. In LHA and PeF, effect of forced swim stress to total c-Fos protein marked, total CART protein marked, c-Fos and CART double marked neuron numbers were found statistically significant.

Conclusion: Increased c-Fos expression of CART neurons in LHA and PeF after forced swim stress exposure indicate these neurons play a critical role in regulating HPA axis and sympathetic nerve system activity by acute stress response.

Keywords: CART, lateral hypothalamus, perifornical area, stress

P-15

Movement skill development in WAG/Rij rats with genetic absence epilepsy: head, trunk and limb orientation and limb flexion and extension

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Objective: Absence epilepsy is a form of primary generalized epilepsy commonly seen in children. Absence seizures are clinically

characterized by a sudden brief loss of consciousness and by electroencephalography indicating diffuse spike-wave discharges. Associated comorbid medical conditions such as learning disorders and developmental delay are also seen in children diagnosed with absence epilepsy. The Wistar Albino Glaxo/Rijswijk (WAG/Rij) strain is a genetic rat model for human absence epilepsy. All animals from this strain present generalized epileptic seizures. In this study our aim is to investigate developmental progression of skilled movement, including head, trunk and limb orientation and limb flexion and extension from postnatal day 7 to postnatal day 30 in Wig/Rij rats with genetic absence epilepsy.

Methods: Rung bridge stepping task was used in order to reveal developmental progression of movement skill development. 11 Wig/Rij rat pups were filmed daily at the same time from postnatal day 7 to postnatal day 30 on the rung bridge stepping task. Each pup was filmed for 3 minutes or until transversing a distance of 50 cm (during later stage of development). Analysis of movements from the video recordings was performed using the rung bridge stepping task rating scale for rats.

Results: While at the postnatal day 7 the pups were able to orient their head in the direction of movement, by postnatal day 12 they were able to align both their head and torso in the direction of movement (p<0.05). The scores for fore- and hind-limb orientation were found low between postnatal days 7–10. By postnatal day 11 animals exhibited fore- and hind-limb orientation with higher scores (p<0.05). The pups exhibited paw flexion and paw extension at postnatal day 12 and postnatal day 13, respectively (p<0.05).

Conclusion: Our findings show that the Wig/Rij rat pup motor development progresses similarly as Norway rats as reported by previous studies for head, trunk and limb orientation and limb flexion and extension.

Keywords: absence epilepsy, WAG/Rij rat, motor function

P-16

Cortical structural changes and visual functional outcomes associated with homozygous LAMC3 mutation

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Objective: We investigated the cortical structure of a patient with bilateral occipital and parietal cortical gyration abnormalities caused by a single gene mutation. Using a battery of visual tests and eye-tracking we also measured visual function in the same patient in order to understand how structural abnormalities might be linked visual behavior.

Methods: T1-weighted images were acquired using a 3T scanner with 32- and 12-channel phase-array head coils for the

patient and 12 age-, sex-, and education-matched healthy individuals. Analyses were performed using Freesurfer. Preprocessing involved intensity normalization, non-brain tissue removal, subcortical segmentation, gray matter (GM)-white matter (WM) boundary identification. The cortex was registered to a spherical atlas, parceled into units based upon Desikan Killiany Atlas. Statistically significant differences were determined by bootstrapping [95% Confidence Intervals (CI)]. Visual tests involved Cortical Vision Screening, Leuven Perceptual Organization Screening, Cookie Theft Picture, Benton's Judgment of Line Orientation, Benton's Visual Retention, Clock Drawing. An eye-tracking experiment was conducted to assess the patient's ability to maintain focus in the presence of visual distractors.

Results: Voxel-based morphometric analysis revealed statistically significant differences in mean curvature (MC), thickness, GM- and WM volume between patient and controls, not only in occipital and parietal cortices, but also throughout the brain. Structural abnormalities of the patient comprised decreased MC in early visual areas, increased thickness in early visual and middle temporal areas, increased GM volume in early visual areas, and decreased WM volume in lateral occipital cortex (95%CI). However, parietal, superior temporal and frontal areas showed increases in MC and decreases in thickness (95%CI). The results of visual function examination pointed to impairment in visuo-spatial attention in the patient.

Conclusion: Our results support the idea that cortical malformations caused by LAMC3 gene mutation are not only restricted to occipital lobe, but involve structural changes throughout the brain. Despite these widespread structural abnormalities, findings of visual assessment revealed deficits primarily in visuo-spatial attention. Overall, our findings indicate remarkable ability of the brain to organize itself in order to maintain or attain 'normal' visual function in the face of a compromised cortical architecture.

Acknowledgements: Funded by TUBA-GEBIP and TUBITAK 112K069 grant awarded to KD.

Keywords: eye-tracking, LAMC3, MRI, voxel-based morphometry

P-17

The effect of temporal expectation on pupillary activity

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Objective: Forming temporal expectations regarding the likely time of occurrence of behaviorally relevant events enables effective allocation of attentional resources and the optimization of behavior. Although the effects of temporal expectations on visual attention have been well documented by electrophysiological studies, the question of how do the pupils, an autonomic

response, are affected by temporal contingencies in the environment remains unanswered. Therefore, this study aimed to obtain an online measure of pupil size while human participants were asked to differentiate between visual targets presented after varying time intervals.

Methods: In different test blocks, we manipulated temporal predictability in the presentation of visual targets consisting of letters which appeared either 1.5 or 3 s (short and long delay condition) after trial onset, and predicted that temporal expectations would result in distinguishable patterns of pupillary response between delay conditions (23 participants were tested). We hypothesized that temporal expectations would result in dilatory activity in both delay conditions, and this increase in pupil size would occur at a faster rate in the short delay condition.

Results: To investigate the differential pupillary response as a function of target delays, we evaluated the pupil size in both delay conditions measured from 1.4 to 1.5 s, which corresponds to a time window of 100 ms before target presentation in the short delay condition. As expected, presenting targets after a shorter delay resulted in a higher rate of dilatory activity (linear mixed effects model; $b=-.011$, $SE=.002$, $t=-5.58$, $p<.001$). Furthermore, linear regression fits to pupil size within the same time window showed that slope estimates in both delay conditions were significantly different from each other, $t(20) = 2.82$, $p = .011$, and slope estimates differed from 0 in the short, $t(20) = 4.45$, $p<.001$, but not in the long delay condition, $t(20) = 0.07$, $p=.948$.

Conclusion: These findings indicate that temporal predictions can change the temporal dynamics of pupillary activity, and specifically show that pupillary regulation of temporal expectations is manifested earlier after a shorter delay to visual targets. As temporal preparation has been shown to affect the autonomic pupillary function, observed results further suggest that locus coeruleus and norepinephrine system which affect pupillary dynamics might have relevance to temporal processing and anticipation.

Funding: This research was partially supported by the EU Horizon 2020 FET Proactive grant TIMESTORM-Mind and Time: Investigation of the Temporal Traits of Human-Machine Convergence (grant no: 641100).

Keywords: pupil size, temporal expectation, visual system

P-18

Cognitive functions of newborn, emotional impact of the learning and blood parameters male and female rats in mother separation time

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Objective: In recent years, can be seen in the future periods against the traumatic experience during the critical early development of life for neuropsychiatric disorders such as mood dis-

orders are considered to be risk factors. Negative experiences agreed development period of early withdrawal of the mothers in later life, cause behavioral changes with neurochemical changes in the brain. In this study, cognitive functions of newborn, emotional impact of the learning and blood parameters male and female rats in mother separation time.

Methods: In the study, Wistar Albino separated from his mother (21. GAG) male (n=8) and female (n=8) on 21 day, leaving the mother during 1 hour a week (15. GAA) men (n=8) and female (n=8) after on day 15, separated from his mother (28. GAA) male (n=8) and female (n=8) on 28 days including consists of 6 groups. In the open field taste cognitive and autonomic function, T-maze anxiety, emotional learning and intracardiac blood taken at the end of study were analyzed for complete blood count and ACTH values.

Results: The open field taste pass line in increased compared 28. GAA male and female groups in to the rears number of other groups, of line crossings decreased significantly in the 15. GAA male and female groups ($p<0.05$). T maze taste to leave off the arm of each subsequent 3 trial in the rats. T maze taste escape time is decreased in 28. GAA male and female groups and 15. GAA the male and female group ($p<0.05$). ACTH values are more in 15. GAA male and female group ($p<0.05$). No significant difference was seen in whole blood parameters.

Conclusion: When the time is prolonged maternal separation increased cognitive function in both sexes, it has exhibited a more anxious behavior. The reduction of the separation period may increase the mother's addiction. Short time prior to separation from the mother mother suspension decreased locomotor activity, suppression occurred in depressive-like activity behavior. Extension of time to learn the fear of separation from the mother or mother to have to change short-term suspension emotional learning during this period is intact in both sexes. The extended separation from the mother did not change the value of ACTH is creating stress. The extended separation from the mother did not affect the blood parameters.

Keywords: cognitive function, emotional learning, open field, T Maze, blood parameters, rat

P-19

The effect of subthreshold negative emotional state attribution on time perception

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Time perception refers to the subjective experience of time. Internal clock theories about how time is perceived can be listed under three titles: process-delay, oscillator/coincidence-detection, pacemaker-accumulator. Even every theory has a different neural map process, all of them have constant components such as clock, memory and comparison. Former experiments on animals show that posterior parietal neurons of monkeys process the

signals of time perception. Furthermore, neurons of lateral intraparietal regions are related with recalling time intervals. Researches on neurobiology underline the relationship between dopamine, acetylcholine and time perception. Researches show that the presence of emotional stimuli deviates time perception in comparison to absence of emotional stimuli. While negative affection slows down time perception for high arousal of stimulation, positive affection accelerates it. The present study is based on the idea that subthreshold negative stimuli may affect time perception. Subthreshold represents that the subjects cannot be distinguished by conscious. 64 undergraduated students from Psychology Department of Hacettepe University participated in this research. The experiment was conducted in Psychophysiology Laboratory of Hacettepe University Psychology Department. Before the experiment, the moods of participants were tested with Positive and Negative Affection Scale. Instructions were given in the inception of task which was created with E-Prime 2.0. The experiment was designed with three different groups, and the negative stimuli affection was measured by time reproduction method. To analyze the results, one-way ANOVA statistical method was used. Between groups of Control (n=21, M=0.21, S=0.12), Neutral Stimuli (n=20, M=-0.39, S=0.16) and Negative Stimuli (n=19 M=-0.01, S=-0.15), there was no significant difference between time reproduction scores ($F(2.57)=0.83, p>0.05$). One of the reasons of indifference in time reproduction scores can be the lack of control over the arousal levels of stimulus. The task of time reproduction was created with 20 exercises in order to prevent the habituation effect. This can be considered as short. Exercise number can be greater for better measurement of time perception.

Keywords: time perception, subthreshold, negative emotional stimuli

P-20

Improvement of behavioral and neurochemical disturbances in rat offspring exposed to maternal metabolic stress by GLP-1

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Objective: A growing body of research suggests that there is a relationship between inflammatory processes, cytokines, and neuropsychiatric disorders. The incretine hormone glucagon-like peptide 1 (GLP-1) receptor agonists are currently used for the treatment of type 2 diabetes. In addition, GLP-1 is an attractive potential treatment modality for various neurodegenerative diseases. In the present study, we aimed to investigate the effects of liraglutide, a GLP-1 analog, on behavioral and neurochemical disturbances in offspring exposed to maternal metabolic stress using a rat model of non-alcoholic fatty liver disease (NAFLD).

Methods: Sprague Dawley female rats were randomly distributed into two groups: control (n=6) and NAFLD (n=6). NAFLD group received 30% fructose in nutrition water for 12 weeks while controls (n=6, female) received only tap water. After 12 weeks, control and NAFLD rats were caged with a fertile male for 3 days during oestrus period. Then, pregnant NAFLD rats received 30% supplemented enriched water and regular rat chow throughout pregnancy, delivery and until offspring's weaning. On P21, twenty-four littermates were distributed into 4 groups as follows: Group 1 (male NAFLD+saline, n=6), Group 2 (female NAFLD+saline, n=6), Group 3 (male NAFLD+liraglutide, n=6) and Group 4 (female NAFLD+liraglutide, n=6). Six male and six female rats served as controls. All rats were separated and housed in same sex and same study group cages with ad libitum access to standard food and tap water. Following neurobehavioral evaluation at P50, groups were intraperitoneally administered with either saline (1 mL/kg) or liraglutide (1.8 mg/kg) for 4 weeks. Then, all rats were assessed for behavioral (social preference test), biochemical (brain TNF- α , NGF and neuregulin1 levels) and histopathological alterations. Statistical analyses were performed using one-way ANOVA and post-hoc Tukey HSD test.

Results: Statistical analysis of social preference test revealed that while male and female control groups spend significantly more time in the chamber housing the stimulus rat compared with the compartment containing the object ($p<0.005$ and $p<0.05$, respectively), saline treated rats failed to demonstrate a preference for social proximity by spending same time in both chambers ($p>0.05$). However, liraglutide treatment significantly improved the social preference in NAFLD groups. Similarly, liraglutide treatment caused a significant decrease in brain TNF- α levels, and a significant increase in brain NGF-1 and neuregulin-1 levels in NAFLD group compare to saline-treated groups ($p<0.05$).

Conclusion: Our results imply that post-natal GLP-1 treatment may be efficient in decreasing harmful effects of maternal metabolic stress in offspring.

Keywords: GLP-1, liraglutide, NAFLD (non-alcoholic fatty liver disease), cytokines

P-21

A light microscopic study of rat sciatic nerve cut injury after ozone therapy

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Objective: The aim of this study was to evaluate light microscopic analysis of sciatic nerve cut injury after intraperitoneal ozone therapy. We have investigated whether an oxygen/ozone mixture would have potential against the sciatic nerve cut injury and the effects of ozone on nerve healing in rat peripheral nerve cut model.

Methods: A hundred adult, male, *Rattus norvegicus*, Wistar albino rats weighting 400–450 gr were used in the present study. Wistar rats were divided into 4 groups. Their numbers were determined as follows: Control (n=20), Sham (n=20), Group 1 (n=30) (only nerve cut injury, no ozone administration) and Group 2 (n=30) (after nerve cut injury rats treated with 35–40 ug/ml and 5 cc O₃/O₂ (ozone/oxygen) mixture via intraperitoneal for 2 months). After sacrifice semi-thin serial transverse sections approximately ~2 cm thick were mounted on glass slides and stained with toluidine blue for light microscopic study.

Results: In the light-microscopic analysis carried out; in control and sham; myelinated sciatic fibers and vasa nervorum in different diameters in the semi-thin sections of the nerve. The epineurium encircling the nerve trunk completely from the outside covered all bundles. No deformation was encountered in the myelinated nerve fibers of different diameters constituting the nerve. In group 1; there were a lot of regenerative fibers, a small amount of myelin residue and deformative myelinated axons were also observed in the nerve trunk. In group 2 (ozone treated group); almost all of the myelinated fibers were regenerated and the fibers had different diameters and also observed an endoneurial structuring in the nerve trunk. Schwann cells along with the endoneurial fibroblasts showed remarkable proliferation and were visible as prominent fascicles alternating with the degenerating nerve fibres.

Conclusion: It was concluded that the intraperitoneal administration of ozone appears to perceptibly improve the functional recovery, reduce the post-injury nerve dysfunction and also improve nerve regeneration. This finding provides evidence of the safety of intraperitoneal ozone treatment for the peripheral nerve cut injury. We hope that this study will stimulate general interest in this area of medicine and result in investigation of alternative treatment modalities.

Keywords: ozone therapy, sciatic nerve, light microscopic study

P-22

Ionotropic glutamate receptor-mediated activation of anorexigenic nesfatin-1 neurons localized in the paraventricular nucleus

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Objective: Nesfatin-1 is an anorexigenic peptide controlling the food intake and energy metabolism. It is secreted by the neurons localized in the paraventricular (PVN), supraoptic and arcuate nuclei, and in lateral hypothalamic area and it blocks the food intake. Glutamate is the major excitatory amino acid neurotransmitter in central nervous system. Ionotropic glutamate receptors are classified into three sub-groups by their binding affinity for glutamate agonists. In this study activating effects of glutamate agonists (kainic acid, AMPA, NMDA) and antagonists (CNQX, MK-801) on nesfatin-1 neurons of PVN was assessed by using dual immunohistochemistry.

Methods: To determine the effects of glutamatergic agonists, female rats were injected with kainic acid, AMPA or NMDA (2.5, 5, 100 mg/kg, respectively). Control rats received saline and for the antagonist groups the animals were injected with either CNQX or MK-801 (2 and 1 mg/kg, respectively). Ninety minutes after intraperitoneal injections rats were perfusion-fixed, floating sections were collected and dual immunohistochemical staining was employed with c-Fos and nesfatin-1 antibodies. Results were analyzed for the percentage of dual-labeled (activated) neurons over all nesfatin-1 neurons.

Results: In female rats 55% of nesfatin-1 neurons expressed c-Fos following kainic acid, whereas this ratio was 63% after AMPA and 50% after NMDA in PVN. When compared with the control groups' 7% of c-Fos-positive neuron ratio the increase in activated neuron number was statistically significant. Injection of specific antagonists prior to agonist caused a statistically significant reduction in the activation of nesfatin-1 neurons in paraventricular nucleus. The application of non-NMDA antagonist CNQX after kainic acid reduced the number of active neurons to 26%. Number of active neurons which increased to 63% following AMPA was dropped down to 29% with CNQX. NMDA antagonist MK-801 suppressed the effect of NMDA and decreased the number of c-Fos-expressing neurons to 21%. As a result, we found that the effects of glutamate agonists towards neuronal activation in PVN-localized nesfatin-1 neurons were significantly suppressed by specific antagonists.

Conclusion: Results of this study implied that hypothalamic paraventricular nucleus is an area of central nervous system where the glutamatergic signals reach to and activate nesfatin-1 neurons. The suppression of glutamatergic neurotransmission by antagonists and the reduction of neuronal activation suggested that nesfatin-1 neurons in PVN are under the control of a mechanism involving the ionotropic glutamate receptors. It is concluded that paraventricular nucleus nesfatin-1 neurons function under the control of glutamate.

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Keywords: nesfatin-1, glutamate, c-Fos, PVN, immunohistochemistry

P-23

Let's protect the brain hypoxia by using GABA agonist

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Glutamate is the major excitatory neurotransmitter in the mammalian central nervous system. When glutamate remains in synaptic cleft for a long time cortical neurons in culture shows high mortality by activate NMDA and non-NMDA glutamate receptor. Remain attached to the receptor out of physiological condition Ca⁺⁺ ions flow from the channel into the cells. Gabapentin is GABA agonist and using as antiepileptic drug. In addition, it connected to the voltage-dependent calcium channel subunit $\alpha 2\delta$ and

reduces calcium flow. Oxcarbazepine is an antihistamine and MAO inhibitors. Oxcarbazepine is also voltage dependent Na⁺ channel blocker and prevents hyperactivity of neurons. Brain hypoxia frequently happens in trauma, brain stroke and neuropathic damage. In this study, our aim to prevent neurotoxic effect of glutamate rising by hypoxia with using gabapentin and oxcarbazepine which regulate Ca⁺⁺, Na⁺ and Cl⁻ channels to increase the percentage of viability of cortical neurons.

Keywords: Brain hypoxia, GABA agonist, gabapentin, glutamate toxicity, oxcarbazepine

P-24

Grey matter increase in motor cortex in pediatric ADHD: a voxel-based morphometry study

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Several studies report that attention-deficit/hyperactivity disorder (ADHD) is associated with reduced grey matter (GM), whereas others report no differences in GM volume between ADHD patients and controls, and some even report more GM volume in individuals with ADHD. These conflicting findings suggest that reduced GM is not a universal finding in ADHD and that more research is needed to delineate with greater accuracy the range of GM alterations. The present study aimed to identify GM alterations in ADHD using pediatric templates. Eighteen drug-naïve ADHD patients and 19 controls, all aged 7–14 years, were scanned using magnetic resonance imaging. Relative to the controls, the ADHD patients had more GM, predominantly in the precentral and supplementary motor areas (Cluster threshold set as 20 voxels using $p < 0.001$). Moreover, there were positive correlations between GM volume in these areas and ADHD scale scores ($r = 0.329 - 0.396$, $n = 37$, $p < 0.05$). The clinical and pathophysiological significance of increased GM in the motor areas remains to be elucidated by additional research.

Keywords: attention-deficit/hyperactivity disorder, brodmann area 6, precentral gyrus, supplementary motor area, voxel based morphometry

P-25

Occipitocervical synostosis: case report

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Objective: Fusion of atlas with occipital bone is a rare congenital anomaly known as occipitocervical synostosis, occipitalization of atlas, assimilation of atlas or atlanto-occipital fusion. The atlas partially or totally fuses with the occipital bone due to failure in segmentation and separation of the most caudal occipital sclerotome and first cervical sclerotome during the first week of intrauterine life.

Methods: One-hundred dry adult human occipital bones from the collection of Ege University, School of Medicine and Department of Anatomy were investigated for the presence of atlanto-occipital fusion. The anteroposterior and transverse diameters of the foramen magnum and diameters of the inferior articular facets were measured using a digital caliper.

Results: Two skulls showed occipitalization of atlas (0.5%). Both skulls showed complete occipitalization. For these cases, the sagittal and transverse diameters of foramen magnum were 35.7 mm and 30.32 mm, respectively for the first case, and 35.33 mm and 26.56 mm, respectively for the second case. The transverse diameter of the inferior articular facets were 16.50 and 13.84 mm on the right side, and 11.48 mm and 13.40 mm on the left side for these cases. The sagittal diameter was 22.97 mm and 21.18 mm on the right side and 19.64 mm and 19.11 mm on the left side.

Conclusion: The knowledge of bony fusion between the cranial base and the first cervical vertebra is important as it may cause narrowing of foramen magnum which may compress the brainstem, vertebral artery and cranial nerves, and also for surgeons approaching the craniovertebral region.

Keywords: atlanto-occipital fusion, occipitalization of atlas, fusion, occipitocervical synostosis

P-26

To compare with brain parenchyma and tumor area on T1W-SE, T2W-TSE, DWI and ADC map in glial tumors

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Objective: To compare with brain parenchyma and tumor area of intensity areas on T1W-SE, T2W-TSE, DWI and ADC map in glial tumors.

Methods: In this study, cases were selected diagnosis of intracranial mass from cases admitted ERU hospital. A total of 20 patients were enrolled 7 of glioblastoma multiforme (GBM), 4 of anaplastic astrocytoma (AA), 4 of diffuse astrocytoma, 3 of ependymoma, 2 of low-grade astrocytoma in study. The apparent diffusion coefficient (ADC) images were acquired from echo-planar diffusion-weighted images. The intensity area of each tumor was measured through tumor and from normal brain which is tumor symmetry by defined large region of interest (ROI).

Results: The intensity area on T1W-SE, T2W-TSE, DWI and ADC map of each case were compared with brain parenchyma

and tumor area. While GBM was hypointense in brain parenchyma on T1W-SE, T2W-TSE and ADC map, was hyperintense in tumor area. While DWI was hyperintense in brain parenchyma, was hypointense in tumor area. While AA was hyperintense in brain parenchyma on T1W-SE ve DWI, hypointense in tumor area. T2W-TSE and ADC map were hypointense in brain parenchyma, T2W-TSE was hyperintense and ADC map was hypointense in tumor area. The diffuse astrocytoma was hyperintense in brain parenchyma and hypointense in tumor area on T1W-SE, T2W-TSE, DWI, and ADC map were hypointense in brain parenchyma, and hyperintense in tumor area. While ependymoma was hypointense in brain parenchyma on T1W-SE, T2W-TSE, DWI and ADC map, was hyperintense in tumor area on T1W-SE, T2W-TSE and DWI. The ADC map was hypointense. The low-degree astrocytoma was hypointense in brain parenchyma T1W-SE, T2W-TSE, DWI and ADC; all of images were hyperintense in tumor area.

Conclusion: The DWI with ADC value measurements being a functional imaging method can provide a significant contribution to in the diagnosis and differential diagnosis. The intensity areas in glial tumors may provide additional information in determining of the degree.

Keywords: apparent diffusion coefficient (ADC), diffusion weighted imaging (DWI), glial tumor, region of interest (ROI).

P-27

Pentoxifylline administration alleviated tissue injury in a rat model of subarachnoid hemorrhage

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Objective: Subarachnoid hemorrhage (SAH) due to intracranial aneurysm rupture is a devastating disease with high mortality and morbidity. Recent studies suggest that early brain injury (EBI) rather than vasospasm might be responsible for morbidity and mortality within 24–72 hours after SAH. The rise in intracranial pressure following SAH causes a significantly decrease in cerebral perfusion pressure that leads to global cerebral ischemia. Various molecular mechanisms were shown to be involved in the pathophysiology of EBI including cellular apoptosis. The aim of the study was to evaluate the effects of pentoxifylline administration in SAH treatment by using physiological, biochemical and immunohistochemical analysis.

Methods: Adult Wistar male rats (380–420 g) were randomly divided into 4 groups as follows: Control; Sham; SAH; SAH+pentoxifylline administration (SAH+P). The SAH experimental rat model was created as previously described by Prunell GF et al. A needle was stereotaxically placed in the prechiasmatic

ic cistern and 200 ml of tail arterial blood was injected manually, keeping the intracranial pressure (ICP) at the mean arterial blood pressure (MABP) level. Sham groups received equivalent volume injections of saline. Pentoxifylline was adjusted to a dose of 60 mg/kg and intraperitoneally injected for one time in SAH+P groups. Rats were sacrificed 24 hours after pentoxifylline administration. Brains were evaluated with Evans blue to verify blood brain barrier permeability and apoptotic neurons were determined in brain sections by using cleaved caspase-3 immunohistochemical analysis. The expression intensity was quantified using ImageJ analysis. Red blood cell (RBC) deformability was determined at various fluid shear stresses by laser diffraction analysis using an ektacytometer (LORCA). TNF- α and reactive nitrogen metabolites were measured in brain tissue by ELISA and spectral analysis, respectively.

Results: RBC deformability did not change in response to neither constitution of SAH nor treatment of SAH group of rats with pentoxifylline compared with Sham and Control groups. SAH+P group had significantly lower cleaved-caspase-3 expressions compared to SAH groups. Positive stained cells were markedly less in control and sham groups of brain tissues. Brain TNF- α concentration and total nitrate/nitrite levels were also significantly higher in SAH compared to sham and SAH+P groups.

Conclusion: Based on the significantly lower TNF- α expression, reactive nitrogen metabolites and decreased cleaved caspase-3 expression in pentoxifylline treated animals that experienced SAH; our findings suggest that pentoxifylline may reduce brain damage due to subarachnoid hemorrhage.

Keywords: Subarachnoid hemorrhage, rat, immunohistochemistry, ELISA

P-28

Towards realizing neural structures on neuromorphic devices: an implementation of Izhikevich neuron model in Simulink

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Objective: Hardware that have the functional properties of the brain do not only provide new technological approaches for the intelligent systems but also provide new treatment methods for neurological disorders due to tissue loss. In order to realize such hardware with electronic devices neuromorphic structures are designed. These designs are developed based on the mathematical models of neurons and their connections with synapses, and they are first tested on simulation environments and then emulated on graphical modeling tools that consider the hardware properties. In this work, behavior of a small group of cortex neurons is realized in MATLAB graphical modeling environment: Simulink. Later on, based on this Simulink model, the model will be realized on a hardware structure called FPGA (Field Programmable Gate Array)

Methods: In this work, behavior of a small group of neurons related to cortex will be modeled using Izhikevich neuron model. The pyramidal neuron which is excitatory will be considered and its behavior will be modeled as regular spiking neuron while basket and stellate neurons of cortex which are inhibitory will be modeled as fast spiking neurons. The synaptic connection between neurons is modeled as a dynamical system and the synaptic weight are updated due to the Hebbian rule. The dynamic behavior of Izhikevich neuron models, synaptic connections are modeled in MATLAB Simulink environment as a modular structure. The Izhikevich neurons are stimulated by Poisson distribution and the activity of small cortex model is observed.

Results: The activity of the membrane potential of excitatory and inhibitory neurons will be obtained by modular structures designed in the Simulink environment for single neuron, and a number of such modules will be connected. The synaptic connections will also be realized in Simulink environment, considering the spike formation between pre and post neurons. With such a small network of neurons, some results for image recognition will be obtained.

Conclusion: With the small group of neurons, a structure for cortex will be obtained in Simulink environment and this will first step towards realizing neuronal activity on a neuromorphic structure. This model will be further realized on FPGA, thus one more step would be taken toward realizing learning and pattern recognition on a hardware.

Keywords: cortex, Izhikevich neuron model, Simulink, FPGA

P-29

The relation between cognitive impairment and visuospatial functions in Parkinson's disease

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Objective: Visuospatial function's impairment has been reported even in the early stage of Parkinson's disease (PD). Also, there are studies indicating that visuospatial deficit is seen in Parkinson's disease dementia (PDD). However, there is no sufficient information about visuospatial ability of Parkinson's disease and Parkinson with mild cognitive impairment. In our study, we aimed to investigate in the course of how the visuospatial functions of Parkinson's disease, Parkinson's with mild cognitive impairment and healthy controls.

Methods: In this study; we are tested 10 Parkinson patients who are cognitively normal (PDNC), 7 patients who have Parkinson with mild cognitive impairment (PDMCI) and 12 healthy controls (NC). The patient's clinic characteristics were evaluated by

Unified Parkinson's disease Rating Scale (UPDRS) and disease was degreed by Hoehn-Yahr scale. Neuropsychiatry inventory (NPI) was applied to determine patients' behavioral aspects. Moreover, comprehensive neuropsychological assessment including tests of verbal and nonverbal memory, attention, executive functions, and visuospatial functions were applied. Neuropsychometry batteries and Clinical demantia Rating (CDR) test result were used to understand patient's cognitive states. Visuospatial functions were assessed by Benton facial recognition (BFR) and Benton line orientation (BLOT) tests.

Results: All groups mean age consist of; PDNC groups (n=10) women's mean age 61 and men were 58, PDMCI (n=7) women's mean age 57 and men's 71, NC groups (n=12) women's mean age 60 and men's were 52. Comparing with three groups(PDMCI, NC ve PDNC) about their visuospatial abilities; we found that there are significant differences among them. PDMCI groups observed significantly worse performance than PDNC groups in terms of visuospatial abilities. These results were found for BLOT and BFR test scores.

Conclusion: The results of our study will be discussed in the light of literature.

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Keywords: Parkinson, MCI, neuropsychometry, visuospatial tests

P-30

The effect of pre-SMA activity on speed-accuracy trade-off in perceptual decisions: an rTMS study

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Objective: The decision processes in two-alternative scenarios can be explained by the drift-diffusion model. According to this model, a decision variable move towards one of two decision boundaries corresponding to the two alternatives based on the evidence accumulated in favor of these options and a decision is made when one of the decision boundaries is hit. However, the noise in the evidence accumulation process creates randomness in the trajectory of the decision variable which might result in hitting the wrong decision boundary. This leads to the speed-accuracy tradeoff (SAT) which is modulated by how high the decision boundaries are set. While higher threshold setting increases the likelihood of an accurate decision at the cost of longer response times, lower threshold setting results in less accurate but faster decisions. Recent neuroimaging studies showed that the activity of pre-supplementary motor area (pre-SMA) and striatum was higher when speed was emphasized compared to when accuracy was emphasized. Additionally, the activity in these brain regions was negatively linked with decision thresholds. However, the imaging studies provide only

correlational information. In the current study, we aimed to draw a causal relationship between the pre-SMA activity and threshold setting by inhibiting the activity in this region using rTMS.

Methods: We tested 24 participants in the random dot motion task across 3 sessions. In this task, participants were presented a cloud of dots a subgroup of which moved coherently towards either left or right, while the rest moved randomly. In the first session participants were tested without stimulation. In the second and the third sessions they performed the task after pre-SMA or vertex (control condition) inhibition. Decision thresholds for both rTMS sessions were estimated by the drift diffusion model.

Results: Our results revealed that under the pre-SMA inhibition condition, participants set higher decision thresholds compared to the control condition. Furthermore, the weight assigned to accuracy relative to reward was higher under the pre-SMA inhibition condition, $p < .05$. Additionally, while the decision thresholds in the post-error trials were higher compared to the post-correct trials, this change did not differ between conditions, $p = .64$.

Conclusion: This is the first study showing that there is a causal relationship between the pre-SMA activity and the control of SAT. Inhibition of pre-SMA results in higher threshold setting and more cautious decisions. The results were discussed within the framework of the neural basis of micro- and macro-adaptive decision processes.

Keywords: Perceptual decision making, speed-accuracy trade-off, pre-SMA, rTMS, drift-diffusion model

P-31

The association between consolidation and forgetting in long term memory: a norm study via Öktem-SBST

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Objective: One of the fundamental factor for neuropsychological evaluation is memory. Memory tests that are currently used, generally follows a learning procedure that stimulates encoding and storage, evaluates delayed recall and recognition after 30–40 minutes of the test. However these standard measurements are often incompatible with the subjective dysmnnesia complaints of the neurology patients. Furthermore, recently “accelerated forgetting” phenomenon has been identified as a characteristic for temporal-lobe epilepsy patients which indicates a long standing consolidation problem. Later on, this kind of memory impairment has been investigated with the other neurologic conditions such as dementia, multiple sclerosis, head trauma etc. There is no instrument that is developed especially for this purpose. In the literature, experimental set ups are preferred with a standard memory tests which examine

learning within 1 hour to six week period of time. In this study, the aim was generating normative values to ensure clinical use for measuring consolidation process and evaluating possible accelerated forgetting, even though the sample is limited. A standardized verbal memory test (Öktem Sözel Bellek Süreçleri Testi (SBST)) that is widely used in Turkish were utilized.

Methods: The study was conducted with 40 volunteer (20F-20M) university students aged between 20–30 who have no neurologic/psychiatric diagnosis and are not on medication. After filling demographic form, participants were applied Öktem-SBST. It consists of 15 words that is created to measure immediate and long term verbal memory. After the first application, 1 week and 6 weeks later, same participants were asked to tell (free recall) the words that are memorized. If the participants can not recall the items, they were given the 50 words- recognition list to identify the words. Participants were not informed about these repetitive applications, in any stage. Standard deviations and means of free recall, recognition and total retrieval scores were estimated. The data were standardized with statistical analyses. The norm values were obtained. Thus they can be used as reference to measure consolidation and forgetting in long term memory.

Results: It is known that most of the things we learn are not stored in long term memory permanently. This study demonstrates the change in the level of forgetting in the critical periods. The findings were evaluated considering the literature.

Keywords: consolidation, forgetting, long term memory, Öktem-SBST, standardization

P-32

Does neurodynamic exercise effect straight leg raise test degree?

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Objective: To investigate short time effects of neurodynamic exercises which commonly used lower extremity neural system evaluation and treatment on straight leg raise test in subjects with low back pain.

Methods: Forty-one subjects, diagnosed with low back pain and SLR test was less than 70 degree, were included the study. The groups were randomly assigned. Study group was treated with neurodynamic exercises along with physiotherapy program and control group was administered only physiotherapy program. Study group practiced neurodynamic exercise repeatedly 10 times at one minute period in slump position for three weeks. SLR test degree was measured with electronic goniometer before and after treatment.

Results: The study was completed with forty-one subjects, including 20 subjects diagnosed with low back pain at study group (mean age: 39.4±8.5 years) and 21 subjects diagnosed with low back pain at control group (mean age: 38.3±9.7 years). At baseline, straight leg raise test degrees not significantly differed between groups ($p>0.05$). At the end of the measurements, sta-

tistically significant differences were not found in control group for SLR test degrees at both legs in comparison to the baseline ($p>0.05$). However, the study group who practised neurodynamic exercise demonstrated statistically significant improvements in SLR test degree ($p<0.05$)

Conclusion: It was found that there was significantly increase at SLR test degree with neurodynamic exercise addition to physiotherapy program. Nevertheless, it is required to support that the effectiveness of neurodynamic exercise on lower extremity by quantitative data. The fact that the physiological basis of neurodynamic exercises took place in the literature in animal studies but the effects of neurodynamic exercise on adults can be shown only ultrasound imaging and EMG. More studies are required to assess the effects of neurodynamic exercises with more advanced imaging and measurement methods.

Keywords: low back pain, neurodynamics, physiotherapy, straight leg raise test

P-33

An overview to trauma from subfornical organ window

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Blood-brain barrier (BBB), is a complex system and a highly selective permeable barrier that controls the chemical transition from vascular bed to brain. While brain is tightly protected by BBB, it is necessary to perceive peripheral changes by brain and sampling of materials which are circulating in blood and did not allowed passing brain by BBB to convey information about these substances to the central nervous system. Brain needs to have “windows” without BBB to sense the changes in the body. That’s why circumventricular organs (CVO) are called “windows of the brain”. These important organs generally located along the third and fourth ventricles of the brain. Contrary to other nervous system structures which have BBB, CVOs capillaries are permeable. In this study, we investigated the ultrastructure of capillaries at the subfornical organ, one of CVOs, at a brain trauma model on rats. Twelve Wistar albino rats are divided into two groups: 2nd day group after head injury and control group. A moderate brain-injury model, described by Marmarou et al. was applied for head trauma to experimental group and they were sacrificed after 48 hours together with control group animals. 48 Hours after trauma and control animals were sacrificed. Subfornical organs were obtained using Paxinos & Watson’s stereotaxic atlas. Samples were prepared with routine electron microscopic procedure. The sections were examined and photographed using LEO 906 E transmission electron microscope. In the control group subfornical organs, this located in the lamina terminalis and protruding into the third ventricle of the brain was observed as normal. There were cytoplasmic protrusions and cytoplasmic vesicles at

endothelium cells of some capillaries. While these capillaries have narrow perivascular space, some of the capillaries have not. Other capillaries' endothelial cells, which are placed a continuous basal lamina, have fenestrations. At these capillaries perivascular space was wider and an external lamina existence drew attention around this wide space. In the trauma group, cytoplasmic protrusions at endothelial cells were missed, surface of the endothelium was flattened, cytoplasmic vesicles were reduced and oedematous enlargement in the perivascular space was seen. Capillaries with external lamina have narrowed perivascular space and closed fenestras. It is seen that at subfornical organ, different types of capillaries are affected by trauma. We thought that these ultrastructural changes like closed fenestrations, flattened endothelium surface can cause disorder at the potential of brain to sense the peripheral changes.

Keywords: circumventricular organ, subfornical organ, capillary, traumatic brain injury,

P-34

Combination of metformin and nifedipin can protect neurons against brain hypoxia

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Glutamate is a major neurotransmitter that released from brain and spinal cord neurons. Glutamate has a significant role in neuronal development, memory and learning in normal physiological conditions. Glutamate, during brain hypoxia increased in synapse cleft to toxic level. When glutamate remain for long time in synapse cleft, continuously stimulates receptors and let Ca⁺⁺ flow into the cell and gain toxic level. Considering the mechanisms of hypoxia the use of nifedipin and metformin medicals as a cure has been investigated. Nifedipin is a T type of Ca⁺⁺ channel blocker. Metformin is frequently used while type 2 diabetes. Also metformin used as energy regulator drug for neuroprotection in hypoxic condition. The purpose of this study is prevent the neuronal damage of patients how suffer hypoxia by controlling over flow of Ca⁺⁺ efflux and tolerate the energy consumption by neuron cells.

Keywords: brain hipoxia, glutamate toxicity, metformin, nifedipene, neuron culture

P-35

The effect of adenosinergic system modulation on convulsive seizures and relationship with cytokines

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Objective: Epilepsy is an important pathological conditions characterized by recurrent seizures and it affects approximately

1% of the population. Current studies indicated that there are relationship between epilepsy and inflammation. Therefore, changes in cytokine levels were usually examined. Adenosinergic system is a process that affects epileptic seizures by regulating the secretion of neurotransmitters and contributes to inflammation. The aim of this study is to investigate the effects of caffeine and adenosine on seizure activity and cytokine levels that may be associated with this effect by generating the generalized seizure model.

Methods: In our study, 4 months old male Wistar-albino rats were used. PTZ was injected intraperitoneally (ip) to obtain convulsive seizures, effects of caffeine and adenosine on seizure were evaluated. Three groups for this study were planned; 60 mg/kg/ip PTZ (n=8; PTZ), 500 mg/kg/ip of adenosine treatment 15 min before PTZ administration (n=9; Adenosine+PTZ), 5 mg/kg/ip of caffeine treatment 30 min before PTZ administration (n = 8; Caffeine+PTZ). After PTZ administration, seizure activity was observed and seizure parameters were evaluated by using the scale defined by Velisek. Cytokine levels (TNF- α , IL1- β , IL-6) were measured with ELISA technique.

Results: Generalized convulsive seizure was induced by injection of PTZ in all groups. In PTZ group; seizure latency 49.25 \pm 27.51, total seizure duration 2389 \pm 720, in Caffeine+PTZ group; seizure latency 38.43 \pm 10.89, total seizure duration 3110 \pm 452, in Adenosine+PTZ group; seizure latency 94.38 \pm 32.04, total seizure duration 3030 \pm 656 were found. The effect of adenosine and caffeine on cytokine in generalized seizures induced by PTZ is currently in measurements phase. PTZ administration caused convulsive seizures. In Adenosine+PTZ group a statistically significant decrease in seizures latency was observed (p=0.005**), but not in total seizure duration compare to PTZ group. In Caffeine+PTZ group a statistically significant increase in total seizure duration was observed, but not in seizure latency compare to PTZ group. The effect of adenosine and caffeine on cytokines will be discussed when results obtained.

Keywords: adenosine, IL-1beta, IL-6, TNF-alpha, caffeine, pentylentetrazole

P-36

The effect of quercetin on penicillin-induced epileptiform activity

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Objective: Epilepsy is one of the most common chronic neurological disorders that involves synchronized abnormal electrical discharges. Quercetin is a dietary flavonoid ubiquitously present in tea, red wine, fruits and vegetables. There are studies show that quercetin acts as anticonvulsant as well as studies suggest that quercetin has proconvulsant effect. On the other hand, these studies are performed with behavioral methods that base on observation in animal models of epilepsy. Hence, we aimed to investigate the effect of quercetin on penicillin-

induced epileptiform activity by using electrophysiological methods.

Methods: In this study, 180–240 gram weighting, 18 Wistar albino female rats were used. The rats were divided into three groups: control group, vehicle group and quercetin group. Each group was consist of six animals. To the control group penicillin G, to the vehicle group penicillin G+dimethyl sulfoxide (DMSO) and to the quercetin group penicillin G+quercetin were administered. Quercetin was dissolved in DMSO. Urethane (1.25 g/kg) was injected intraperitoneally (i.p.) for anesthesia. After placing the animals under anesthesia to stereotaxic device, three holes were drilled on skull using a hand drill. Recording electrode were placed into two of the holes and connected to the PowerLab data acquisition system for electrocorticogram (ECoG) recording. Then, penicillin (500 IU, 2.5 µl, intracortical) was injected through the third hole to induce epileptiform activity. Quercetin was administered at dose of 10 mg/kg i.p. 30 minutes after penicillin injection. The data obtained were analyzed by Kruskal-Wallis and Mann-Whitney U tests.

Results: Compared to the control group, quercetin at dose of 10 mg/kg (i.p.) significantly decreased frequency of epileptiform activity from 90th minute to the end of the recording ($p < 0.01$). Although, it didn't alter amplitude of epileptiform activity ($p > 0.05$). In terms of neither frequency nor amplitude there was significant change between vehicle group and control group ($p > 0.05$).

Conclusions: In previous studies conflicting results were reported about effect of quercetin on epilepsy. In the present study; it is demonstrated that quercetin decreased epileptiform activity, suggesting anticonvulsant action for quercetin in the experimental penicillin model of epilepsy. Further studies are needed to reveal the mechanism(s) on how this effect has occurred.

Keywords: Quercetin, flavonoid, epilepsy, penicillin, rat

P-37

An investigation of event-related potentials of recall in video game addiction

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The goal of the study was to investigate effects of violent game addiction on emotional memory retrieval using event-related brain potentials (ERPs). Forty-four participants (24 female, 20 male; 18 to 31 years) were separated into two groups, namely addicted ($n=23$) and non-players ($n=21$) based on the time they spend for violent game playing (per week), DSM based pathological game addiction symptoms, and their scores on the Game Addiction Scale. All the participants were right-handed, had a normal or corrected-to-normal vision, and had no history of neurological, psychological or memory diseases. A word list (consisted of violent and non violent adjectives) was used. In the

encoding phase, all words were shown and participants were asked to learn the presented words which they will be asked about later. In the retrieval phase, a stem completion test was used, and the participants were asked to complete the presented word. Stimulus presentation, recording, storage, and analysis were carried out using a 32 channel EEG/EP NeuroScan system. EEG activity was recorded with 30 electrodes placed according to the international 10-20 system. During correct and incorrect retrieval, P1, N1, P2, and P3 peaks were observed at the fronto-central regions and amplitudes of the peaks for correct retrieval were higher than for incorrect retrieval. On the other hand, amplitude and latency of the peaks of addicted and non-players were not different. Results indicated that game addiction may have no effect on these brain potentials obtained during emotional memory retrieval.

Keywords: game addiction, emotional memory, ERP, retrieve

P-38

The neuroprotective effects of urotensin II antagonist against glutamate induced neurotoxicity in SH-SY5Y human neuroblastoma cells

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Urotensin II is a potent vasoactive peptide, plays an essential role in physiological and pathological conditions. In our previous study we reported that UTR antagonist shown anti-inflammatory and anti-oxidant effect in hepatotoxicity model. We hoped to investigate the neuroprotective mechanism of these agents via the antioxidant system and pro-inflammatory cytokines *in vitro*. The neuroprotective effects of URT II antagonist against glutamate-induced SH-SY5Y neuronal cells injury were evaluated in the present study. Human SH SY5Y neuroblastoma cells were exposed to glutamate, UT II agonist and antagonist. Cell viability was determined by MTT and LDH (lactate dehydrogenase) assay. Exposure of cells to glutamate (10–80 mM) for 24 h decreased cellular viability and increased LDH release. We showed that glutamate inhibited SH SY5Y cell growth by inducing inflammation. Incubating glutamate-exposed SH SY5Y cells with UT II antagonist for 2 and 4 h ameliorated this inflammation and decreased TNF- α and IL-6 mRNA expression. The decreased UT II receptor gene expression through glutamate was significantly increased in antagonist treated groups at 4 h when compared with the glutamate groups. We also evaluated apoptosis in SH SY5Y cells. We found that UT II antagonist protected against glutamate induced toxicity in SH SY5Y cells by decreasing apoptosis markers, such as caspase 3 and caspase 9 at 4th h. Overall,

the present findings indicated that UT II antagonist exerts neuroprotective effects against glutamate toxicity, which might be of importance and contribute to its clinical efficacy for the treatment of neurodegenerative diseases.

Keywords: apoptosis, glutamate toxicity, inflammation, sh-sy5y, urotensin II

P-39

Evaluation of the potential neuroprotective effects of antiepileptic drugs on neonatal status epilepticus rat models

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Objective: There have been several contradictory results related to percentages of neonatal status epilepticus (NSE) which varieties between 8–43% in neonatal seizures. Molecular mechanisms of antiepileptic agents on brain in neonatal seizures are not clearly understood. Therefore, the aim of the present study was to investigate the potential neuroprotective effects of topiramate, lacosamide and levetiracetam that have a prophylactic effect on NSE.

Methods: In our study, 46 neonatal rats on postnatal day of 7 were divided into 4 groups: I. Pentylene-tetrazol (PTZ) induced NSE-group, II. Topiramate (60 mg/kg/day) treated before PTZ induced NSE-group, III. Lacosamide (50 mg/kg/day) treated before PTZ induced NSE-group, IV. Levetiracetam (150 mg/kg/day) treated before PTZ induced NSE-group. Rats were intraperitoneally PTZ injected at a single dose of 60 mg/kg to generate neonatal status epilepticus. Generalized convulsion and rotation movement seizures were occurred after injection. Before PTZ, antiepileptic drugs were applied by gavage twice a day during 14 days. Levels of thiobarbituric acid reactive substances (TBARS) and protein carbonyl were measured on brain tissues obtained after experiments. Apoptosis was evaluated with active-caspase-3 on brain slices.

Results: The level of TBARS was significantly higher in PTZ treated groups as compared to antiepileptic treated groups. The level of protein carbonyl was significantly lower in topiramate and levetiracetam treated groups as compared to PTZ treated groups. However, there was not any significant difference between PTZ and lacosamide treated groups. Histopathologic analyses showed that the ratio of Caspase-3 positive cells on PTZ, topiramate and lacosamide treated groups was not statistically significant whereas the ratio of Caspase-3 positive cells was higher in levetiracetam treated groups as compared to PTZ treated groups.

Conclusion: Obtained results of the present study indicated that effects of topiramate, lacosamide and levetiracetam drugs on brain may be related to their antioxidant effects. However, further studies are needed to show mechanisms of antioxidant effects of drugs and their interaction between antioxidant enzymes.

Keywords: antiepileptic drugs, oxidative stress, status epilepticus

P-40

The effects of nogo task difficulties on response inhibition in visual go-nogo paradigm

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Objective: The maintaining of normal cognitive processes and behaviours occurs through inhibitory control mechanism works against irrelevant and inappropriate stimuli from surrounding. The go-nogo paradigm which includes both go stimulus requiring response and nogo stimulus requiring no response is one of the most common used experimental designs in the evaluation of inhibition response. Nogo-N2 and Nogo-P3 potentials obtained from nogo stimuli appear as a complex to reflect inappropriate response inhibition, response conflict, and inhibition efficiency. In our research, we aimed to investigate the effects of nogo task difficulty on response inhibition in visual go-nogo paradigm.

Methods: Event-related potentials (ERPs) were recorded from 30 electrodes (10/20 system) from 32 healthy volunteers (17 men, 15 women), ages between 19 and 28 years with a visual go-nogo paradigm. In order to track vertical and lateral movement of eyes, electrooculogram (EOG) was recorded. Go and nogo stimuli were pseudo-randomly presented with 1.5 s inter-stimulus intervals (ISI) and probabilities of 0.28, and 0.72 respectively. Nogo stimuli were divided into 5 groups according to their difficulty level (as to resembling go stimuli in terms of shape, and/or content). The amplitude and latency values of N2 and P3 potentials in the averaged responses to nogo stimuli were measured and analyzed by repeated measures analyses of variance (ANOVA) for each nogo stimulus group.

Results: It is observed that subjects made more commission errors to more difficult stimuli ($p=0.001$). The amplitudes of Nogo-P3 potentials obtained from responses to difficult nogo stimuli were found lower ($p=0.026$), and latencies were longer ($p=0.001$). Also, the amplitudes of nogo-N2 potential acquired from responses to difficult nogo stimuli was found higher ($p=0.005$), and latencies were longer ($p=0.001$).

Conclusion: Our results indicate that nogo task difficulty significantly affects amplitude and latency of nogo-N2-P3 complex. The anteriorization of nogo-P3 in frontal regions and decrease in amplitudes and prolongation of latencies of nogo-P3 potentials were evaluated as indicators to reflect task

difficulty. On the other hand, the increment in amplitude of Nogo-N2 was interpreted as an indicator of response conflict.

Keywords: N2-P3 complex, response inhibition, task difficulty, visual go-nogo paradigm

P-41

The investigation of cytotoxic and apoptotic activity of Cl-amidine on the human U-87 MG glioma cell line

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Objective: Peptidyl (protein) arginine deiminases (PADs) provide the transformation of peptidyl-arginine to peptidyl-citrulline in the presence of calcium with posttranslational modification. The dysregulated PAD activity plays an important role on too many diseases including also the cancer. In the research, the determination of the potential cytotoxic and apoptotic activity of the Chlor-amidine (Cl-amidine) which is a PAD inhibitor and whose effectiveness has been shown *in vitro* and *in vivo* studies recently on human glioblastoma cell line U-87 MG forming an *in vivo* model for the glioblastoma multiforme (GBM) which is the most aggressive and highest mortality in the brain tumors has been aimed.

Methods: In the study, the antiproliferative and apoptotic effects of Cl-amidine on GBM cancer model were investigated. The antiproliferative effects of Cl-amidine on the U-87 MG cells were determined by WST-1 (4-[3-(4-iodophenyl)-2-(4-nitrophenyl)-2H-5-tetrazolio]-1,3-benzene disulfonate) method at the twenty-fourth and forty-eighth hours. The apoptotic effects were analyzed by the Annexin V-PI, caspase-3 activation and mitochondrial membrane polarization (JC-1) methods in the flow cytometry device. The data were statistically analyzed using one-way ANOVA and Tukey's post hoc test.

Results: It has been determined that Cl-amidine has significant antiproliferative effects on U-87 MG cell line by the WST-1 method depending on the time and concentration (% viability values at the twenty-fourth and forty-eighth hours are in sequence $p < 0.01$, $p < 0.001$). The apoptotic effects which were analyzed by the Annexin V-PI and JC-1 methods have been found effective particularly at the forty-eighth hour. It has been determined that Cl-amidine drives the cells to apoptosis by increasing the mitochondrial depolarization without caspase-3 activation. However; in terms of the effect on healthy cells, it has been shown that the GBM causes less damage when compared to carmustine which is one of the existing therapeutic agents.

Conclusion: This research has shown that Cl-amidine may have a significant anticarcinogenic potential in the GBM chemotherapy because of its significant antiproliferative and apoptotic effects on U-87 MG cells and also its less damage to the healthy cells than the current treatments. We believe that the antineoplastic effects of this agent should be investigated also for more different cancer cell types. In addition, we think that the

working of Cl-amidine with single or combined agents will contribute to the discovery of new anticancer drugs.

Acknowledgments: This research was supported by Scientific Research Projects Coordination Unit of Ordu University (Project No: AR-1408).

Keywords: peptidyl arginine deiminase inhibitor, Cl-amidine, glioblastoma multiforme, U-87 MG cell line

P-42

Investigation of the effects of 900–2100MHz RF-EMR exposure on the hippocampal level/activity of protein kinase A

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Objective: The aim of the present study was to investigate the basal effects of both acute and chronic 900–2100MHz RF-EMR exposure on rats on the hippocampal level/activity of protein kinase A (PKA) using western blotting technique.

Methods: Rats were divided into following groups: Sham group; rats exposed to 900MHz and 2100MHz RF-EMR for 2 h/day for 1 week; rats exposed to 900MHz and 2100MHz RF-EMR for 2 h/day for 10 weeks, respectively. Simulator systems emitting those frequencies were used as a represent exposure to GSM. After exposure, all rats were anesthetized under urethane and hippocampus region of perfused brain was dissected. The level of PKA enzyme on homogenized hippocampus tissue was estimated using Western Blotting technique. PKA activity was determined using PKA Activity Kit Assay.

Results: The obtained results have been shown that both hippocampal level and activity of PKA were significantly higher in 2100MHz-10 weeks group and were significantly lower in 900MHz-10 weeks group as compared to sham group. Similar results have been obtained for 1 week groups with significantly higher expression level and activity of enzyme in 2100 MHz group as compared to 900 MHz group. The comparison of both hippocampal level and activity of PKA between 10 weeks and 1 week groups of 900 and 2100 MHz was revealed that both hippocampal level and activity of enzyme were significantly higher in 10 weeks as compared to 1 week groups.

Conclusion: Overall, the present study provides experimental data suggesting that both duration and different carrier-frequencies (900 MHz versus 2100 MHz) had different effects on level and activity of PKA enzyme on brain tissue.

Support: This study was supported by a grant from Akdeniz University Research Foundation, Turkey (Grant no: FBA-2015-28).

Keywords: Electromagnetic radiation, PKA, hippocampus, Western Blot, rat

P-43

Relationships between violent video-game addiction and recognition: findings from an ERP study

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The goal of the study was to investigate effects of violent game addiction on emotional memory recognition using event-related brain potentials (ERPs). Forty-four participants (24 female, 20 male; 18 to 31 years) were separated into two groups, namely addicted (N=23) and non-players (N=21) based on the time they spend for violent game playing (per week), DSM based pathological game addiction symptoms, and their scores on the Game Addiction Scale. All the participants were right-handed, had a normal or corrected-to-normal vision, and had no history of neurological, psychological or memory diseases. A word list (consisted of violent and non-violent adjectives) was used. During the encoding phase, all words were shown and the participants were asked to learn the presented words, which they will be asked later. During the recognition phase, in addition to previously shown words, new words (consisted of violent and non-violent adjectives) were presented randomly and participants were asked to evaluate whether they have seen the presented word previously. Stimulus presentation, recording, storage, and analysis were carried out using a 32 channel EEG/EP NeuroScan 4.5 system. EEG activity was recorded with 30 electrodes placed. During retrieval process, N1, N2, P2, and P3 peaks were observed at parietal and fronto-central regions. Amplitude and latency of the peaks of addicted and non-players were not different. Also, correct and incorrect recognized items produced similar ERP profiles. These results showed that game addicts had no deficiency for ERPs obtained during emotional memory recognition.

Keywords: game addiction, ERP, emotional memory, recognition

P-44

A study to represent pattern on brain using spiking neural networks

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Objective: In this study, we propose a computational model that simulates the pattern representation on brain. This model represents a pattern using spiking neural networks (SNN) in a self-organizing way and with this model; representation of a stimulus related to a more complex task like decision making can be accomplished.

Methods: We create two neuron groups for the computational model, one group is for inputs and the other is for outputs, using

SNN. Input neurons are connected to output neurons in an all-to-all manner. All the connections are excitatory and the weights are determined randomly. The output neurons are also connected in an all-to-all manner inside the group by excitatory and random valued connections. Python programming language is used with the NEST library for the simulation environment. During the task, the input neurons' activation corresponds to the pattern and spike activity of input neurons excites the output neurons. Only the connections between fired output neurons are potentiated by a constant value and the connections from the fired neurons to the inactive output neurons are depressed and turn to inhibitory connections at the end. The process is repeated for the new patterns. The connections from input to output neurons are fixed.

Results: At the beginning, almost all of the output neurons fires to the presented pattern. The count of inhibitory connections between output neurons themselves increases with new patterns. This decreases spike activity of output neurons and only certain neurons fire to different patterns by repeatedly presenting patterns. Since the update procedure continues during task, some of the neurons may quit the representative groups. In addition, some of the patterns are represented with neurons that fires in high frequency which means a high relation while some of which are weakly connected.

Conclusion: In this study, a computational model to understand how a pattern may be represented on brain is presented. This model can represent different patterns with different spiking neuron groups and the model may change these groups to create new ones with new patterns. Thus, the representation of patterns are provided by a simple learning method in a self-organizing way which is closely related to Hebbian learning, but differentiates from it because of creating inhibitory connections. In future studies, using "Spike Timing Dependent Plasticity", which represents the relation between learning and spike activity in a better way, would be an important development to investigate reward and representation relation.

Keywords: Spiking neural networks, pattern representation, computational neuroscience, self-organizing learning

P-45

Sulforaphane produces anti-inflammatory effects by inhibiting NLRP3 inflammasome activation in microglial cells

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The nod-like receptor family, pyrin domain containing 3 (NLRP3) inflammasome, contrary to the canonical inflammasome activation, is activated by various stimuli, including metabolic stress products (cholesterol crystals, ATP, monosodium urate crystals etc.) and exogenous molecules (asbestos, silica etc.). The NLRP3 inflammasome activates microglia, which in turn

increase secreted IL-1 β and IL-18 production. Inflammasome activation can lead to pyroptotic cell death, which should be inhibited under such conditions. Sulforaphane is a well-characterized phytochemical with known anti-inflammatory effects, and is a potential candidate to inhibit inflammasome activation. The aim of the present study was to characterize the effects of sulforaphane on NLRP3 inflammasome activation. We found that sulforaphane treatment decreased IL-1 β and IL-18 secreted cytokine levels in N9 microglial cells. In addition, sulforaphane treatment decreased protein levels of pro-IL-1 β and secreted IL-1 β , NLRP3, and secreted p20 subunit of pro-caspase-1. Moreover, we found that sulforaphane treatment suppressed ROS production, and inhibited caspase-1-dependent cell death. Taken together, our results indicate that sulforaphane produces anti-inflammatory effects by inhibiting NLRP3 inflammasome activation in murine microglial cells.

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Keywords: SFN, sulforaphane, inflammasome, NLRP3, microglia, caspase-1

P-46

Therapeutic effects of nesfatin-1 on oxidative brain damage and memory dysfunction in rats induced with epileptic seizures

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Objective: Nesfatin-1 is a newly defined peptide, which can pass the blood-brain barrier. In addition to its regulatory function in food intake and homeostasis of energy balance, we have recently shown that nesfatin-1 exerts anti-apoptotic and anti-inflammatory effects in oxidative injury. The present study aimed to elucidate the effect of nesfatin-1 on oxidative brain damage due to an epileptic seizure.

Methods: Wistar albino male rats (n=56) initially had a learning session in a passive avoidance chamber and were then randomly assigned to control and pentylenetetrazole-induced (PTZ) seizure groups. Saline or nesfatin-1 (0.3, 1 or 3 μ g/kg) was intraperitoneally (ip) injected at 30 min before the ip injection of PTZ (45 mg/kg) and the seizures were video-taped for scoring by Racine's scale. Saline or nesfatin-1 treatments were repeated at the 24th and 48th h of epileptic seizure. Following the second passive avoidance test performed to evaluate the memory function, rats were decapitated at the 72nd hour of seizure induction. Malondialdehyde (MDA; indicator of lipid peroxidation) levels, antioxidant glutathione (GSH) content, and myeloperoxidase activity (MPO; indicating neutrophil infiltration) were measured. Using chemiluminescence, levels of reactive oxygen metabolites

(ROM) and nitric oxide (NO) were determined. Statistical analysis was performed by ANOVA and Student's t tests.

Results: Compared to saline-treated PTZ group, the ratio of rats that had tonic-clonic seizures and maximum seizure scores were reduced in nesfatin-1-treated groups, reaching to statistical significance only at 1 μ g/kg dose. On the 3rd day of seizure, memory dysfunction was observed in the saline-treated PTZ group presenting with a high percentage of rats (75%) entering to the chamber where rats have received electrical shock. The ratio of rats with memory dysfunction was reduced in the groups treated with nesfatin-1 at 0.3, 1 and 3 μ g/kg doses (25, 38 and 13%, respectively). NO level that was elevated in saline-treated seizure group was suppressed, while GSH levels were increased with all doses of nesfatin-1 (p<0.0001). PTZ-induced elevation in MDA was reversed by only 1 μ g/kg dose (p<0.05), while ROM were suppressed by 1 and 3 μ g/kg doses; but increased MPO activity was not altered by none of the doses.

Conclusion: Nesfatin-1 improved PTZ-induced memory dysfunction and oxidative brain damage via the maintenance of GSH and the inhibition of NO and ROM production. The results suggest that further experimental and clinical studies are required to verify the anti-epileptic and anti-oxidant potential of nesfatin-1.

Keywords: epileptic seizure, memory dysfunction, nesfatin-1, oxidative stress

P-47

Increased telomerase activity in major depression disorder: potential role of pro-inflammatory cytokines and brain derived neurotrophic factor levels

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Objective: Major Depression Disorder (MDD) is commonly diagnosed with clinical symptoms that are based on patient's self-report. However, diagnosis with a declarative method has some disadvantages. For this reason, molecular targeted agents for the diagnosis and therapy came into prominence in recent years. Several studies have showed that pro-inflammatory cytokines are higher levels in people with MDD compared to healthy participants. It has been shown that elevated pro-inflammatory cytokines can predict neurogenesis especially in depression with melancholic features. In MDD increased cytokines and decreased BDNF can cause early shortened telomeres and even as a reaction to this situation increases in telomerase activity level can be compensatory and predicted. However, there is no enough information about it. The aim of this study was to compare target pro-inflammatory cytokines (IL-6, IL-1 β and TNF- α), BDNF and levels of PBMCs telomerase activity of patients with MDD and

healthy controls. We also aimed to investigate the relationships between these target molecules and their links to each other in people with MDD. To our knowledge, in the literature this is the first study to show these relations.

Methods: Ethics approval for the study was obtained from Dokuz Eylül University, Ethics Committee for Non-invasive Clinical Research (project ethics number: 2014/02-26) In the present study, 37 patients who had major depression with melancholic features and un-medicated ($M=33.40$; $SD=10.58$) and 34 healthy control subjects ($M=31.79$; $SD=9.97$) were included. Control groups were selected from the healthy volunteers who had similar demographic features with depression groups. Plasma concentrations of BDNF, IL-6, IL-1 β , TNF- α were measured with ELISA; telomerase activity level in PBMCs were measured with real time PCR.

Results: As a result we showed that: PBMC telomerase activity ($p=0.002$), plasma IL-6 level ($p=0.012$) were significantly higher in people with MDD who were un-medicated than healthy matched controls. BDNF ($p=0.007$) level was significantly lower in people with MDD. However there were no significant differences in plasma IL-1 β ($p=0.451$) and TNF- α ($p=0.751$) levels between MDD subjects and controls. Although depressed group were significantly differed from the controls in IL-6, BDNF and telomerase activity, a significant correlation between plasma concentration of BDNF and IL-6 was observed.

Conclusion: The relationship between telomerase activity and the levels of plasma BDNF, IL-6, IL-1 β and TNF- α is unclear in depression. Our preliminary results provide strong evidence that telomerase activity, IL-6 and BDNF levels might be the new molecular targets in MDD. Increased telomerase activity was thought to show fixing telomeres of depressed patients. However our study showed that in depression this mechanism of telomerase should be associated with another mechanism besides of BDNF and pro-inflammatory cytokines which had a role in depression etiopathogenesis.

Support: Supported by Scientific Research Projects Commission of Dokuz Eylül University (Project No: B.08.6.YÖK.2.DE.0.06.0.01.00/930)

Keywords: BDNF, pro-inflammatory cytokines, depression, telomerase activity

P-48

Morphometry of the petrous portion of the temporal bone as a guide for suboccipital retrosigmoid surgical approach

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Objective: The surgical anatomy of the temporal bone, specifically the posterior surface of the petrous bone, is important for suboccipital retrosigmoid and retrosigmoid transmeatal approaches in the removal of acoustic neuromas protruding from the internal

acoustic meatus. We aimed to provide morphometry of this region to establish anatomical guidelines for safe removal of lesions here.

Methods: We performed morphometric analysis of 217 (123 left side, 94 right side) temporal bones from the bone collection of Ege University, Faculty of Medicine, Department of Anatomy and measured ten different parameters using a stainless steel caliper with an accuracy of 0.01 mm.

Results: The distance between the uppermost point on posterior wall of the sigmoid sulcus and the lateral wall of internal acoustic meatus (IAM) was measured 41.07 ± 2.37 mm, distance between the opening of vestibular aqueduct and the lateral edge of IAM 10.29 ± 1.25 mm, distance between the midpoint of upper margin of jugular foramen (corresponds to highest point of jugular bulb) and the level of lower margin of IAM 9.81 ± 1.44 mm. Vertical and horizontal diameters of the IAM were measured 3.86 ± 0.71 mm and 5.80 ± 0.94 mm, consequently. There were no significant differences statistically between right and left sides.

Conclusion: This study provides anatomical guidelines for safe removal of the lesions in the petrous bone posterior surface region during suboccipital retrosigmoidal surgical approaches.

Keywords: morphometry; petrous bone; suboccipital retrosigmoid approach; temporal bone

P-49

Clinical and neuropsychometric profile characteristics of adult ADHD patients with dysmnesia complaints

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Objective: Attention Deficit Hyperactivity Disorder (ADHD) presents itself in patients as a difficulty to recognize the order of the external and/or internal stimuli. Therefore, ADHD patients suffer difficulties in activating learned information, and in matching, arranging, organizing them with new information. According to the theory of parallel processing, prefrontal lobe has a crucial role in the functional processing and interpreting of information and patients who suffer from ADHD have structural and functional abnormalities on prefrontal level when compared to individuals who were not diagnosed with ADHD. ADHD patients' working memory can not check the arrival of the new stimuli can not record information properly to long-term memory and can not hold information on stand-by for recall. These express the dysmnesia symptom in ADHD patients. This study aims to examine the neuropsychometric and behavioral profile of the adult patients using the data of the patients who consulted the Dysmnesia Polyclinic at Istanbul Medipol University with dysmnesia complaints and later diagnosed with ADHD.

Methods: Clinical observation and Adult Attention Deficit Hyperactivity Disorder Self-Report Scale (ASRS-v1.1) were used to diagnose adult ADHD. Neuropsychometric assessment

was conducted on five axis: attention and executive functions; memory; visual-spatial functions; language, and mood. To evaluate attention and executive functions Digit span, Stroop Test, Wisconsin Card Sorting Test, Proverbs and Binary Similarity Sub-Tests; to evaluate memory Verbal Learning Test (SBST), WMS Logical Memory sub-test, Rey Complex Figure; to evaluate visual-spatial functions, Benton Facial Recognition test, Identification of Line Orientation test and Figure Copying test; to evaluate language, Boston Naming Test; and to evaluate mood the Beck Depression Inventory was utilized respectively.

Results: 17 patients with adult type ADHD was diagnosed (8 female, 9 male). Patients age between 20 and 49. Low performance in propulsive (executive) functions of the patients was dominantly observed along with self reported dysmnnesia complaints. Evaluation and test results are discussed and compared with the existing literature.

Keywords: adult ADHD, neuropsychometric testing, dysmnnesia

P-50

An analysis of early demantia: comparison of quantitative FDG PET analysis and neuropsychological profiles of adult patients

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Objective: Dementia is a neurological disease which is characterized with progressive decline in mental abilities such as memory, language, and executive functions. Although its distinct symptoms make it possible to diagnose dementia, the overlap of behavioral and cognitive profiles makes it difficult to distinguish the subtypes of dementia. Dementia diagnosis is usually based on clinical criteria and neuropsychological tests but evaluation of objective techniques is crucial to differentiate neurodegeneration in dementia. [18F]-florodeoksiglukoz Positron Emission Tomography (FDG PET) is a method which measures changes in cerebral glucose metabolism. Glucose metabolism increase with regional synaptic activity whereas it decreases with neural degeneration or synaptic dysfunction. In this study, we aim to evaluate the association between hypo metabolism in FDG PET and cognitive deficits by using data from neuropsychological tests conducted upon patients with early dementia.

Methods: The current study included 21 patients with dementia which were treated in Istanbul Medipol University Hospital, Dementia Policlinics. To differentiate the clinic profile, FDG PET and neuropsychological tests of patients were analyzed retrospectively. Neuropsychological evaluation was conducted in 5 axis: attention and executive functions, memory, visua-spatial functions, language and mood states. Digit Span, Stroop Test, Similarities and Comprehension tests were utilized to assess

attention and executive functions; Verbal memory processing scale (SBST) for verbal memory and Wechler Memory Scale Visual Subtest (WMS/G) tests for non-verbal memory functions. Also patients were subjected to Rey Complex Figure Test and Recognition Trial (RCFT); Benton Naming Test, Line Orientation Test; Boston Naming Test, Geriatric depression scale tests.

Results: The association between quantitative FDG-PET analysis and neuropsychological profile in 21 patients with degenerative dementia (4 Alzheimer, 8 Frontotemporal Dementia, 4 Lewy Body Dementia, 3 Mild Cognitive Impairment) is evaluated.

Keywords: dementia, FDG PET, neuropsychology

P-51

The study of executive function impairment with fNIRS in adults with ADHD

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Objective: It has been found that the region of the brain associated with attention and impulse control, located on the frontal lobes of the brain, which differ structurally and functionally in ADHD patients. Moreover, ADHD is critically linked with executive functions deficit. The Stroop test is considered by some to be an effective measure of executive function. This study is aimed to reveal the concentration change of oxy-deoxy hemoglobin in the bilateral DLPFC between ADHD patients and healthy participants.

Methods: Participants were 4 patients with adult ADHD and 4 healthy volunteers. All participants were evaluated on Istanbul Medipol University Hospital Memory Deficit Division and had neuropsychological assessment by psychologists. Participants have neither color vision deficit nor speech disorders. Adult ADHD Self-Report Scale (ASRS-v1.1) is used in order to assess ADHD. In addition to ASRS-v1.1, assessment of executive function using Trial Making Task, Stroop task, Wisconsin Card Sorting Task, proverb interpretation; assessment of memory using SBST, WMS Logical Memory, Rey Complex Figure; visuospatial functions using Benton Face Recognition Task, The Benton's Judgment of Line Orientation Task; assessment of language using Boston Naming Task and finally emotional assessment using Beck Depression Inventory were analyzed. As modified Stroop test which is created by Nirstim program examined, the concentration changes of oxy-deoxy hemoglobin in the bilateral DLPFC were measured. Application was completed by using 18 channel, 8 source which are located on the surface of the scalp and 8 detectors. The pair of source and detectors is located in according to international EEG system.

Results: During modified Stroop test which is created by Nirstim program examined, the results of the concentration changes of oxy-deoxy hemoglobin in the bilateral DLPFC by

measured fNIRS are focused on whether 4 adult with ADHD patients differ from 4 healthy participants.

Keywords: adult ADHD, fNIRS, strop test, executive functions

P-52

Relation between isolated syndrome and long term memory

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Objective: It is widely known that cognitive impairments prevail among patients with Multiple Sclerosis (MS). Even if not that prevalent, it is also reported that patients with Clinically Isolated Syndrome (CIS) might also have similar cognitive impairments. In MS, and also in CIS, these impairments mostly emanate in attention, executive functions, verbal memory and visual-spatial functions. However, this topic has not been studied in detail yet. In this study, we aim to examine the impacts of such cognitive impairments on memory consolidation.

Method: In this study, 10 patients diagnosed with CIS and a control group of 10 healthy and demographically matched people are compared in terms of recalling verbal material in the long term. In order to assess verbal memory functions, Öktem-Sözel Bellek Süreçleri Testi (SBST) is applied. SBST is a standardized test in Turkish that consists of 15 words and aims to make the subjects learn these words. Besides standard 40th minute evaluation, participants were also asked to recall the words in SBST at the 7th and the 42nd day after the first encounter. Additionally, Expanded Disability Status Scale (only CIS patients were subjected to this test to determine probable risk factors), Beck Depression Inventory, Pittsburg Sleep Quality Index and Epworth Sleepiness Scale are applied.

Results: Findings that are derived from both patients and the control group is discussed allied to literature.

Keywords: isolated syndrome, consolidation, multiple sclerosis, verbal memory, long term memory

P-53

The association between ventricular and sulcal atrophy and cognitive and behavioral condition

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Objective: Low performance in some cognitive functions is noticed in the patients even on the earliest stage of Parkinson's disease (PD). Along with these findings, behavioral symptoms such as apathy, anxiety, depression occur on the earliest stage in some PD patients. In this process, the possibility of development of dementia is high in PD. Recently, Parkinson type Mild Cognitive Impairment that seems to represent of transitional period is defined. Recent findings suggest that patients might have different processes in cognitive impairment in terms of clinical, cognitive and behavioral properties which claim probable subtypes of PD. The aim of this study is to investigate the association between behavioral and cognitive findings and ventricular and sulcal atrophy in PD patients who have different cognitive and behavioral features.

Methods: In this study, we have rated 10 Parkinson patients who are normal in terms of cognitive status, 10 PD patients who have Mild Cognitive Impairment (MCIPD), 10 PD patients with dementia (PDD), 10 normal controls who are matched up in age and gender. Clinical properties of patients are assessed by UPDRS and rated by Hoehn-Yahr scale. Neuropsychiatric Inventory (NPI) is utilized for identifying the behavioral properties of patients. In addition, detailed Neuropsychometric battery including verbal and nonverbal memory, attention, executive functions and visual perceptual functions is applied. To create these groups, cognitive status of patients is classified using Clinical Dementia Rating Scale (CDR). Ventricular and sulcal atrophy levels of patients and controls are assessed by a visual rating scale on T1 images in axial slices of Magnetic Resonance Imaging (MRI).

Results: Results of this study will be discussed with literature.

Keywords: dementia, mild cognitive impairment, magnetic resonance, Parkinson's disease, ventricular and sulcal atrophy

P-54

The effect of maternal l-thyroxine treatment during lactation affects long-term potentiation in adult rat progeny

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Objective: Numerous animal studies have shown that thyroid hormone imbalance affects cognitive functions such as learning and memory. However, the timing of this imbalance is crucial, and the possible electrophysiological alterations that could underlie these learning deficits in hyperthyroid animals remain largely unexplored. The goal of the present study was to investigate hippocampal long-term potentiation (LTP), an electrophysiologic assay of synaptic plasticity and to compare individuals with maternally-induced and adult-onset hyperthyroid adolescents to typically developing adolescents.

Methods: Animals were kept for 1 week before mating (M/F=2:1). The day of vaginal plug was taken as gestational day (GD) 0. The pregnant rats were randomly assigned into three groups

(n=8 per group): control group, developmental-treatment (DT) group, and adult-treatment (AT) group. After delivery, pups were held for 21 days with their dams and breastfed by their own mothers. During lactation period, all dams were fed with tap water and Purina rodent chow ad lib, but dams of DT group were also treated with L-thyroxine (0.2 mg kg⁻¹ body mass, 1 mL). Maternal hyperthyroid group (MH) consisted of male rat offspring from these mothers. Then all pups were separated from their mother and were singly housed in hanging wire cages in a temperature-controlled room. When pups were grown to age of 39 day, male rat offspring from AT group were treated with L-Thyroxine for 21 days and they were consisted of adult-onset hyperthyroid group (AOH). Euthyroid group (EU) consisted of male rat offspring from control mothers. Field potentials were recorded from dentate gyrus in response to stimulation of medial perforant pathway *in vivo*. LTP was induced by taken after recording, serum thyroxine levels were measured by ELISA (n=6 per group). Measurements were all done in rats aged 60–66 days.

Results: One-way ANOVA followed post-hoc test revealed significantly elevated levels of fT4 in AOH (2.91±0.18 ng/dL) and MH rats (3.15±0.11 ng/dL) when compared to control rats (1.82±0.18 ng/dL). An ANOVA on PS-LTP and EPSP-LTP revealed a significant group effect (P=0.001 and 0.014, respectively). The post hoc analysis showed that the magnitude of PS-LTP at last 5 minutes of recording was lower in the AOH group (p=0.01) and MH group (p=0.001) than that of control group. There was also significant difference between AOH group and MH group (p=0.001). When considering EPSP-LTP data, only difference was found between control and MH group (p=0.014).

Conclusion: These results suggest that perinatal excessiveness of thyroid hormone has longstanding effects on hippocampal function and may account for memory problems experienced by adolescents with congenital hyperthyroidism.

Keywords: long-term potentiation, maternal hyperthyroidism, hippocampus

P-55

An inverse agonist effect of tetraiodothyroacetic acid on the long-term potentiation *in vivo*

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Objective: Tetraiodothyroacetic acid (tetrac) is a T4 analog that inhibits binding of iodothyronines to the integrin $\alpha\beta3$ receptor. We have previously shown that intra-hippocampal T4 infusion attenuates the long-term potentiation (LTP) in the synapses between the perforant pathway and the dentate gyrus. However, the effect of tetrac on the attenuated LTP induced by T4 remains unexplored.

Methods: 1 M stock solutions of L-Thyroxine (Na salt pentahydrate, Catalogue No.: T2501-5G) and 3,3',5,5'-Tetraiodothy-

roacetic acid (tetrac; Catalogue No.: T3787-100 MG) were prepared by dissolving them in a minimal volume of 0.1 N NaOH and diluting them with saline. Drugs were diluted to 100 pM (final concentration) when used. Field potentials were recorded from the dentate gyrus in response to stimulation of the medial perforant pathway by high-frequency stimulation (HFS). Infusions of saline, T4 and tetraiodothyroacetic acid (tetrac), either alone or together, were made during the stimulation protocol. The averages of the excitatory postsynaptic potential (EPSP) slopes and population spike (PS) amplitudes between 55–60 minutes after HFS was used as a measure of the LTP magnitude and were analyzed by two-way univariate ANOVA with T4 and tetrac as between-subjects factors.

Results: The absence of a significant drug effect (Fs 2.30=1.92 and 0.95; p>0.05) on the input/output curves showed that the drug used had no effect on baseline synaptic transmission. A 2 x 2 ANOVA for the magnitude of EPSP-LTP revealed a significant effect of T4 (F1.28=13.75; p=0.001), a significant effect of tetrac (F1.28 = 10.70; p=0.003), and a non significant interaction between these drugs (p>0.05). The post hoc analysis showed that the magnitude of LTP within the last 5 minute of recording was lower in T4 infused experiments (115±3% of baseline) than that of non infused experiments (133±5%) and significantly greater in tetrac infused experiments (132±4%) than that of non-infused experiments (116±4%).

Conclusion: Integrin $\alpha\beta3$ receptors contain a thyroid hormone-binding domain. Binding of thyroid hormone to this receptor leads to the activation of the mitogen-activated protein kinase signal transduction cascade. Although tetrac is normally considered to be inactive in reference to intracellular thyroid hormone functions, the present study shows that binding of tetrac to the $\alpha\beta3$ integrin receptor in the cell membrane does not only block the effects of binding T4 but also activate the basal activity of the integrin $\alpha\beta3$ receptor. However, the molecular mechanisms mediating these effects need to be resolved.

Keywords: hippocampus, synaptic plasticity, tetraiodothyroacetic acid, thyroxin

P-56

Audiovisual interactions in time and spatial grouping principles of vision

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Multisensory integration is often studied with intermodal conflict where either visual input dominates and alters the percept of simultaneous auditory input or the other way around. For instance, when put in conflict, visual stimuli can drive the perception of where a sound originates (spatial ventriloquism) (Bertelson & Aschersleben, 1998; Howard & Templeton, 1966) whereas auditory stimuli can drive the perception of when visual events occur (temporal ventriloquism) (Fendrich & Corballis, 2001; Morein-Zamir, Soto-Faraco, & Kingstone, 2003; Recanzone, 2003). These interactions make adaptive sense given the auditory system's supe-

rior temporal resolution and the visual system's superior spatial resolution (Alais&Burr, 2004). Moreover, it was found that temporal ventriloquism can change the perceived speed of visual motion (Kafaligonul&Stoner, 2010). By taking advantage of this influence of auditory timing on perceived speed, we investigated how audiovisual interactions in time (i.e., temporal ventriloquism) are modulated by the spatial grouping principles of vision. In our experiments, we manipulated spatial proximity, similarity and uniform connectedness between moving bars. Observers compared the speed of motion between different auditory timing conditions. Our results revealed that an auditory influence on perceived speed was significantly modulated by only uniform connectedness. More specifically, auditory effects on vision was strongest when a horizontal gray path connected and grouped two/three sequential moving bars ($t=3.166$, $p=.007$). When horizontally placed moving bars were grouped in a vertical path, the degree of auditory influences in time was significantly stronger compared to not grouped (no-path) and horizontal path conditions ($F=5.126$, $p=.007$). Overall, our findings here suggest that temporal ventriloquism effects exist in different spatial grouping conditions of vision, but they can be also modulated by certain intra-modal grouping principles such as uniform connectedness.

Support: This work was supported by The Scientific and Technological Research Council of Turkey (TUBITAK Grant 113K547).

Keywords: audiovisual interactions, spatial grouping, speed perception, temporal ventriloquism

P-57

Sleep disordered breathing in child as presenting Chiari type I malformation: a case report. "Electrophysiology and neuroimaging for a correct diagnosis"

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Objective: The aim of this case is to provide a suggested approach to sleep disordered breathing in child for general pediatrics, especially pediatric neurologies and neurosurgeries. Sleep-disordered breathing consists of apnea and hipopnea, which are repeated breathing pauses and decreased breathing during sleep, respectively. Apneas may be either central or obstructive. Sleep related breathing disorders in children occur along a spectrum of severity, ranging from habituel snoring on the mild end of the spectrum to obstructive sleep apnea (OSA) on the serious end of the spectrum. Central sleep apneas (CSA) are frequently observed in polysomnograms (PSG) of patients with OSA. CSA is mostly associated with systemic conditions such as heart failure. Other less common etiologies for CSA include living in high altitude, use of opioids and central nervous system conditions. Chiari Type 1 malformation (CM-1) is a rare disorder with displaced cerebellar tonsils through foramen magnum. CM-1 does not become symptomatic until adolescence or adulthood.

Results: The patient with 14-year-old girl underwent treatment of the epilepsy by pediatric neurology for 5 years. Her family described tics of the mouth and face during the sleep and waking who was referred sleep and electrophysiology laboratory by pediatric neurology. Girl Ü. spent a night in the sleep laboratory and PSG demonstrated increased apnea hypopnea index of 15.1. She was obesity (BMI: 30.04). Brain MRI was done to rule out any nervous system pathology. And brain imaging showed signs of CM-1. Results indicated CPAP at 8 cm H₂O eliminated patient's disordered breathing during all nightsleep.

Conclusion: CM-1 is a congenital disorder. Most cases are asymptomatic and diagnosed with and incidental finding in a brain MRI. CSA in child hood is not common. Our patient had 26 central apneas per one night. Complete resolution of central apneas after neurosurgery in patients with CM-1 has been shown in several studies. In this case, we suggested to followed by neurosurgery and used to CPAP to her.

Keywords: correct diagnosis, electrophysiology, sleep disorders, child hood

P-58

Auditory adaptation alters evoked potentials by visual motion over temporal and frontal regions

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There have been numerous studies examining interactions between sound and visual motion (Soto-Faraco et al., 2003). Several illusions have demonstrated strong influences of simultaneous presentation of auditory stimuli on the perception of visual motion (e.g., Sekuler et al., 1997; Freeman&Driver, 2008; Hidaka et al., 2009). Here, we aimed to determine how auditory adaptation changes the neural activity by the subsequently presented visual motion. In our experiments, we used brief visual flashes and auditory clicks during the adaptation phase. We defined two timing adaptation conditions called high-frequency and low-frequency adaptation. The time interval between each event (visual flash or auditory click) was 40 ms and 240 ms for high-frequency and low-frequency adaptations, respectively. A two-frame apparent motion with a fixed temporal interval (80 ms) and spatial displacement (1.4°) was used during each test phase. Each experimental session consisted of four blocks (2 adaptation frequencies x 2 modalities) and each block consisted of forty trials. At the beginning of each block (first trial), each adaptation phase was presented thirty times and then followed by visual apparent motion. The rest of the trials consisted of eight adaptation phases and a single presentation of apparent motion. Participants (n=12) were instructed to fixate on the red circle at the center of the display and attend to visual and auditory stimuli during the experiments. Even though the physical apparent motion was exactly same across conditions, our results showed significant differences between

evoked potentials to apparent motion presented after high-frequency and low-frequency auditory clicks. These differences were mostly constrained to 300–400 ms after the onset of the apparent motion and they were observed over temporal and frontal regions. Interestingly, no significant difference between high- and low-frequency visual adaptation conditions was observed. Taken together, these findings suggest that not only simultaneous presentation of sounds but also previous experiences through adaptations are involved in visual motion computation.

Support: This work was supported by The Scientific and Technological Research Council of Turkey (TUBITAK Grant 113K547) and approved by the ethics committee at Faculty of Medicine, Ankara University.

Keywords: visual motion perception, auditory adaptation, visual adaptation, evoked potentials

P-59

Prefrontal activity measured by functional near infrared spectroscopy during probabilistic inference in subjects with persecutory delusions

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Objective: Jumping to conclusions (JTC) is a probabilistic reasoning bias (Garety et al., 1991). The JTC bias has been claimed to play a role in delusion formation and may be associated with premature acceptance of delusional beliefs (Garety and Freeman, 1999; Speechley et al., 2010). We aimed to examine the prefrontal cortex (rPFC) activation during a modified version of Beads In a Jar Test (BIJT) (Huq et al., 1988) in subjects with persecutory delusions. We were also interested in patterns of probabilistic reasoning and possible functional neuroanatomical correlates of these patterns.

Methods: The rPFC activity was examined with Functional Near Infrared Spectroscopy during a modified version of the Beads in a Jar Task (BIJT) in subjects with persecutory delusions (N=25). In BIJT participants are presented beads either drawn from one of the two jars with opposite probability ratios (PRs) of colored beads and are required to decide from which jar beads are being drawn (Huq et al., 1988). We modified the BIJT to include two different conditions with different bead probability ratios (90/10 and 55/45).

Results: Compared to healthy controls (N=20), patients reached a decision earlier in both conditions. While the medial rPFC regions were more active in the 90/10 condition in controls compared to patients, lateral rPFC activation was higher in

the 55/45 condition in patients than controls. Only in the control group, there was a marked decline in the lateral rPFC activity in the 55/45 condition compared to the 90/10 condition. The activity in the lateral rPFC was negatively correlated with the amount of beads drawn in healthy controls but not in subjects with persecutory delusions.

Conclusion: We found that psychotic subjects decided earlier than control subjects in the BIJT. The probabilistic reasoning paradigm activated the anteromedial parts of the rPFC more than the anterolateral parts. Our results suggest that during the BIJT, rPFC does not function as a single unit and rather consists of functional subunits that are organized differently in patients and controls. The failure to deactivate the lateral rPFC may be associated with earlier decisions in subjects with persecutory delusions.

Keywords: functional near infrared spectroscopy, persecutory delusions, probabilistic reasoning

P-60

Effect of a social defeat experience on prefrontal activity in schizophrenia

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Objective: Social defeat (SD) is a commonly used term that describes the physical defeat of one animal by another within-species conspecific member in a series of experiments conducted on social stress (Miczek and De Boer, 2005; Tidey and Miczek, 1997). Selten and Cantor-Graae (2005) proposed SD as a common unifying mechanism to explain the relationship of schizophrenia with migration, childhood trauma, unemployment, urbanicity, and lower IQ scores, since all these risk groups are also exposed to high levels of SD. Selten and Cantor Graae (2007) also proposed that defeated animals in the resident-intruder paradigm resemble in subjects with schizophrenia, in biological terms, who have increased amphetamine induced dopamine release. If the results of the animal studies can be extended to humans, chronic exposure to SD may lead to sensitization of the mesolimbic dopamine system and/or over activity of this system, and thus further the development of psychosis (Selten & Cantor-Graae, 2005). We investigated PFC response to SD in schizophrenia. We hypothesized that subjects with schizophrenia and healthy controls have different activations in PFC during a computer simulation of a single SD experience.

Methods: We measured prefrontal cortex (PFC) activity in subjects with schizophrenia (n=26) and healthy controls (n=27) during exposure to a single SD experience with functional near infrared spectroscopy.

Results: PFC activity declined in both groups. SD exposure was associated with a broader deactivation in left ventromedial, right medial and right lateral PFC in healthy controls, and a sharper deactivation in right ventrolateral PFC in subjects with schizophrenia. The deactivation in right ventrolateral PFC, was significantly higher in patients compared to controls.

Conclusion: We found that, a single SD experience was associated with deactivations in PFC in both groups and with a lower activity in subjects with schizophrenia in the right VLPFC compared to healthy controls. This suggests that even a single experience of a computer simulated SD experience is processed differently in index subjects and controls and provides further support for the toxic effect of social stress on the right PFC as a risk factor for the index condition and as a putative psychosis risk.

Keywords: functional near infrared spectroscopy, schizophrenia, social defeat

P-61

Evaluation of cognitive functions by using event-related potentials in patients with severe OSAS

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Objective: Obstructive Sleep Apnea (OSAS) is a sleep disorder characterized by partial or complete obstructions of the upper airway. Oxygen desaturation occurs due to these obstructions, which eventually causes impairments in memory, attention, and executive functions. In the present study, we aimed to assess cognitive dysfunction in patients with severe OSAS using neuropsychological tests and event-related potentials (ERP).

Methods: Twenty-three patients with severe OSAS (AHI>30; mean age: 40.01) and 18 healthy controls (mean age: 39.22) were participated to the study. Groups were matched according to age, education and gender. A detailed neuropsychological test battery was administered to all participants and EEG was recorded by using a classical visual oddball paradigm. EEG was digitally filtered between 0.5–25 Hz for ERPs and maximum peak amplitude and latency values of N200 and P300 components were measured. ERPs were analyzed by using repeated measures of ANOVA, which included 2-level group (OSAS and healthy controls) as between-subjects factors and anterior-posterior distribution (4 level=frontal, central, parietal, occipital) and lateral distribution (3 level=left, midline, right) as within-subject factors. Neuropsychological test scores were compared with independent sample t-test.

Results: Neuropsychological test scores did not differ between groups. There was a main group effect on P300 amplitude [$F(1.39)=6.003$; $p=0.019$]. OSAS patients showed lower P300 amplitudes than healthy controls over F3, Fz, and F4 electrode

sites. No main group effect was observed on P300 latency. While N200 amplitude did not differ between groups, a main group effect on N200 latency was found [$F(1.39)=7.017$; $p=0.012$]. OSAS patients showed prolonged N200 latencies over F4, Cz, C4 and P4 electrode sites compared to healthy controls. OSAS patients were divided into two subgroups according to disease duration (“Early” versus “Late” diagnosis). The N200 latency over F4 electrode site was shorter for healthy controls than both OSAS subgroups. Moreover, healthy controls showed shorter N200 latency over P4 electrode site than late diagnosed OSAS subgroup, while no difference with early diagnosed OSAS subgroup was observed.

Conclusion: In the present study, OSAS patients showed significantly lower P300 amplitudes than healthy controls, particularly over frontal regions. Decreased frontal P300 responses may indicate cognitive changes which may not be detected yet by neuropsychological assessment.

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Keywords: Obstructive Sleep Apnea, Neuropsychological Assessment, Event Related Potentials, N200, P300

P-62

Review of the afferent and efferent connections of amygdaloid body

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Amygdaloid body is a part of limbic system that is located deep to the uncus of parahippocampal gyrus and anterior to hippocampus and temporal horn of lateral ventricle. It is subdivided into three nucleus groups; basolateral, corticomедial and central nuclei. The first two groups mainly receive afferent fibers, whereas the central nuclei give efferent fibers. Basolateral nuclei reciprocally connect the sensory association areas of cortex and the medial dorsal nucleus of thalamus, basal nuclei and ventral striatum. This nucleus is related to feeding and drinking behaviors, autonomic and somatic reflexes and responses to stress. The corticomедial nuclei are connected to the olfactory cortex and its fibers reach to the ventromedial nucleus of hypothalamus. It plays a part in eating behaviors. The central nuclei receive afferent fibers from the other two nucleus groups and are connected to the visseral motor and sensory nuclei of brainstem. It continues with ventral amygdalofugal pathway to the autonomic nuclei of brainstem. In this study, we aimed to comprehensively evaluate the afferent and efferent connections of amygdala in human that receives sensory input (somatosensory, visual, auditory, visseral stimuli) widespread regions of the nervous system and shed light on the further studies by researching the recent publications. Also, we intended to provide a guide for clinical use by summing up the functions related to the connections of amygdala with olfactory cortex, limbic system, thalamus, hypothalamus and brain stem.

Particularly we tried to clarify the confusions about the nuclei and pathways of amygdala inclusive of the literature.

Keywords: Amygdaloid body, hippocampus, limbic system, neuroanatomy, olfactor cortex

P-63

Longitudinal assessment of subcortical gray matter structures in mild cognitive impairment

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Objective: Amnesic mild cognitive impairment (MCI) is a transitional stage between normal aging and Alzheimer's disease (AD) and has an increased risk of developing dementia. We aimed to evaluate longitudinal changes in the volume of subcortical gray matter structures (thalamus, caudate nucleus, putamen, globus pallidus, brain stem, amygdala, hippocampus and nucleus accumbens) in patients with amnesic MCI, using the algorithm FIRST (FMRIBs integrated registration and segmentation tool) which is provided in FSL software package (FMRIB Software Library, <http://www.fmrib.ox.ac.uk/fsl/fslwiki/>).

Methods: 22 MCI patients were scanned twice 1-year follow-up with axial TSE T2 weighted and sagittal 3 dimensional GRE T1 weighted magnetic resonance imaging. Brain stem and bilateral thalamus, caudate nucleus, putamen, globus pallidus, amygdala, hippocampus and nucleus accumbens were segmented. Volumes were assessed by using wilcoxon test ($p < 0.05$).

Results: The longitudinal comparison showed that the volume of the right hippocampus was significantly reduced ($p = 0.042$) in MCI patients.

Conclusion: Subcortical volume measurements have the potential to help in monitoring the course of disease in patients with MCI who are at risk for progression to probable AD.

This study was supported by TUBITAK 112S459 grant.

Keywords: volume assessment of subcortical structures, FSL, mild cognitive impairment

P-64

Effects on clinical and laboratory findings of transcranial magnetic stimulation and cranial direct stimulation, applications on two individuals with progressive nonfluent aphasia

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Frontotemporal lobar dementia (FTLD) is the most common type of primary degenerative dementia after Alzheimer's disease. The initial phase of disease, depending on the focal atrophy in frontal or temporal region; personality, behavior, language functions affected in addition to the emotional changes occur in the form of parkinsonian symptoms with asymmetric focal motor. In this study, Repetitive Transcranial Magnetic Stimulation (rTMS) or Direct Cranial Stimulation (DCS) applied on two individuals diagnosed with Progressive Nonfluent Aphasia (PNFA) which is a subtype of FTLD. Results of treatments have been re-evaluated by using initial clinical conditions and laboratory instruments. In this study, 2 PNFA individuals were recruited from Istanbul Medipol University Department of Amnesia. These patients had Electroencephalogram (EEG), Fluorodeoxyglucose-Positron Emission Tomography (FDG-PET) of resting state and clinical, behavioral, Neuropsychometric assessment pre-post rTMS and DCS application. Digit Span (Forward/Back) Test, Verbal Fluency Test, Lexical Fluency Test, Clock Drawing Test, Similarities and Comprehension test used for evaluation of attention and executive functions on neuropsychometric assessment. The memory assessment, Verbal Learning Test (SBSTTA-Oktem), Wechsler Memory Scale (WMS- Logical Memory Test), WMS visual subtest used; Benton Face Recognition Test (BFR), Line Orientation Identification Test (BLOT) used to evaluate visuospatial skills. Neuropsychiatric Inventory (NPI), Geriatric Depression Scale (GDS), Frontal Behavioral Inventory (FBI) tests used for measuring behavioral symptoms of individuals. Standardized Mini Mental State Examination (MMSE) and Clinical Dementia Rating-Scale (CDR) used clinical evaluation and grading of dementia.

Keywords: DCS, FTD, TMS

P-65

An fMRI investigation of the neural correlates underlying football fanaticism

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Objective: In the literature, five types of sports fans have been described (local, dedicated, fanatic, dysfunctional and temporary) which exhibit different type of behaviors. Emotional states and emotional reactions during the sports game are increased when the team supporter is a fanatic. Whilst being a supporter of a football team represents an identification and attachment behavior, different types of neural responses may be expected in fanatic and dysfunctional team supporters.

Methods: 24 healthy male volunteers (mean age 27.4 ± 6.4 , range 20–48), including 12 fanatic football team supporter and 12 non-fanatic football team supporter, participated in the study. During fMRI task, subjects watched stimulus sets, which included 5

blocks each consisting of a video of 25 seconds with 10 seconds breaks. Each set consisted of videos with (1) goals scored by the supported team against the opponent team, (2) goals scored by the opponent team against the supported team and (3) goals scored by the neutral teams. MRI was performed on a 3 Tesla MRI scanner (Achieva, Philips, The Netherlands) with SENSE 32 channel head-coil. T1 weighted 3D TFE sequence was employed as high resolution anatomical scan and T2*-weighted echo planar imaging (EPI) sequence was used for fMRI measurements. Preprocessing and other analyses were performed using the SPM8 software in MATLAB. A whole brain voxel-based analysis was performed using general linear model (GLM) for analyzing the responses of the two groups across different conditions.

Results: Comparisons between the groups showed significant activation difference between the set of goals scored by the supported team against the opponent team compared to the set of goals scored by the neutral teams. Fanatic supporters showed increased activation at a cluster of 922 voxels (peak coordinates: -10 20 34) including BA 24 and 32 compared to the non-fanatic supporters (cluster-level FWE-corrected $p < 0.05$).

Conclusion: Anterior cingulate cortex (BA 24 and 32), showing hyperactivity at fanatic supporters during goals scored by the supported team, is involved in pain perception, autonomic and endocrine regulation, conditional emotional learning, assessments of motivational content, assignment of emotional valence to internal and external stimuli, maternal-infant relationship and romantic love. Our findings are evaluated to reflect the motivational dimension of the importance attributed and the attachment behavior developed towards the supported team.

This study was supported by the Ministry of Development, Turkey, project no 2010K120330.

Keywords: fMRI, attachment behavior, fanaticism

P-66

Effects of mirtazapine and pregabalin on rat diabetic cerebellum

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Central nervous system is a target organ that can be damaged by diabetes, called "diabetic encephalopathy" as well as peripheral neuropathy. Changes of lipid, protein and carbohydrate metabolism causes oxidative stress and cell death as well as cognition and behavioral disorders in both human and experimental diabetes model's brain. Cerebellum coordination is responsible for muscle tone and control of movement. Purkinje cells that are received by climber and mossy fibers directly or indirectly input are affected by GABAergic input field. Hyperglycemia forms endogenous oxidative stress that induces neuronal damage. GABA plays an important role in functional regulation for enhancing the excitotoxicity caused by diabetes. It can be stressful to live with diabetes and it can also cause symptoms of depression. Mirtazapine is a noradrenergic and

specific serotonergic antidepressant and is used for treating major depression. It reduces enzymatic and non-enzymatic oxidant parameters and some markers of inflammation as well as effective in regulating the inflammatory response. We investigated how diabetic neuropathy affects the cerebellum and efficacy of mirtazapine and pregabalin that is agonist of GABA. We used 28 Sprague Daxley rats. For diabet model, 55 mg/kg Streptozotocin (i.p.) was injected. After 3 days, blood-glucose levels were measured by glucometer and higher than 300 mg/dl were accepted for diabetes. 4 weeks after STZ administration, 20 mg/kg Mirtazapine or 100 mg/kg pregabalin (p.o) were administered for 14 days. 4 weeks after STZ administration, we used allodynia, thermal and mechanical hyperalgesia tests. Statistical comparison of behavioral tests between groups and weeks were performed by international Sigmasat 3.0 Software program (California, USA). Comparisons of behavior test between groups are made by two-way ANOVA with repeated measurements and Holm-Sidak test multiple comparison test. At the end of experiment, cerebellum samples were fixed by %10 formaldehyde and hematoxylin-eosin, cresyl violet acetate histochemistry and axon GAP-43 immunohistochemistry staining were performed. In the control group was observed healthy cortex, medullary settlement and it was determined the highest GAP-43 expression. In diabet group, shrinkage and also loss Purkinje cells in some areas, chromatolysis, vacuolation, neuronophagia and middle GAP-43 expression were seen. In mirtazapine group, Purkinje cells were seen relatively healthy and low GAP-43 expression. In pregabalin group, vacuolization, Purkinje cell injury, neuronophagia and higher GAP-43 expression than mirtazapine group were determined. Purkinje cell injury and myelin loss are seen in diabetic group. Mirtazapine and pregabalin that are used for depression and pain treatment can reduce histopathologic damage of diabet but they are not efficient for myelin regeneration.

Keywords: cerebellum, diabetes mellitus, mirtazapine, pregabalin

P-67

Resting state functional connectivity networks related with mild cognitive impairment in Parkinson's disease

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Objective: Currently, a valid and reliable biomarker is not available for Parkinson's disease-mild cognitive impairment (PD-MCI), which is diagnosed through clinical evaluation and neuropsychological tests. In this study, resting-state functional connectivity networks (RSNs) of the PD-MCI and cognitively normal Parkinson patients (PD-NC) were compared in order to develop a discriminative biomarker for PD-MCI.

Methods: 20 PD patients (10 PD-MCI, 10 PD-NC) diagnosed according to UK-PD Society Brain-Bank Criteria at the Behavioral Neurology and Movement Disorders Unit of Istanbul Medical Faculty were included in the study. MR imaging was performed on 3T Phillips MRI scanner (Achieva, Philips, The Netherlands), equipped with 32-channel SENSE head-coil. High-resolution T1-weighted images were acquired using fast-spin echo (FSE) sequence, while resting-state functional MR images (rs-fMRI) were acquired using T2*-weighted echo planar imaging (EPI) sequence. RSNs were obtained by using independent component analysis (ICA) in Group-ICA fMRI Toolbox (GIFT). The networks of single subjects were reconstructed using dual regression method. Scores representing the expression level of specific networks in each subject were obtained by calculating the dot product of the subject's and mean group spatial maps. The combination of the RSNs that together best discriminate PD-MCI from PD-NC patients was obtained by using forward conditional logistic regression analysis in SPSS software (21.0. Armonk, NY: IBM). Additionally, correlations were computed between the network expression and cognitive test scores of the subjects.

Results: Forward conditional logistic regression analysis yielded maximum separation of both groups with fronto-parietal (FPN) and para-hippocampal gyrus/hippocampus networks (PHG/HN) (χ^2 :13.6, df=2, p=0.001). FPN expression scores were significantly lower in PD-MCI, while PHG/HN expression scores were lower in PD-NC patients. In the final model, accuracy was 85% (80–90%) with R2=0.66. Additionally, positive correlation was found between the FPN expression scores and ACE-R (Addenbrook's Cognitive Examination Revised) scores (r=0.436, p=0.05).

Conclusion: Our results showed that connectivity in the FPN related with executive functions, was lower in PD-MCI compared with PD-NC. In contrast, the connectivity in the PHG/HN related with memory, was higher in PD-MCI cases. While similar changes in FPN were reported in previous rs-fMRI studies, our study demonstrates that connectivity decrease in FPN when evaluated together with the probably compensatory connectivity increase in PHG/HN allows for 85% correct classification of PD-MCI cases and points to the possibility of developing an fMRI-based biomarker for PD-MCI diagnosis.

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Keywords: fMRG, resting-state networks, Parkinson's disease, mild cognitive impairment, independent component analysis

P-68

Revisiting the afferent innervation of cornea

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Cornea has a rich sensory and complicated nerve supply. The afferent fibers of cornea are mainly carried by the nasociliary nerve, branch of the ophthalmic nerve. Nasociliary nerve enters the orbit through common tendinous ring and lies between the two rami of oculomotor nerve. Nasociliary nerve has the anterior and posterior ethmoidal, long ciliary, infratrochlear branches and a connection with the ciliary ganglion. Two or 3 long ciliary nerves carry the sensory fibers of the cornea and they are accompanied by the postsynaptic parasympathetic fibers that relay in the ciliary ganglion and course in the short ciliary nerve. They together pierce the sclera and run forward between sclera and choroid layers, innervating the ciliary body, iris and cornea. They also carry the postganglionic sympathetic fibers derived from the superior cervical ganglion. Short ciliary nerves consist of parasympathetic, sympathetic and sensory fibers. The afferent fibers aroused from the cornea, ciliary body and iris enter the short ciliary nerves, without making a synapse they pass through the ciliary ganglion and finally carried by nasociliary nerve. The nerve fibers located in the cornea, form the subepithelial and subbasal plexus. The fibers related with the subbasal plexus pass to more superficial epithelial layers. Subepithelial plexus lies between Bowman's layer and stroma of the cornea. Then, these fibers penetrate the Bowman's layer and form the subbasal plexus, which supplies the basal epithelial cell layer. The fibers that carry the sensation of cornea lie in the subbasal plexus. In the literature, it is mainly mentioned that the fibers of subbasal plexus are carried by long ciliary nerves, branches of ophthalmic nerve but some studies bring out that short ciliary nerves also carry the afferent fibers of cornea. The aim of this review is to clarify the complexity of afferent fibers of the cornea. In some clinical pathologies like diabetes and Herpes simplex keratitis, the sensation of cornea may be affected. In this study, we aimed to point out the afferent nerves supplying cornea for the practitioners to be aware of the causes of these pathologies.

Keywords: Neuroanatomy, cornea, long ciliary nerve, short ciliary nerve

P-69

Case report: the relationship between clozapin level and cognitive functions

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Schizophrenia is a central nervous system disorder characterized by distortions in assessment of reality, affect and behaviour as well as impairments in cognitive domains such as executive functions, attention and working memory. Clozapine is an atypical antipsychotic agent that is used in treatment of resistant schizophrenia and its effects on cognitive functions of patients with schizophrenia are still debatable. While some studies showed that clozapine does not affect cognitive functions, some of them showed favorable effects and a part of stud-

ies showed that clozapine negatively effects various domains of cognitive functions. The reason of this variety may be differences in blood levels of clozapine and its metabolite N-desmethylclozapine (NDMC) among individuals. While clozapine shows antagonistic effect on muscarine receptors that have a role in cognitive functions, NDMC shows agonistic effect on these receptors. In earlier studies, it was reported that there is no association between plasma levels of clozapine or its metabolite NDMC and cognitive functions of patients who use clozapine but there is associations between rate of NDMK/clozapine and cognitive functions. In this study we report a case who had improvements in cognitive functions when blood level of clozapine was decreased.

Keywords: schizophrenia, clozapine, cognitive functions

P-70

The long term depression responses in young and older hyperthyroid rats

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Objective: The relationship between age-dependent cognitive decline and thyroid hormones, long-term synaptic depression is aimed to investigate in young and old euthyroid and hyperthyroid rats.

Methods: Young rats ranging in age from 60 to 90 days old and old rats ranging in age from 270 to 300 days old, were used. Thyroxine (0.2 mg/kg,) was administered for 20 days to young rats, and to old rats. LTD was induced by application of low frequency stimulation protocols at the perforant pathway- dentate gyrus synapses. The averages of the excitatory postsynaptic potential (EPSP) slopes and population spike (PS) amplitudes after LFS was used as a measure of the LTD magnitude.

Results: Serum T4 levels were higher than age matched controls after 3 weeks of treatment. The presence of a significant age effect ($p < 0.01$) showed that higher stimulus intensities are required to induce the same field potential in older rats compared to young rats. PS-LTD and EPSP-LTD revealed a significant age effect ($F_{s1.34} = 10.63$ and 4.76 , $P_s < 0.036$), a significant interaction between age and thyroid hormone state ($F_{s1.34} = 7.08$ and 6.15 , $P_s = 0.012$ and 0.017), but no significant thyroid state effect ($P_s > 0.27$). The magnitude of PS at last five minutes of recording was significantly lower in young hyperthyroid rats ($74 \pm 20\%$ of baseline) than that of old hyperthyroid rats ($240 \pm 27\%$).

Conclusion: These results suggest that hyperthyroidism may decrease in the ability to make new memories in aging people; however, the precise underlying mechanism(s) remains to be elucidated.

Keywords: hyperthyroidi, long term depression, learning, memory

P-71

The role of theta oscillations for emotional and attentional processing in young and older adults

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Objective: This study investigated the role of theta oscillations for emotional and attentional processing in young and older adults and show that the brain oscillations are a useful method to study cognitive processes, which are influenced by attention and emotion along with the recognition of facial expressions.

Method: Participants (21 younger, mean age=21.43; 19 older, mean age=60.48 years) were presented simultaneously with two faces, one on the left and one on the right side of the screen. The facial expression of one of the faces was emotional, either positive or negative, while the other face was neutral. Afterward, a dot-probe appeared. Participants were instructed to indicate the position of the dot-probe with right or left button press. The theta activity (4–7 Hz) was analyzed. Repeated measures ANOVAs including one between-group factor GROUP (4 levels: young female, young male, elderly female, elderly male), and three within-group factors CONDITION (4 levels: negative incongruent, negative congruent, positive incongruent, positive congruent), ANTERIOR-POSTERIOR (6 levels: frontal, frontal-central, central, central-parietal, parietal, occipital), and LATERALITY (5 levels: lateral-left, medial-left, medial, medial-right, lateral-right) were performed for statistical analysis.

Results: The theta results revealed a significant threefold interaction for ANTERIOR-POSTERIOR * LATERALITY * GROUP, $F(60.720) = 2.655$, $p = 0.001$, shortly after face onset. Frontal theta power 0–500 ms after face onset was enhanced in elderly compared to younger participants, with more theta power occurring after positive compared with negative pictures. Young male participants showed higher theta power in negative incongruent condition than young females and elderly participants. For the theta power related to the dot-probe onset, the repeated measures ANOVA showed a significant threefold interaction, CONDITION * ANTERIOR-POSTERIOR * LATERALITY, $F(60.216) = 7.537$, $p < 0.001$ for the first 500 milliseconds following dot-probe onset. More theta power occurred after positive incongruent face pairs as compared to all other conditions.

Conclusion: Theta oscillations are enhanced in attention demanding tasks, including the emotional dot-probe task. The present theta results indicate that aging influences the face recognition process and recognition of face expressions.

Keywords: attention, emotion, event related oscillations, theta oscillations

P-72

TRPM2 antagonist ACA ameliorates okadaic acid-induced cognitive impairment in ratsMurat Çakır¹, Halil Düzova¹, Suat Tekin¹, Yılmaz Çiğremiş²¹Department of Physiology, Faculty of Medicine, İnönü University, Malatya, Turkey; ²Department of Medical Biology and Genetics, Faculty of Medicine, İnönü University Malatya, Turkey

Objective: Alzheimer's disease (AD), one of the most common causes of adult dementia, is a neurodegenerative disease characterized by progressive cognitive decline. Intracellular neurofibrillary tangles (NFT), which are composed of insoluble aggregates of hyperphosphorylated tau protein in brain are considered the most important histopathogenic traits in AD. Its phosphorylation is regulated by activity of several protein kinases (PKA) and protein phosphatases (PP). Okadaic acid (OKA) is a specific PP inhibitor and it can cause the accumulation of phosphorylated forms of tau protein and induce impairments in cognitive function, neuronal morphology, glial function and free radical homeostasis. Transient receptor potential melastatin 2 (TRPM2) is an oxidative stress sensing calcium-permeable channel that is thought to contribute to calcium dysregulation associated with neurodegenerative diseases, including Alzheimer's disease. The highest expression levels of TRPM2 are found throughout the nervous system, such as neurons and microglial cells. The present study was designed to determine the protective effects of TRPM2 inhibitor N-(p-Amylcinnamoyl) anthranilic Acid (ACA) in a rat model of intracerebroventricular (icv) OKA induced AD.

Methods: In the present study, fifty male Sprague-dawley rats (320–380 g) were randomly divided into five groups (n=50): Control, Sham: Rats were injected İcv with artificial cerebrospinal fluid (aCSF) and treated vehicle (DMSO) for 13 day, ACA: Rats were treated with ACA intraperitoneally (ip) 25 µg/kg/day for 13 day, OKA: OKA was dissolved in aCSF and injected icv (200 ng) in a volume of 10 µl bilaterally. OKA+ACA: Rats injected icv with OKA (200 ng) and treated with ACA ip 25 µg/kg/day for 13 day. After 13 days of surgical operations and injections, Morris water maze (MWM) test was performed. The parameters of latency to platform and distance moved to reach the platform were evaluated using ethovision automation software.

Results: The latency to platform and distance moved of OKA injected rats were significantly increased in comparison to control, sham and ACA groups (p<0.05). In the OKA+ACA group, time latency to platform and distance moved were significantly shorter was significantly longer than OKA injected group (p<0.05).

Conclusion: Our results suggested that ACA supplementation prevented to cognitive decline.

This study was supported Inonu University BAP (2015/105).

Keywords: Okadaic Acid, Alzheimer's disease, TRPM2, N-(p-Amylcinnamoyl)anthranilic Acid (ACA)

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ERP-based biomarker candidates for the discrimination of mild cognitive impairment in Parkinson's diseaseEmel Erdoğan¹, Elif Kurt², Seda Bükür³, Başar Bilgiç⁴, Haşmet Hanağası⁴, Tamer Demiralp⁵, Canan Başar Eroğlu¹¹Institute of Psychology and Cognition Research, University of Bremen, Bremen, Germany; ²Hulusi Behçet Life Sciences Research Laboratory, Istanbul University, Istanbul, Turkey; ³Department of Neuroscience, Institute of Experimental Medicine, Istanbul University, Istanbul, Turkey; ⁴Department of Neurology, Istanbul Faculty of Medicine, Istanbul University, Istanbul, Turkey; ⁵Department of Physiology, Istanbul Faculty of Medicine, Istanbul University, Istanbul, Turkey

Objective: Currently no reliable biomarker is present for the clinical diagnosis of PD-MCI. This study investigates the usefulness of event-related brain potentials (ERPs) for the discrimination of Parkinson's disease patients with mild cognitive impairment (PD-MCI) from those without MCI (PD-NC).

Methods: Patients diagnosed at the Behavioral Neurology and Movement Disorders Unit of Istanbul Faculty of Medicine as PD-MCI (n=12) or PD-NC (n=12) took part in the study. PD-MCI diagnosis was based on clinical evaluation and ACE-R (Addendrooke Cognitive Examination-Revised), Stroop and Benton-JOLO (Judgement of Line Orientation) tests. The patients performed a two-color-Stroop test (executive function) and an ERP-design based on the novelty-paradigm for testing the sensitivity to line orientation (ORI) (visuospatial perception), while 32-channel EEGs were recorded.

In ORI task, all stimuli were composed of horizontal gratings in the background with gratings in the same orientation in the circle for frequent standard stimuli, slightly different orientation for "novel" stimuli and solid gray circle for target stimuli. Peak and mean ERP amplitude comparisons were carried out using repeated measures ANOVA in SPSS (21.0. Armonk, NY:IBM).

Results: Significantly higher peak P3 amplitudes were obtained in PD-MCI group independent of the congruence of the words and ink colors in the Stroop test (p<0.01), confirmed by the mean amplitudes in the P3 time window (p<0.02). In the PD-MCI group we obtained significantly higher P200 (p<0.01) and P3b amplitudes (p<0.005) in ERPs to target stimuli of the ORI task.

Conclusion: Significantly higher P3b amplitudes obtained in the ORI test derived from the widely used "novelty" paradigm, points to a weaker distracting effect of "novel" stimuli in PD-MCI patients. As novel and standard stimuli are discriminated by the difference between the orientations of gratings within and outside of the circle, this finding is interpreted to reflect decreased sensitivity of PD-MCI patients to line orientation. Hence, decrease of visuospatial capabilities in PD-MCI patients can be measured without active effort of the subjects. The presence of a P3 instead of a N400 potential expected for the incongruent condition of the Stroop test, and the increase of the P3 amplitude in PD-MCI group are evaluated as the results of increased resource allocation of PD-MCI cases to compensate for the dysfunction of neural circuitry related with executive

functions. ERPs might allow the estimation of visuospatial abilities in an easy and reliable manner and their usage in the development of biomarkers for PD-MCI. This study was supported by “German-Stipend” and ERASMUS-practicum-stipend.

Keywords: Parkinson’s disease, Mild cognitive impairment, Event-related potentials, EEG, visuospatial abilities

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Forecasting hypothalamic NPY, POMC and UCP2 mRNA levels according to different irisin concentrations using polynomial regression models

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Irisin is a novel-described myokine associated with feeding behavior. In our previous research, central irisin infusion increased hypothalamic neuropeptide Y (NPY) and Uncoupling protein 2 (UCP2) mRNA levels, and decreased the mRNA levels of proopiomelanocortin (POMC). The objective of this research is to forecast the levels of hypothalamic NPY, POMC and UCP2 mRNA according to intracerebroventricular (icv) irisin concentrations using polynomial regression models in rats. The study was conducted according to the protocol approved by Animal Experimentation Ethics Committee of Inonu University, Faculty of Medicine (Protocol no: 2014/A-17). In this research, 30 male Wistar-Albino rats evenly separated into three groups (n=10 per group) were infused (10 µl/h) with artificial cerebrospinal fluid for sham group and with 10 and 100 nM irisin concentrations (IC) for other experimental groups during 7 days via alzet osmotic mini pumps. The brain tissues (hypothalamus) were taken from the rats for determining hypothalamic NPY, POMC and UCP2 mRNA levels by means of RT-PCR method. Polynomial regression (PR) models were fitted to forecast the levels of hypothalamic NPY, POMC and UCP2 mRNA according to IC. The PR models were forecasted as follows: $POMC = 0.00003(IC)^2 - 0.0037(IC) + 0.0568$; $NPY = -0.0001(IC)^2 + 0.0171(IC) + 0.1672$ and $UCP2 = 0.00006(IC)^2 + 0.0076(IC) + 0.0747$. The coefficients of determination for the PR models were quite high (almost 1). The results indicated that the constructed PR models were capable of forecasting hypothalamic NPY, POMC and UCP2 mRNA levels with respect to IC. Hence, the suggested models can be used for predicting other hypothalamic neuro peptide levels based on IC. This study was supported by The Scientific & Technological Research Council of Turkey (TUBITAK; Project no:114S138).

Keywords: irisin, NPY, polynomial regression model, POMC, UCP2

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Comparison of “default mode network” activity of late onset depression patient and healthy controls

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Recent studies have shown that, problems regarding cooperation of different brain regions play important role instead of regional dysfunctions. However, neither the disease is clearly defined nor the occurrence period (syndrome or prodrome) of the deterioration is fully understood. In late onset depression, which starts after age of 45, it is thought that genetic effects are less pronounced and neurodegenerative process is more dominant in contrast to early onset depression. Thereby, it is thought that acquired pathophysiology, which starts shortly before syndrome, causes clinical symptoms. Recent studies present the evaluation of the relation of different brain regions in order to investigate the pathology. Default mode network (DMN) activity, which is disrupted in early stages of neurodegenerative diseases and activated when brain is not focused, was investigated in late onset depression. The aim of this study is to present findings of pathophysiology of the LOD by comparing functional Magnetic Resonance Imaging (fMRI) images taken from LOD and healthy individuals. Determination of brain regions in which disruption occurs during LOD can lead us to understand the pathology of the disease, develop treatment and predict the treatment prognosis. In this study, it is hypothesized that in late onset depression, the relations of DMN regions is disrupted. This disruption can be visualized using fMRI and can be used to better understand neurobiology of the disease. 15 LOD-patients and 14 healthy controls (HC) are included in this study. Following detailed-psychiatric assessment, Structured Clinical Interview (SCID-1), Mini Mental State Examination (MMSE), Hamilton Rating Scale-Depression (HRS-D), Clinical Dementia Rating (CDR) is performed. Participants underwent structural and functional MRI scanning. DMN activities of patients and HC were evaluated during the resting state. In order to determine the resting state, patients were asked to perform an fMRI task. fMRI scans during 5-minutes resting period were analyzed. In fMRI images, functional connections of DMN were compared between patients and controls using fMRG-CONN-FC software and t-tests. Compared to healthy controls, functional connectivities between mPFC and parahippocampal gyrus-posterior right (PaHg-pr) of the LOD patients were significantly stronger during resting period ($B=0.24$, $t=5.57$, $p-FDR<0.000921$). Additionally, increased functional connection of mPFC with PaHg-pr, posterior-cingulate cortex (PCC), left lateral-parietal lobe(LLP), right lateral-parietal lobe(RLP) in patient group were shown. Differences in functional connectiv-

ity of DMN sub-regions are consistent with previous studies. Increased connectivity of mPFC and PaHg-sp (responsible for memory encoding/recall and emotional processing) is shown. These neural changes can be valid diagnostic criteria in neurobiology-based diagnostic systems in the future.

Keywords: default mode network (DMN), functional magnetic resonance imaging (fMRI), late onset depression (LOD), major depression

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Structural and functional effects of extracellular matrix components in the construction of 2D and 3D embryonic mouse neuronal culture systems

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Objective: The goal of this study is to develop a functional 3D primary neuron culture with the use of a commercial extracellular matrix product called Matrigel, containing several extracellular matrix components such as fibronectin, laminin, entactin etc., in order to mimic physiological conditions *in vitro* and compare the outcomes with poly-D-lysine incorporated 2D culture systems.

Methods: Cortical primary neuron cells were harvested from 16th day embryo's (n=12) from Balb C female mice. Cell plating occurred according to 4 defined groups. Group 1: Neuron cells plated on top of Matrigel matrix (n=3), Group 2: Neuron cells co-plated with Matrigel matrix (n=3), Group 3: Neuron cells alternated by Matrigel matrix layer (n=3), Group 4: Neuron cells plated on Poly-D-Lysine matrix (n=3). All groups were analyzed by live cell imaging on cell growth, axon growth and synaps formation and further analyzed for neuronal morphology and function by Immunofluorescence (IF), Western Blot (WB), scanning electron microscopy (SEM) and confocal microscopy using neuronal (MAP2, BIII tubulin, Tuj1, Nestin, Neu-N, GABA, GAD), astrocyte (GFAP, ALDH1L1) oligodendrocyte (O4), microglia (IBA1) and surface attachment (NCAM) cell markers.

Results: Compared to Poly-D-Lysine coated matrix condition, neuronal cells formed a better 3D network on Matrigel matrix. The expression of cell cytoskeleton forming proteins and axons were clearly visible and stable on Matrigel grown neurons. Interestingly, neuronal cell bodies formed concentrated separate groups connected by thick axon bundles on Matrigel matrix. On Poly-D-Lysine coated matrix, neuron cells were evenly spread over the surface connected by single or several axons.

Conclusion: combined extracellular matrix content can offer a 3D network frame for primary neuron cultures to investigate

neuronal structure and function, especially for axonal investigations, on a more physiological level.

Keywords: cortical neuronal culture, three-dimensional culture, matrigel

P-77

Classification of dyslectic and normal readers

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Objective: Dyslexia is characterized by constant failure to gain fluent and accurate reading skills. In this study, it is aimed to classify dyslexic and control subjects based on information lies in EEG data recorded during two separate experiments, reading a word and reading a non-word.

Methods: EEG data was recorded from 27 control and 31 dyslexic patients through 14 electrodes positioned on the scalp. Reading procedure in the brain has been divided into two stages, late and early stages. Early stage of reading is considered to be between (80–120 ms) and the late stage is considered to be (200–800 ms) after the subjects observe the word they are supposed to read. Time-frequency representation of the EEG data was extracted via wavelet tranform in early and late stages, separately in four specified frequency bands. In each experiment, for each of the two stages of reading, 56 values which are measures of the activity of electrodes in each frequency band are computed. These values are employed as the features of Support Vector Machine (SVM) to classify two groups. To reduce the number of features to train SVM classifier, significantly different features between two groups are found via statistical t-test ($p < 0.05$) and are introduced as the feature set. To optimize the classification accuracy, all possible subsets of the feature set are used to train classifier and the obtained best classification accuracy is reported as the classification rate. Leave-one-out technique was applied to evaluate the efficiency of the classifier.

Results: In reading a word experiment, Dyslectics and controls were classified by 67.24%, based on the information in early stage and by 55.17% based on the information in late stage. Using the information in both stages, increases the classification accuracy to 72.41%. In reading a non-word experiment, Dyslectics and controls were classified by 74.14%, based on the information in early stage and by 67.24% based on the information in late stage. Using the information in both stages, increase the classification accuracy to 77.59%.

Conclusion: In both experiments, dyslectics and controls are distinguished more efficiently based on the data that lies in early stage of reading rather than the late stage. This indicates the more distinguishable abnormalities in dyslexic brains during early stage of reading. Classification rates are higher in non-word reading experiment in comparison to word reading experiment, which implies that reading a non-word is more challenging for dyslectic subjects.

Keywords: dyslexia, EEG, classification, wavelet

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The potential protective role of etanercept in nerve tissue damage during spinal cord injury

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Objective: To assess the neuroprotective effects of the tumor necrosis factor (TNF- α) inhibitor Etanercept (ETA) on the histopathological and biochemical changes following spinal cord injury (SCI).

Methods: Fifty-four male Wistar albino rats were randomly assigned to three main groups: the sham, trauma, and ETA group (n=18 per group). Each of these groups was further divided into three subgroups (n=6 per subgroup) based on the different tissue sampling times post injury: 1h(hyperacute stage), 6h(acute stage) and 24h(subacute stage). Clip compression model was used for SCI. Rats in the ETA group were treated with 5 mg/kg of ETA immediately after the clip was removed. After 1, 6, and 24 h the spinal cord was totally removed between levels T8-T10. Sample tissues were immediately harvested and fixed for histopathological and electron microscopic examination and were analyzed for TNF- α and interleukin-1 β (IL-1 β) levels in both the tissue and serum.

Results: After SCI in ETA group the serum and tissue levels of TNF- α and IL-1 β which were proinflammatory cytokines that causes secondary tissue damage by inducing neutrophils and microglia activation were lower than the trauma groups during the hyper-acute (1 h post SCI) and acute (6 h post SCI) stages post-injury but higher in subacute stage and the difference was statistically significant (p<0.05). Light microscopic examination of sections revealed that histopathological grades of ETA group were improved in comparison with the trauma groups. When the ETA groups compared with each other the histopathological grade of subacute stage was higher than the acute stage and the difference was statistically significant (p<0.05).

Conclusion: In our study biochemical and histological findings suggest that early administration of ETA after SCI may remarkably attenuate secondary tissue damage due to injury by decreasing tissue and serum TNF- α and IL-1 β levels in hyperacute and acute stages but single dose may not be sufficient to maintain beneficial effects of ETA through 24 h post injury.

Keywords: spinal cord injury, nerve tissue, etanercept

P-79

Analyzing the effect of dominant hemisphere according to handedness on auditory attention and memory: a pilot study

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Objective: Most functions of human brain represented asymmetrically between two hemisphere. This gives rise a phenomenon called as cerebral lateralisation. Hemispheric asymmetry brings out many differences in behavioral, motor and intellectual skills. There is a great amount of study in the literature interested in differences of cortical functions such as language, memory, attention and learning between right handed and left handed peoples. In this pilot study we aimed to analyze the effect of dominant hemisphere according to handedness on auditory attention and memory.

Methods: We included 48 healthy young volunteer, age between 18–25 in this current study (6 left handed, 42 right handed). Handedness is assessed by Turkish translation of modified form of Oldfield Hand Preference Questionnaire (2). All participants were tested by Wechsler Adult Intelligence Scale Revised Edition's (WAIS-R). Digit Span Forwards test and Digit Span Backwards tests in order to assess the auditory memory and initial two task of WMS3 test for assessing attention.

Results: WAIS-R Digit Span Forwards tests mean score was 6.21 \pm 1.01 in right handeds while it was 7 \pm 1 in left handeds and it was 6.33 \pm 1.03. WAIS-R Digit Span Backwards tests mean score was 4.12 \pm 0.78 in right handed group while it was 4 \pm 0.81 in left handed group and it was 4.10 \pm 0.77 among whole participants. Mean duration of finishing the first task of WMS3 test was 12.91 \pm 3.60 sec for right handeds while it was 15.42 \pm 6.26 sec for left handeds and it was 13.28 \pm 4.10 among all participants. Mean duration of finishing the second task of WMS3 test was 6.68 \pm 1.45 sec for right handed group while it was 7 \pm 1 sec. Mean duration of finishing this task was 6.72 \pm 1.39 sec among all participants. We used Mann Whitney U test for analyzing non parametric data. There is no significant difference between two groups results of each form of WAIS-R Digit Span tests. But left handed groups mean score was higher than the right handed group for these two tests. There is no significant difference between two groups according to the mean duration of finishing initial two WMS3 task.

Conclusion: Handedness is most used indicator for hemispheric dominance. It has been claimed that right hemisphere has a great importance on maintaining attention. We couldn't found any statistically significant difference between right handed groups and left handed groups according to our results. But by enlarging the number of participants these parameters can be more clearly understood.

Keywords: handedness, dominance, attention, memory

P-80**Investigation of long-term potentiation in young and old hyperthyroid rats**

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Objective: Continuous remodeling of synaptic connections in response to neuronal activity, synaptic plasticity, is widely thought to underlie learning and memory. The two best-characterized forms of synaptic plasticity are long-term potentiation and long-term depression. Both are accompanied by long-lasting changes in synaptic strength. Aging is associated with specific impairments of learning and memory, which include deficits in the induction and maintenance of LTP and lower thresholds for depotentiation and LTD, some of which are similar to those caused by experimental hypothyroidism. In order to better understand the relationship between age-dependent cognitive decline and thyroid hormones, long-term synaptic potentiation is aimed to investigate in young and old euthyroid and hyperthyroid rats.

Methods: Two age groups of Wistar male rats, young rats ranging in age from 60 to 90 days old and old rats ranging in age from 270 to 300 days old, were used in this experiment. Thyroxine (0.2 mg/kg, ip) was administered for 20 days to young rats starting at post natal day 40, and to old rats starting from post natal day 210. LTP was induced by application of high frequency stimulation protocols at the perforant pathway-dentate gyrus synapses.

Results: Serum T4 levels were higher than 30% of that of age matched controls after 3 weeks of treatment. The presence of a significant age effect ($p < 0.01$) showed that higher stimulus intensities are required to induce the same field potential in older rats compared to young rats. Two-way ANOVA for PS-LTP revealed a non significant age effect ($p > 0.05$), and a non significant thyroid state effect ($p > 0.05$), but a significant interaction between these factors ($F_{1,20} = 12.26$; $p = 0.002$). Post-hoc Tukey's test followed by one-way ANOVA revealed significant differences between young euthyroid and old euthyroid rats ($p = 0.005$), between old euthyroid and old hyperthyroid rats ($p = 0.027$). There was no significant difference between young euthyroid and young hyperthyroid rats and young euthyroid and old hyperthyroid rats ($P_s > 0.05$). Similar results were confirmed for the magnitude of EPSP-LTD.

Conclusion: It is thought that LTD is necessary to prevent saturation of synapses that become potentiated during LTP. Without such balance between LTP and LTD, all the synapses are potentiated toward the upper limit or depressed toward the lower limit. These results suggest that hyperthyroidism may decrease in age-dependent LTP impairment; however, the precise underlying mechanism(s) remains to be elucidated.

Keywords: memory, learning, hyperthyroidea, long term depression, long term potentiation

P-81**Effects of A2A receptors on hypoxic ventilatory response in intermittent and sustained hypoxia models**

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The ventilatory response to hypoxia (HVR) depends on the pattern, intensity and time domains of hypoxic exposure and involves several physiological mechanisms. LTF is known as a persistent augmentation of ventilation and respiratory motor output after a long time period (>1 hour) induced by AIH. 5-Hydroxytryptamine (Serotonin; 5-HT) secretion induced by AIH is also necessary to stimulate the ventilation. With a similar protocol but more severe hypoxic episodes, a distinct adenosine-dependent mechanism is also elicits LTF and cause a cross-talk inhibition with 5-HT receptors. CSH also increases normoxic ventilatory drive and the HVR, which is termed ventilatory acclimatization to hypoxia (VAH). Serotonin-dependent mechanism could be help to explain cellular mechanism of VAH. However, only this mechanism insufficient to explain VAH. The objective of this project is to compare and contrast the cellular signals for neural plasticity in the reflexes that control breathing in LTF versus VAH. In this study we used 3 group (for each group $n = 6$). Before measurements an intrapleural cholera toxin B (CtB; 0.25 μ l) injection done with 3 rats in each groups. Normoxia group kept in normoxic conditions (O_2 ; 20.93%) for 1 week. We used whole body pletismography (WBP) to measure ventilation, breathing frequency and tidal volume for AIH (O_2 ; 10%) group. Lastly, CSH group exposed to hypobaric hypoxia condition (O_2 ; 10%, PO_2 ; 380 mmHg) for 1 week. We perfused and fixed the all body after each measurement. Then taken out the spinal cord (C3-C5) and brain stem (Nükleus Traktus Solitarius; NTS) tissues to localize and quantify the 5-HT_{2A} and A_{2A} receptors with immunofluorescence staining. For statistical analysis, $p < 0.05$ significance level was adopted. In this study we discussed the possibility that interactions between pathways confer properties to LTF, including pattern sensitivity and formation of VAH. For our results activated 5-HT pathway caused pLTF but not vLTF after exposed to moderate AIH conditions. Activated adenosine A_{2A} receptor pathway showed similar effect to elicits plasticity with VAH during sustained hypoxia. Understanding these mechanisms and their interactions may enable us to understand plasticity as a treatment for patients with ventilatory impairment or other motor neuron deficits.

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Keywords: acute intermittent hypoxia, chronic sustained hypoxia, hypoxic ventilatory response

P-82**Age-related prepulse inhibition (PPI) changes in rats**

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Objective: Prepulse inhibition of the acoustic startle shows sensory motor gating capabilities. Disrupted PPI is accepted one of the biological endophenotypes seen in psychotic disorders such as schizophrenia. Early diagnosis and treatment is expected to change of the progress of the disease in a better way. Thus, detection of high risk groups and starting the treatment before the appearance of disease is important. The aims of this study are 1) early detection of age-related changes by using PPI 2) observation of the change in the value of PPI during the transition from adolescents to the adulthood, and 3) to examine the response to the treatment of these high risk groups.

Methods: Six weeks old male Wistar rats were used at the beginning of the study. Startle reflex apparatus were used to measure PPI. Animals were grouped according to baseline PPI levels as low inhibitory (LI), medium inhibitory (MI) and high inhibitory (HI). Baseline PPI levels according to the time-dependent change were followed weekly for 8 weeks. Subsequently, acute and subchronic (8-day) clozapine treatment were administered and PPI levels were investigated. In order to measure the drug efficacy, after the last injection PPI levels were measured for 22nd week.

Results: Animals were divided as LI and HI subgroups at the 10th week ($p < 0.05$). Between the 10 and 18 weeks PPI levels remained significant for LI and HI groups. Subchronic clozapine treatment between 18 and 19 weeks did not change the PPI levels for HI group but it improved LI group. The measurements on 22nd week showed that significant difference LI and HI groups of the PPI levels were present.

Conclusion: Our study shows that animals can be grouped according to the baseline PPI as shown in previous studies. Differences between LI and HI groups in the life cycle of the rats were continuing throughout adolescence. LI groups can be defined as high-risk groups and this group gives significant response to treatment of subchronic clozapine. Key finding of the study is that drug therapy in early adolescence gives a positive response to the treatment. To our knowledge, this is the first study showing PPI level changes from the adolescence to adulthood. The presenting data can be useful in early diagnosis and treatment of the disease process in the future.

Keywords: Schizophrenia, prepulse inhibition (PPI), clozapine, age, experimental Animal Model

P-83

MR spectroscopy in the diagnosis of nonketotic hyperglycinemia (NKH): a case report

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Objective: Nonketotic hyperglycinemic (NKH) is an otozomal inherited disease due to the lack of glycine activity of mitochondrial enzyme complex. NKH is usually seen in newborn. It is manifested by symptoms such as difficulty sucking, hypotonia, lethargy, and convulsions. Most of the patients lose their lives early; the survivors face with the serious neurological disorders. The accumulation of glycine in blood, urine, and cerebrospinal fluid is decisive for the diagnosis of the disease. Meanwhile, the high peak of glycine obtained by using magnetic resonance spectroscopy (MRS) is also specific for NKH. MRS offers a non-invasive method for diagnosing and monitoring of NKH disease.

Methods: Magnetic resonance spectroscopy is a non-invasive technique that can distinguish various chemical metabolites in the body by use of different resonance frequencies. In this study, the conventional and diffusion-weighted MR images of the patient diagnosed with NKH were obtained at 1.5 T MR. Additionally, multi-voxel brain MRS data were collected, and the cerebrospinal fluid glycine level was measured.

Results: Corticospinal tract myelinated localisations at birth were determined in diffusion-weighted MR images. The glycine peak was obtained as 3:56 ppm at MRS. The diagnosis of NKH was confirmed by MRS through the glycine peak.

Conclusion: The diagnosis and monitoring of NKH disease using MRS could be alternative to the other invasive methods. The results obtained from this case should be confirmed on a larger patient population.

Keywords: Nonketotic hyperglycinemia, MR spectroscopy, Diffusion-weighted MRI

P-84

The anatomical comparison of the EEG data collected from dyslexic and control groups using functional and effective brain connections obtained by Partial Directed Coherence (PDC) and Dynamic Bayesian Networks (DBN)

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Objective: Dyslexia is a learning disorder that makes reading hard although normal intelligence level. The progress of processing of information takes longer in dyslexic people than non-dyslexic people and the reason behind it is the complexity in information flow of dyslexic brains. In this study, the distortion in the dyslexic brains is investigated in terms of effective connectivity which aims to explain causal relationships between different parts of the brain and functional connectivity which aims to explain functional relationships between different parts of the brain. These models are obtained from electroencephalography (EEG) data which were collected from both

dyslexic and healthy subjects according to the before-stimulus (pre-reading) and after-stimulus (reading) intervals. In order to model the effective connectivity Dynamic Bayesian Networks (DBN) while in order to model the functional connectivity Partial Directed Coherence (PDC) are used and results are being compared in anatomical basis.

Methods: In this study, the data is being used collected by a 10-20 system EEG device from the scalp of both dyslexic and control groups in Ankara University Faculty of Medicine. The number of electrodes being used was decreased to 14 considering the experiment. The data collected were checked and preselected by the experts. After the preselection, there remained 31 subjects from dyslexia and 27 subjects from control groups. The data then preprocessed by normalizing and removing noise. In order to obtain the functional connectivity by PDC, the EEGLAB Toolbox (Mullen et. al., 2010) with SIFT Toolbox (Delorme et. al., 2011) which are toolboxes for MATLAB. In order to obtain effective connectivity by DBN, DBmcmc MATLAB Toolbox is used. The models are being compared according to the groups and in anatomical basis.

Results: For both groups, it is observed that the parietal lobe plays an important role in connecting the occipital lobe with other lobes of brain. For both groups, it is observed that, in before stimulus-interval, there are less functional connections but with high connectivity intensity; in after-stimulus interval, there are more complex connections but with less intensity. The study is still going on and through time it is expected to have more results and the new results will be added.

Conclusion: The parietal lobe is in contact with other brain lobes in terms of functionality in both pre-reading and reading intervals. Since the study is still in progress, it is expected to obtain more and better results as time goes by.

Keywords: Brain connectivity modelling, Dynamic Bayesian Networks, Dyslexia, EEG, Partial Directed Coherence

P-85

Resting state networks in major depressive patients

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Objective: Brain connectivity refers to a pattern of anatomical links (anatomical connectivity), of statistical dependencies (functional connectivity) or of causal interactions (effective connectivity) between distinct units within a nervous system. We aimed to find and explain the differences in resting state networks between major depressive disorder (MDD) patients and healthy controls. The methods and procedures used in the study had approval from the Ankara University Institutional Review Board.

Methods: Functional magnetic resonance imaging was performed on 8 MDD patients and 20 healthy control subjects (age range: 18–45). The subjects were instructed to keep their eyes open and stare to a cross (“+”) during scanning without thinking a particular thing. Data were analyzed by SPM8 toolbox on MATLAB. The regions of interest (ROI) were chosen on the base of our previous fMRI study investigating the brain regions responsible for time perception and reward circuit on healthy subjects. Accordingly, five brain regions were defined as our ROIs. These regions included left and right medial frontal gyri, right and left inferior parietal lobules, left medial temporal gyrus for time task and caudate nucleus for rewards circuit. The ROIs which showed significant interaction between time perception and reward prospect were left posterior insula and left posterior cingulate cortex. All of ROIs and their connectivity with each other during resting state were analyzed in Conn program of SPM8 toolbox on MATLAB among MDD patients and healthy controls.

Results: Connectivity between left posterior cingulate and left superior frontal regions was different between MDD and control groups ($p < 0.05$). Left posterior insula and anterior cingulate cortex connectivity was also different between two groups ($p < 0.05$). Finally left middle temporal cortex and precuneus connectivity was different between 2 groups.

Conclusion: The left hemisphere of MDD patients showed significant connectivity differences when compared with healthy control subjects. These differences may help to explain the psychopathology underlying the MDD symptoms.

Keywords: connectivity, major depressive disorder, resting state networks

P-86

DTI in MDD patients reveals widespread white matter changes in reward circuit and regions responsible for time perception

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Objective: We aimed to investigate brain white matter diffusivity abnormalities in major depressive disorder (MDD) patients in relation with time perception and reward prospect.

Methods: Diffusion tensor imaging (DTI) was performed on 8 MDD patients and 17 healthy subjects. The methods and procedures used in the study had approval from the Ankara University Institutional Review Board. Voxel-wise statistical analysis of fractional anisotropy (FA) and mean diffusivity (MD) maps were carried out using tract-based spatial statistics (TBSS), a part of

FSL 4.1.3. software (<http://www.fmrib.ox.ac.uk/fsl/>) and significantly affected voxels were labeled using a human brain white matter atlas. Johns Hopkins University WM tractography and the International Consortium for Brain Mapping DTI-81 WM atlases included in FSL. Preprocessing of the FA and MD maps included eddy current correction, brain extraction and tensor fitting. The regions of interest (ROI) were chosen on the base of our previous fMRI study investigating the brain regions responsible for time perception and reward prospect on healthy subjects. Accordingly, 19 brain regions were defined as our ROI. **Results:** Compared to control subjects, we detected widespread significant decreases in fractional anisotropy (FA), and increases in mean diffusivity (MD) in structures including right superior parietal lobule, right corona radiata (anterior part), right and left fornix, right external capsule, right and left corona radiata (superior part), right superior longitudinal fascicle, left cingulum, right and left premotor cortex in MDD patients. On the other hand the FA significantly increased and MD significantly decreased in brain regions including left uncinate fascicle and left corona radiata (anterior part) in patients. There were no statistically different changes regarding FA and MD values in right and left superior frontal gyrus, left superior parietal lobule and right cingulum.

Conclusion: The diffusion tensor imaging showed widespread changes in frontoparietal, frontotemporal and limbic tracts in patients. These findings might explain why MDD patients have disturbances in reward processing and time perception.

Keywords: Diffusion tensor imaging, major depressive disorder, reward circuit, time perception

P-87

The evaluation of childhood traumas, dissociation and the affective neuro-science personality scale results in women

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Objective: In this study it is aimed to reveal the profile differences and relationships of women, both who reported traumatic experiences and those who didn't, in terms of the dissociative experience levels and the basic affective styles.

Methods: The study group which consisted of 222 female teachers was randomly chosen from ten high schools in five counties (two schools from each) in Anatolian Side of Istanbul. To obtain the required data, Childhood Trauma Questionnaire (CTQ), Dissociative Experiences Scale (DES) and The Affective Neuroscience Personality Scale (ANPS) were applied to participants.

Results: While 39,8 % (79) of the participants reported childhood psychological trauma, 60,2% (115) of the participant women didn't report any psychological trauma. According to the research results CTQ scores are: Emotional neglect=14.82±3.96;

emotional abuse=10.61±4.05; sexual abuse=9.03±4.95; physical neglect=8.91±3.27; physical abuse=7.43±3.39. Consequently total CTQ score for the participant group is 50.79±13.37. The participants' DES scores are 9.93 for the women who didn't report trauma and 21.76 for the women who reported trauma. It was found that women who reported childhood psychological trauma, scored higher on sub scales of ANPS' fear ($t_{189}=2.78$ ve $p<.05$); anger/rage ($t_{189}=2.14$ ve $p<.05$), sadness ($t_{189}=3.70$) and spirituality ($t_{189}=2.05$ ve $p<.05$) than the women who did not report childhood psychological trauma. The research showed that the women with high DES scores also have high ANPS fear ($r=.503$) and sadness ($r=.557$) scores. Another finding is that as the participants' age of trauma gets younger, (youngest 4 years, oldest 19 years), DES scores increase ($p<.01$). While it is found that there is a negative correlation between the trauma age and fear ($r=-.206$ ve $p<.01$) and sadness ($r=-.263$ ve $p<.01$); there is a significant positive correlation between trauma age and anger/rage ($r=.534$ ve $p<.01$) and spirituality ($r=.347$ ve $p<.01$).

Conclusion: A positive correlation was found between the reported childhood psychological trauma and dissociative experience levels. It was found that women who reported childhood psychological trauma, scored higher on sub scales of ANPS' fear, anger/rage, sadness and spirituality than the women who did not report childhood psychological trauma. Moreover, the results showed that women who reported childhood psychological trauma with high level dissociation had much more significant positive correlation with sub scales of ANPS' fear, anger/rage, sadness and spirituality than the women who did not report childhood psychological trauma. These results are consistent with the generally accepted psychological trauma literature related to the relationship between the psychological trauma and dissociation. The research results can be interpreted as psychological trauma has long-lasting effects on basic human emotions, affective styles and cognitive processes that which they believed to have been built on and in addition to this, it can be concluded that traumatic memory is a special type of memory.

Keywords: trauma, dissociation, affectiveness

P-88

Brain lymphatic system: to be or not to be?

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Objective: Clearance of excess fluid and interstitial solutes is critical for all tissue homeostasis. Although the central nervous system is characterized by a high metabolic rate, it lacks conventional lymphatic system. The purpose of this evaluation; to make a review on cleaning system of the central nervous system from the neurotoxic wastes, the studies on the lymph vessels that are located close to dura mater and to examine the recent developments.

Methods: Pubmed and ScienceDirect were scanned and examined articles on this subject.

Results: Some researchers have defined “Glymphatic System” that based upon glial dependence and the functional and structural homology to the peripheral lymphatic system. Glymphatic system consists of 3 elements: perivascular space surrounding by astrocytic endfeet, interstitial space and perivenous space. Cerebrospinal fluid (CSF) fills the paravascular space and then enters into the interstitial space. Neurotoxic waste products in the interstitial space enter into the perivenous space with CSF and thus waste products are cleaned. The factors that drive the glymphatic system are arterial pulsatility and sleep. The factors that reduce the glymphatic system are awakeness and aging. Some researchers suggest that low activity of the glymphatic system could be a major risk factor for development of neurodegenerative diseases. In recent years some researchers have found new lymphatic vessels near the brain venous sinuses.

Conclusion: The presence or absence of brain lymphatic system is still a popular topic in neuroscience. Future studies with focus on the brain lymphatic system are expected to identify mechanisms and treatment of neurodegenerative diseases.

Keywords: glymphatic system, neurodegenerative diseases, cerebrospinal fluid, perivascular space, sleep

P-89

The relationship between life satisfaction and the neuroplasticity awareness and development

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Objective: With ‘Neuroplasticity Awareness and Development Education Program’ application (NADEP, created researcher), aimed neuroplasticity awareness and development of university students, depending on this, their life satisfaction increased and sustainability of growth ensured. Hypotheses: 1. Compared to control group, there’ll be increase in neuroplasticity awareness and development level of experimental group. 2. Increase with those NADEP applied ones in their neuroplasticity awareness and development level’ll continue in monitoring measurements, done after 2 months following completion of sessions, there’ll be no change in control groups. 3. the more their Neuroplasticity Awareness and Development Scale (NADS) score increases, the more their life satisfaction’ll increase.

Methods: Research carried out on 326 students in Ordu University SSVF during 2013–2014 Academic Year. 163 people took part in experimental and 163 people took part in Control Group. First, ‘pre-test’ practice carried out for all subjects for condition determination. 16 sessions for Experimental Group done, each 60 minuted NADEP sessions. Group sessions carried out twice a week with a four houred program (2+2). Control Group didn’t receive training. Experimental group asked to apply their experiences during six months in their lives. To determine whether there happened improvement after six months or not, ‘final test’ practice applied to all subjects. In order to determine

whether the improvement would continue or not, tracking test applied. NADS used in pre-final and monitoring test created by researcher. For detection of life satisfaction, Kohler Life Satisfaction Scale (LSS) used. Difference between NADS-LSS pre and final test scales of experimental and control group tested with two-factor variance analysis (ANOVA). Findings concerning comparison of NADS-LSS pre and final test scales of experimental and control group stated in arithmetic mean and standard deviation values. KMO value of preliminary joint found 0.668 in pretest, 0.976 in finaltest and 0.978 in monitoringtest. Harmony between NADS finaltest and monitoringtest is %99. χ^2 /sd value is 2.18; CFI, NFI values are 0.99, RMSEA, 0.059 GFI (0.81) and AGF is (0.78). NADS-LSS correlations, posttest-monitoringtest pearson coefficient is 0.992.

Results: In first two hypotheses; there has been increase in neuroplasticity awareness and development of experimental group, no change seen in control group. It seen this change in experimental group continued in monitoringtest after 2 months following finaltest, also seen increase in life satisfactions of control group turned out to be more than %100 and no development in control group noticed. In third hypothesis, pearson correlation coefficient between NADS-LSS showed harmony between them. It appears the more score of experimental group increases, the more their life satisfactions increase. Improvement of 163 subjects got Neuroplasticity awareness training and applied this training in their lives is important as for showing the fact that neuroplastic improvement capacity of people and their life satisfactions could be fairly increased.

Keywords: university students, neuroplasticity, awareness, life satisfaction

P-90

Investigation on possible behavioral changes caused by Othmer’s neurofeedback application on healthy subjects

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Objective: Neurofeedback (NFB) methods are one of the popular contemporary research and alternative therapy areas. These techniques have several varieties, which are being used as additional medical support for some time. However, the efficacy and the mechanism of action of NFB studies are quite limited. In the present research, the effects of the training through a commercially available neurofeedback system are examined on healthy subjects in terms of stress-depression scales, QIK test performance and heart rate variability.

Methods: With a random sampling of volunteers, two groups are planned as an experimental group (n=25) receiving Othmer training and a control group receiving no training (n=25). In the first part as a pre-test, both study groups’ participants are evaluated by STAI Form I-II and DASS to define psychological states

regarding stress, depression or anxiety, and also by QIK test, which is widely used in NFB applications to determine the levels of attention, concentration and impulse control. Moreover, for HRV analysis, ECGs from D2 derivation are recorded during 15 minutes in both groups. Then, members of experimental group are trained by Othmer approach with 12 sessions lasting half-hour each, during one month (three days a week).

Results: Results indicate that trait anxiety level decreases both within experimental group and compared to control group in terms of STAI-II Form. Also, similar findings are seen in the depression subscale of DASS. QIK test results were homogeneous among the groups and although it has some statistically significant differences within both experimental and control groups, the development of attention parameters in experimental group was more evident. There were no significant difference in terms of HRV analysis in the study groups due to NFB.

Conclusion: Our results suggest that, Othmer training may cause some significant and generally positive changes in healthy volunteers. This study reveals the necessity of more controlled experiments to investigate whether NFB application can be useful for the treatment of the above mentioned parameters.

Keywords: brain training, EEG, heart rate variable, neurofeedback, othmer's method, QIK test

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Hemispheric specializations for recognition of emotional expressions in facial transplantation patients

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Objective: Face perception is executed by a complex bilaterally distributed network in the brain. However, a large number of imaging and behavioral studies indicated a right hemispheric (RH) specialization. According to Approach/withdrawal Hypothesis, there are different hemispheric asymmetries for different emotional experiences and expressions. The approach emotions such as joy and interest are related to the left frontal brain activity, while withdrawal emotions such as sadness, fear and disgust are related to the right frontal brain activity. One of the important developments about face is face transplantation. It was showed that a face transplantation patient sensed perceptions that belonged to face when his fingers were stimulated and fMRI findings showed reorganization of somatosensory regions for face and hand. In another study, it was observed that patients experience the subjective feelings of emotions, however they could not be observed by other people. Additionally, the facial muscle activity of the patients during emotional expressions were different than that of healthy individuals. It was aimed to examine if the facial transplantation patients who had injury on face since infancy, have the hemi-

spheric asymmetry patterns those supposed to be in healthy individuals according to "Approach/withdrawal Hypothesis".

Methods: Two facial transplantation patients and a control subject participated. Data collection from healthy individuals will be continued. Ten happy faces (5 male, 5 female) and 10 sad faces (5male, 5female) were used. The subjects were instructed to fix their heads in the chin rest and focus on the fixation point. A facial stimulus was presented in right visual-field/left hemisphere (RVF/LH) or left visual-field/right hemisphere (LVF/RH) for 180 msec. They were asked which facial expression they had seen and told to press "1" on the keyboard if the face was happy and to press "2" if it was sad. The correct responses and response time were recorded. E-Prime-2 software was used.

Results: Consistent with Approach/withdrawal Hypothesis, the control subject evaluated the happy faces faster in RVF/LHcondition, while he evaluated the sad faces faster in LVF/RHcondition. No difference was found for correct responses. The first patient evaluated the happy and sad faces faster in LVF/RHcondition. He had no incorrect responses. For the second patient, no difference was observed between the response time in two conditions. However, a LVF/RH advantage was found for the correct responses in evaluation of sad faces.

Conclusion: The findings indicated that there might be a different neural organization in recognition of facial expressions of emotions in facial transplantation patients.

Keywords: face, facial transplantation, facial expressions of emotions

P-92

Wistar rats and GAERS in various brain regional comparison of number of calbindin containing neurons

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Talamus which is a part of the diencephalon in central nervous system has anatomical and functional importance. It consists of a lot of neuron groups which is assigned with sensory, motor and limbic functions. Thalamic nuclei can be classified according to type of received stimuli which will be send to cortex. Anatomically, the thalamic nuclei are divided into three groups according to internal medullary lamina. Several experimental models are available, which have similarities genetically or chemically different types of epileptic seizures in humans. Genetic Absence Epilepsy Rats of Strasbourg (GAERS) are known as experimental animals used for polygenetic rat model of absence epilepsy. Thalamocortical loops are important in the pathogenesis of absence epilepsy. Studies in the rat model of absence epilepsy have shown to be associated with a wide inhibitory neurotransmission of talamus seizures. Calcium supplements of the binding protein with high affinity to calcium and it is a protein essential calcium transport. Imbalances in the distribution of

intracellular calcium-binding protein can be associated with the mechanism of diseases such as epilepsy. It is also used as anatomical markers to identify specific neurons. In this study, we analysed the amount of neurons containing calbindin in laterodorsal thalamic nucleus comparing between the Wistar rats which were chosen as a control group and epileptic rats (GAERS) chosen as a lesioned group. The parts of cross sectional brains containing laterodorsal thalamic nuclei were observed and cut consecutively. In these sections, the detection of neurons containing calbindin was prepared according to monoclonal antibody dying protocol. When the brain areas and sections are compared to one another, there is detected that calbindin levels are decreased in laterodorsal thalamic nucleus, somatosensorial cortex, insular and piriform cortex, supraoptic nucleus, thalamic medullary stria, amygdoloid nucleus, mediodorsal thalamic nucleus and hypothalamic nuclei. As can be see at other experimental models of epilepsy, the level of calbindin positive cells are decreased according to Wistar in this study. These results are the first findings in the literature.

Keywords: Calbindin, talamus, laterodorsal thalamic nucleus, GAERS, brain section

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Anticancer effects of *Momordica charantia* extracts on SH-SY5Y human neuroblastoma cells

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Objective: Neuroblastoma is one of the most common and frequent types of cancer that occurs in childhood period. Investigating of novel effective and safe treatment methods or therapeutic agents for the treatment of neuroblastoma are important. *Momordica charantia* is usually used in folk medicines as a remedy for some diseases and various studies showed that *Momordica charantia* has anticancer, antidiabetic, antibacterial, antiviral, antioxidant and antienflamatuar effects. Anticancer potentials of *Momordica charantia* growing in Turkey are unknown. In our study, we aimed to investigate anticancer drug potentials of *Momordica charantia* extracts against SH-SY5Y neuroblastoma cells and intracellular signal pathways of them in these cells.

Methods: Root, leaves, seed and fruit of *Momordica charantia* plant that grow in Istanbul, Turkey were extracted separately. To investigate cytotoxic activity of these extracts, we have treated SH-SY5Y human neuroblastoma cells and ECV304 human endothelial cells with root, seed, leaf and fruit extracts of *Momordica charantia* at different concentration (500, 50, 5, 1

µg/ml), and cell viability was determined by MTT test. Apoptotic effects of *Momordica charantia* root extract on SH-SY5Y human neuroblastoma cells was analysed by using DNA fragmentation assay. Also, we assessed that effects of *Momordica charantia* extracts on expression levels of apoptotic genes and also their protein levels in neuroblastoma cells and suggested a possible intracellular signal pathway.

Results: *Momordica charantia* root extract has cytotoxic effect above 50% on SH-SY5Y human neuroblastoma cells. On the other hand *Momordica charantia* root extract has proliferative effect on ECV304 human endothelial cells. Apoptotic effect of *Momordica charantia* root extract was screened with DNA fragmentation assay. Furthermore, *Momordica charantia* root extract decrease BAD and cleaved caspase-3 protein level and gene expression but it increase AKT1 and p38 gene expression.

Conclusion: Based on our results, we suggested that *Momordica charantia* root extract can trigger apoptosis through p38 MAPK pathway. In addition to this, these results showed that *Momordica charantia* root extract can have anticancer drug potential for neuroblastoma.

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Keywords: SH-SY5Y human neuroblastoma cells, *Momordica charantia*, cytotoxicity, apoptosis, anticancer drug potential.

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Investigation of the effects of hypoxia on SH-SY5Y cells on graphene oxide sheets

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Objective: In the central nervous system (CNS), neurons are highly sensitive to the availability of oxygen. If oxygen availability is decreased, neurons can degenerate, leading to injury and cell death. Hypoxia is involved in several CNS pathologies, including stroke, head trauma, neoplasia, vascular malformations and neurodegenerative diseases. The human neuroblastoma SH-SY5Y cell line is a well-studied cellular model of neuronal differentiation *in vitro*. Graphene is one of the most attractive nanostructured materials. Due to its unique electrical properties, graphene is considered in potential treatments for regulating neural cell behavior in CNS degeneration. The aim of this study is using graphene oxide (GO) sheets as a scaffold, seeding SHSY5Y cells on it and differentiating them with and without retinoic acid, and evaluating the effects of graphene oxide on neuronal behavior under hypoxic stress conditions.

Methods: Graphene oxide powder was coated onto glass slides as a thin film. SHSY5Y neuroblastoma cell line was cultured in DMEM- HG with 10% fetal bovine serum (FBS), and seeded on graphene oxide sheets. Seeded cells on glass slides were used as a control group. 10 μ M retinoic acid was used for neuronal differentiation. Cells were incubated at hypoxic (3% O₂) and normoxic (21% O₂) conditions in a hypoxia chamber for five days. Cell viability was shown by MTT test. Morphologies of cells were examined by scanning electron microscopy (SEM) and actin staining.

Results: According to MTT results our cells are more resistant to hypoxia on GO sheets and actin staining and SEM images are contributed to MTT results.

Conclusion: The study will evaluate the possibility that GO has potential use for therapy of hypoxia induced neurodegenerative diseases.

Keywords: graphene oxide, hypoxia, SHSY5Y cell line

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Partial corpus callosum agenesis and colpocephaly: a case report

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Objective: Corpus callosum is the largest fibre pathway connects two cerebral hemispheres. Development of the corpus callosum occurs during weeks 8–20 of gestation. Conditions such as chemical agents, hypoxia or chromosomal defects may result in complete or partial defects in the corpus callosum. Agenesis of the CC ranges in occurrence from 0.3–0.7% in the general population to 2–3% in the developmentally delayed population. Corpus callosum agenesis is a rare congenital anomalies are often combined with other commissural fibre anomalies such as anterior and hippocampal commissure. In this case partial agenesis of the corpus callosum, as well as anterior, posterior and hippocampal commissure agenesis accompanying colpocephaly was present.

Methods: A brain material obtained from a 50-year-old, 70 weights and 165 cm lengths man's body was used during autopsy at Pamukkale University department of forensic sciences. Craniotomy was performed. Brain was removed, weighted, dissected midsagittally and photographed. After dissection midsagittally, coronally interval of 2 cm serial sectioning was performed and sections were photographed. In order to operations need to be completed within the period of forensic autopsy following investigations were carried out with photographs.

Results: Partial corpus callosum agenesis, complete agenesis of anterior, posterior and hippocampal commissure in addition to dilatation of inferior horn of lateral ventricle and colpocephaly was determined. Pole of temporal lobe cortex was very

thin and disrupted during the dissection. Two cerebral hemispheres was adherent in the lower part of the medial surface of the frontal lobe. Occipital lob gyri were thinner than the other lobes. There was no cingulate gyrus and gyri of temporal lobe run vertically to diencephalon in medial surface. Based on information received from the family, case had no known psychiatric diagnosis but had learning disability also he did not graduate from school and it was learned that worked as a worker in a workplace.

Conclusion: Isolated callosal agenesis may be asymptomatic but it can be understood with special tests showing interhemispheric transformation. While Corpus callosum agenesis is often associated with epilepsy in literature, in this case the absence of epilepsy shows that agenesis is not always associated with epilepsy. Dilatation of inferior horn of lateral ventricle and colpocephaly is expected to show the relationship between developmental disability of anterior commissure and temporal cortical or white matter dysgenesis. Examining whether the agenesis of corpus callosum in mental retardation and learning disorder cases using neuroimaging methods such as magnetic resonance imaging may be clinically important.

Keywords: corpus callosum, agenesis, postmortem, autopsy

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Investigation of various caspases expression levels in nervous system of paclitaxel applied mice

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Objective: Paclitaxel is a widely used anticancer agent. The purpose of this study is to investigate the caspase-3, -8, and -9 expression levels in central and peripheral nervous systems of paclitaxel applied mice.

Methods: 27 male BALB/c mice were divided into three groups as; paclitaxel (PTX, n=8), vehicle (VEH, n=8), saline (SLN, n=11). Animals received PTX/Vehicle/Saline on 0th, 4th, 8th, and 9th days. Last days animals sacrificed under anesthesia. Sciatic nerves and brain hemispheres were removed. qRT-PCR experiments were done for caspase-3, -8, and -9.

Results: For sciatic nerves PTX and VEH received animals had higher caspase-3, -9 levels when compared to SLN group. There is no difference between groups according to their caspase-8 levels. For brain there is no difference between groups for each caspases expression level.

Conclusion: PTX mostly and VEH partially caused intrinsic apoptotic enzymes activated in sciatic nerve, this may be the result of neurotoxic effects of PTX application. It seems that blood brain barrier kept the central nervous system safe to that anticancer agent.

Keywords: paclitaxel, neurotoxicity, caspases, qRT-PCR

P-97**Persistent irregular activity is a result of intrinsic rebound and coincident detection mechanisms: a computational study**Mustafa Zeki¹, Ahmed Moustafa²¹Department of Mathematics Teaching, Zirve University, Gaziantep, Turkey; ²Department of Psychology, University of Western Sydney, Sydney, Australia

Persistent irregular activity (defined as elevated neural discharges in network activity) occurs in many brain regions. Unlike prior models, we use h-current and coincident detection mechanism as well as a network with random connections to simulate persistent irregular activity. In this study, a neural network of Hodgkin-Huxley type network model with excitatory-inhibitory synaptic interactions exhibited persistent irregular network oscillations, as reported in physiological studies. In the model, excitatory cells included hyperpolarization activated slow calcium and calcium dependent potassium currents, while inhibitory cells included a-type potassium and calcium dependent potassium current. Importantly, h-current, together with fast GABA inhibition from inhibitory cells allowed excitatory cells to rebound with fast GABA inhibition from inhibitory cells. Slow decay rate of h-current in subthreshold level helped excitatory cells to display variable rebound durations by remembering previous fast GABA inhibitions. In addition, a-current and after-hyperpolarization current in inhibitory cells made them sensitive to non-coherent excitatory input, further contributing to irregularity. The model shows that less than perfect rebound pattern in excitatory cells and coincident sensitive inhibitory cells can account for persistent irregular activity in an excitatory-inhibitory neural network with randomly assigned synaptic connections.

Keywords: persistent activity, irregular activity, coincident detection, working memory

P-98**Sleep architecture and neuropsychological profile of first episode drug naive psychotic patients**Nakşidil Yazıhan¹, Sinan Yetkin¹, Emrah Kızılay¹, Eyup Sabri Akarsu²¹Department of Psychiatry, Gülhane Military Medical Academy, Ankara, Turkey; ²Department of Medical of Pharmacology, Faculty of Medicine, Ankara University, Ankara, Turkey

The aim of this study is to investigate the sleep parameters, spindle characteristics and cognitive functions of first episode drug naive psychotic patients (brief psychotic disorder, schizotypal disorder, schizophrenia). In the context of this study we are expecting to understand different dimensions of the

clinical characteristics of the disorder by investigating the sleep structure and its relationship with the cognitive functions. The study sample consisted 19 drug naive male inpatients between the age of 20 and 25; who has non affective first episode psychotic disorder diagnosis and whose year of education is at least 8. The healthy controls were similar according to age, sex and duration of education. Sleep parameters were included some macro (sleep structure and sleep continuity) and micro (sleep spindle) variables. We conducted two days polysomnographic recording consequently. We also evaluated some cognitive functions such as memory, attention, learning, verbal fluency, working memory, inhibition by neuropsychological tests. We are continuing to make our statistical analyses on our data. Our dependent variables are sleep latency, REM latency, duration of REM and stage 2, sleep period time, sleep efficiency index; sleep spindle density, frequency and amplitude; some neuropsychological test scores, as well.

Keywords: sleep, polysomnography, first episode psychosis, cognitive functions, neuropsychology

P-99**An artificial intelligence framework constructed with modeled neurons**

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Dynamics behind neural circuits' ability of associative learning have always been an intriguing research topic. Being the ultimate processors in cognitive abilities, knowledge of neuronal phenomena have also a great value from a computational point of view. This paper consists of detailed analyses of the Mnemosyne, which is designed as a neural dynamics simulator in MATLAB environment. Having a basis in experimental data of neurophysiology literature, algorithm's abilities in mimicking intrinsic behaviors are demonstrated. Defining memory circuitries as 'systems with many inputs and probabilistically distributed outputs' simulator is operated as a neuromorphic artificial intelligence algorithm. From this point of view, learning is functionally defined as 'systems' becoming able to be defined with fewer variables' and investigated in two main parts namely; memory formation and recalling. Machine's success in common pattern recognition tests is demonstrated with a higher cognitive ability experiment of rule extraction. Study proves that a neural dynamics model can successfully be utilized for implementation of cognitive skills in machine environment.

Keywords: neuromorphic artificial intelligence, learning theory, biomimetics, brain inspired computing, spike trains