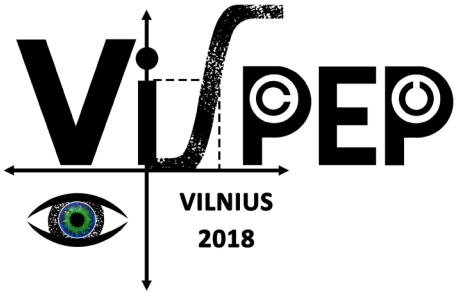


NOVEMBER 30 – DECEMBER 1 / 2018

10th CONFERENCE OF THE LITHUANIAN NEUROSCIENCE ASSOCIATION / LNA AND 2nd INTERNATIONAL SYMPOSIUM ON VISUAL PHYSIOLOGY, ENVIRONMENT AND PERCEPTION / VISPEP 2018

Venue: R106, Life Sciences Center, Vilnius University, Saulėtekio ave. 7, Vilnius

ORGANIZERS

CONFERENCE ORGANIZERS

Osvaldas RUKŠĖNAS
Aiga ŠVEDĖ

SCIENTIFIC COMMITTEE

Inga GRIŠKOVA-BULANOVA
Aidas ALABURDA
Aušra SAUDARGIENĖ
Dovilė ŠIMKUTĖ
Povilas TARAILIS

ORGANIZING COMMITTEE

Ramunė GRIKŠIENĖ
Rokas BUIŠAS
Redas DULINSKAS
Rasa MONČIUNSKAITĖ
Rima NAGINIENĖ
Evaldas PIPINIS
Aleksandras PLESKAČIAUSKAS
Livija ŠARAUSKYTĖ
Aleksandras VOICIKAS

LATVIJAS UNIVERSITĀTE
ANNO 1919
UNIVERSITY OF LATVIA

VILNIAUS UNIVERSITETAS
1579
UNIVERSITAS VILNENSIS

UNIVERSITY OF TARTU
1632

SPONSORS

Lietuvos mokslo taryba

ThermoFisher SCIENTIFIC

OC VISION
together for perfect sight since 1991

NEUROVITA®

EXPERIMENTICA
Scientific Excellence in Ocular Models℠

LANLAB
EST 1998

TSE systems

Werfen
Diagnostic Solutions for Life

LaboChema

Venue: R106, Life Sciences Center, Vilnius University, Saulėtekio ave. 7 | Vilnius

November 30

8.30–9.00 Registration

9.00–9.15 **Welcome**

Rimantas Jankauskas | Vice-rector, Vilnius University
Gintaras Valinčius | Director of Life Sciences Center, Vilnius University
Osvaldas Rukšėnas | President of LNA
Aiga Švede | University of Latvia

9.15–10.00 **Svenja Caspers** | Heinrich-Heine-Universität Düsseldorf, Germany
Connectivity across the scales in the human brain

10.00–10.45 **Andrew Parker** | Oxford University, UK
Seeing depth with two eyes: the binocular physiology of 3D space

10.45–11.00 **Coffee break**

11.00–11.30 **Rasa Gulbinaitė** | Centre de Recherche en Neurosciences de Lyon (CRNL), France
Strobe light effects on the visual brain: From neurons to neural networks

11.30–12.00 **Ewa Kublik** | Nencki Institute of Experimental Biology, Poland
Sensory information flow in thalamo-cortico-thalamic pathways

12.00–12.30 **Alicja Maria Brenk-Krakowska** | Adam Mickiewicz University, Poland
Developmental dyslexia, reading problems and vision

12.30–14.00 **Lunch / Poster session**

14.00–14.45 **Wolf Eberhard Mehling** | UCSF Medical Center, USA
How do you feel? Interoceptive awareness: its role in physical and mental health

14.45–15.15 **Christian Cajochen** | Centre for Chronobiology Psychiatric Hospital of the University of Basel, Switzerland
Light on clocks, cognition and sleep in humans

15.15–15.45 **Sergejs Fomins** | University of Latvia and Institute of Solid State Physics, Visual Perception Lab, Latvia
Colorimetry and circadian light characteristics of skylight, comparison of two datasets

15:45–16:00 **Miglė Kaminskaitė** | Lithuanian University of Health Sciences, Lithuania
Does impulsivity predict risky alcohol use?

16.00–16.30 **Coffee break**

16.30–16.45 ANNUAL MEETING OF LNA

16.45–17.15 **Gytis Baranauskas** | Lithuanian University of Health Sciences, Lithuania
Adaptation acts as a powerful spatiotemporal filter of visual responses in the rat collicular neurons

17.15–17.45 **Simonas Chomentauskas** | Gluk Media, Lithuania
Brain-computer interface in VR

17.45–18.00 **Vykinta Parčiauskaitė** | Vilnius University, Lithuania
40HZ ASSR relation to cognitive performance

18.30–20.30 **Party**

December 1

9.00–9.45	**Milena Korostenskaja** | Functional Brain Mapping and Brain Computer Interface Lab, Florida Hospital, USA Electromagnetic studies of auditory information processing: clinical application
9.45–10.15	**Giedrius Kalesnykas** | Experimentica Ltd., Finland How to interpret discrepancy between function and histopathological readouts in preclinical ocular models
10.15–10.45	**Gatis Ikaunieks** | University of Latvia, Latvia Influence of spectacle lenses on retinal straylight measurements
10.45–11.00	**Gintarė Čepanonytė** | Vilnius University, Lithuania A motor imagery-based brain-computer interface system improves upper limb function in patients post-stroke
11.00–11.30	**Coffee break**
11.30–12.00	**Corrado Cali** | King Abdullah University of Science and Technology, Saudi Arabia The use of Virtual Reality (VR) to investigate the Neuron-Glia metabolic coupling
12.00–12.30	**Karola Panke** | University of Latvia, Latvia Changes in eye accommodation and pupil size after prolonged near work with volumetric 3D image compared to anaglyph 3D image
12.30–12.45	**Tatjana Pladere** | University of Latvia, Latvia Age-related differences in visual search performance through volumetric images
12.45–13.00	**Polina Vinogradova** | University of Latvia, Latvia Fixation disparity in various contrast conditions
13.00–14.00	**BRUNCH / Poster session**
14.00–14.30	**Vilma Kisnierienė** | Vilnius University, Lithuania Sensory systems in plants
14.30–15.00	**Eglė Audronytė** | Vilnius University, Lithuania Olfactory dysfunction in Alzheimer's disease: a possible biomarker for the early diagnosis
15.00–15.30	**Svetlana Alexeenko** | Pavlov Institute of Physiology, Russia Dynamics of visual pathways impairments in developing amblyopia
15.30–16.00	**CLOSING OF CONFERENCE AND AWARDS**

CONTENT

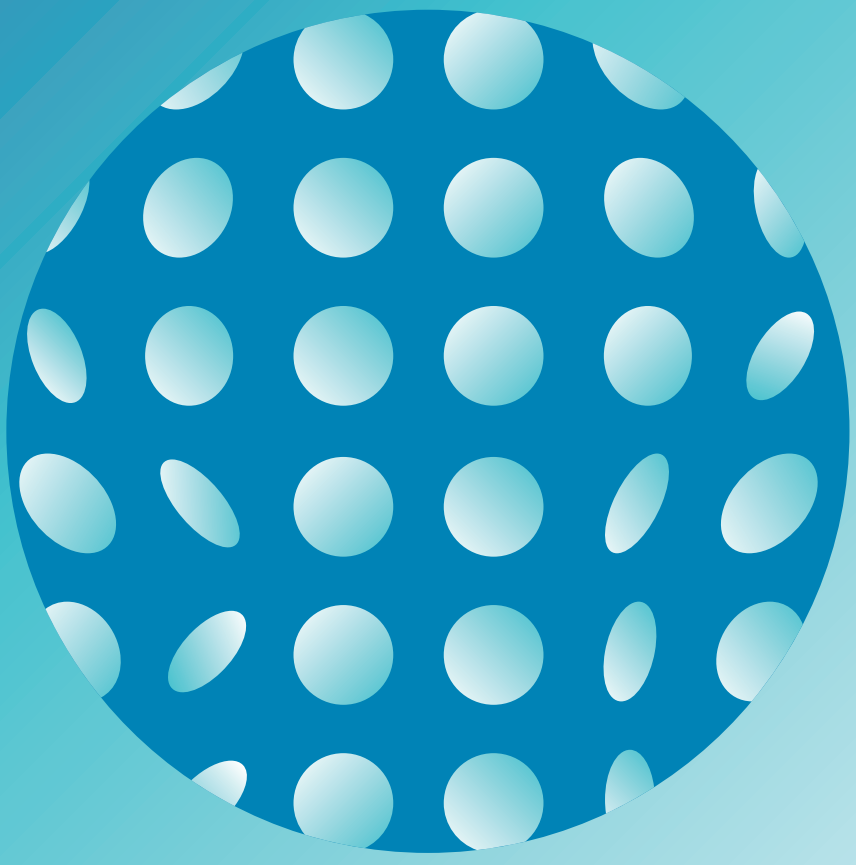
ORAL PRESENTATIONS

POSTER PRESENTATIONS

CONTENT

SPONSORS

ORAL PRESENTATIONS



CONNECTIVITY ACROSS THE SCALES IN THE HUMAN BRAIN

S. Caspers[1,2]

[1] Institute for Anatomy I, Medical Faculty, Heinrich Heine University Düsseldorf, Germany
[2] Institute of Neuroscience and Medicine (INM-1), Research Centre Jülich, Germany
s.caspers@fz-juelich.de

The human brain is intensely wired to enable cognitive performance through large brain networks. Disentangling this complex connectivity particularly of higher-order cognitive regions, such as the parietal lobe, is a major interest in modern neuroscience to lay the basics for understanding neurodegenerative or psychiatric diseases, which are thought to represent disconnectivity syndromes. To understand this network architecture, the interplay between structure, function and connectivity needs to be considered. Modern in-vivo neuroimaging allows assessing this interplay in relation to cognitive performance, environmental and genetic data in large cohorts of healthy subjects. As resolution of these techniques is inherently limited, a combination with ultra-high resolution microscopic postmortem approaches is warranted to integrate knowledge across different spatial scales, from cells and axons to the whole human brain. Such multi-scale integration will be exemplified on processing of visual information. The structural heterogeneity of the early and higher order visual cortical regions will be demonstrated, together with their relation to the known functional diversity. The connectivity within and across the hemispheres will be discussed based on in-vivo and high-resolution microscopic analyses. Finally, variability during the aging process will be exemplarily discussed.

SEEING DEPTH WITH TWO EYES: THE BINOCULAR PHYSIOLOGY OF 3D SPACE

A.J. Parker

Department Physiology, Anatomy and Genetics, University of Oxford
andrew.parker@dpag.ox.ac.uk

Neurons that are specifically tuned to binocular depth were discovered in seminal work published 50 years ago by Horace Barlow, Colin Blakemore and Jack Pettigrew in the Journal of Physiology. Their study in the primary visual cortex opened up the era of understanding the physiology of 3-D perception. Thanks to more recent work, we now know that large areas of the extrastriate visual cortex are involved. Sites where binocular stereoscopic depth is integrated with other visual information can be identified and physiological signals related to active perceptual decisions about depth can be isolated. At some sites, a causal role of physiological signals for the perception of depth can be demonstrated by showing that weak electrical microstimulation of the cortex can alter behavioural reports of depth perception. However, there seems to be no single brain module that is responsible for computing stereoscopic depth. This lecture will trace these paths of discovery in human and animal studies. Andrew Parker will show how a better understanding of the physiology of depth perception changes our view of how the brain constructs a representation of the space around us. Findings from this neurophysiological research have implications for the growing popularity of 3-D cinema and immersive virtual reality.

STROBE LIGHT EFFECTS ON THE VISUAL BRAIN: FROM NEURONS TO NEURAL NETWORKS

R. Gulbinaitė

Centre de Recherche en Neurosciences de Lyon (CRNL), France
rasa.gulbinaite@gmail.com

The effects of repetitive light stimulation (flicker) on perception and cognition fascinated scientists and artists for almost 200 years. Until very recently, flicker has been used mainly to "frequency tag" visual stimuli to probe sensory and cognitive processes. This frequency-tagging approach assumes no interaction between the flicker frequency and ongoing endogenous brain rhythms. In contrast, recent evidence suggests that repetitive light stimulation can be used to alter spontaneous brain rhythms and behavior. In this talk, I will introduce both "frequency-tagging" and "hijacking" approaches of using stroboscopic light to study resonant properties of cortical circuits, frequency-specific brain networks, and visual perception.

SENSORY INFORMATION FLOW IN THALAMO-CORTICO-THALAMIC PATHWAYS

E. Kublik*, A. Sobolewski, D. Świejkowski, Z. Borzymowska, A. Składowska, A. Wróbel

Nencki Institute of Experimental Biology, Warsaw, Poland
*e.kublik@nencki.gov.pl

Background and aim: Depending on the salience of behavioral situation identical sensory stimuli can evoke different neuronal and behavioral responses. The effect may depend on a mechanism gating sensory information to the cortex either through a first-order relays, or through higher-order thalamic relays which has direct input to higher order sensory, insular and motor cortices. Unlike in primates, in rodents, these two functionally distinct thalamic population are separated into neighboring nuclei which facilitates their experimental investigation.

Materials and methods: We used multichannel local field potential and units recordings from the rat somatosensory cortex and thalamic first-order (ventral posteromedial, VPM) and higher-order (posterior medial, PoM) nuclei. Responses to whisker stimulation were analyzed and compared between anesthesia and waking state. Levels of animals arousal was additionally modulated: reduced by long habituation or increased by loud alarming sounds.

Results: In anesthetized rats, somatosensory evoked potentials (EPs) in PoM were dominated by late latency, cortex-dependent responses. In wakefulness, PoM – similar to first order VPM – responded also to peripheral input. However, connectivity analysis revealed that at low arousal the information flow reached sensory cortex mainly via first-order VPM nucleus. Only at high arousal information was effectively transferred to cortex through the PoM nucleus.

Conclusions: Opening of the direct information flow from periphery through PoM to cortex – also to higher order, insular and motor cortical areas can facilitate behavioral reactions to salient stimuli. This pathway may play a vital role during dangerous situations but otherwise should be kept closed because it may disturb normal detection of stimuli features and their behavioral meaning. The gating mechanism remains to be elucidated, however the switch may depend on feed-forward inhibition of PoM exerted by zona incerta in low arousal.

DEVELOPMENTAL DYSLEXIA, READING PROBLEMS AND VISION

A. Brenk-Krakowska[1, 2]

[1] Laboratory of Vision Science and Optometry, Faculty of Physics and Optometry, Adam Mickiewicz University of Poznań, Poland
[2] Laboratory of Neuro and Vision Science, NanoBioMedical Centre of Adam Mickiewicz University, Poznań, Poland
ali_bk@amu.edu.pl

Adequate opportunities to develop reading skills are crucial for the future ability to acquire knowledge though reading. Vision efficiency and visual information processing may potentially affect reading ability. As several studies have shown, some visual factors may be correlated with developmental dyslexia (DD). It is obvious that dyslexic individuals experience reading and writing problems. However, there is increasing evidence suggesting that more general motor and oculomotor deficits can also be found but their influence on DD is still under debate.

One area of interest is fixation disparity (FD). This is a measure of alignment of the oculomotor system during binocular fusion. The results of our experiments suggest that exo-FD and the absolute amounts of associated phoria tend to be higher in dyslexic adults. Moreover, they experience more binocular instability as compared to controls. The question is whether FD may influence body balance in DD? Posturography data has been collected in two sessions: quiet stance only (single task) and performing a mental task while standing (dual task), under three viewing conditions. The results have shown that increased FD in DD does not significantly impact posture. In the dual task, dyslexic subject showed a generally weaker balance, regardless of the experimental conditions. The researchers were also interested in the influence of unstable binocular fixation on visual-motor responses (reaction time – RT) and procedural motor learning (PML). Unstable binocularity in dyslexic subjects affected RT during a task but that did not explain the low level of PML ability.

Postural instability, impaired PML and FD instability in DD may indicate deficits in the area of cerebellum, which seem to be responsible for poor visual-motor coordination and fragile body balance. This observation indicates that traditional therapy methods in DD should be supplemented with procedures facilitating body balance and binocular vision stability.

HOW DO YOU FEEL? INTEROCEPTIVE AWARENESS: ITS ROLE IN PHYSICAL AND MENTAL HEALTH

W. E. Mehling

University of California, UCSF Medical Center, San Francisco, CA, USA
Wolf.Mehling@ucsf.edu

Interoception, the conscious and unconscious perception of signals originating from inside the body, is a multidisciplinary field of research, where neuroscientists meet with social and cognitive psychologists, mind-body practitioners and contemplative scholars. These signals are key ingredients in feelings and emotional experiences and contribute to maintaining homeostasis, self-regulation, and health. Variations in interoceptive processing appear to be associated with health conditions, such as anxiety, depression, eating disorder, addiction, somatization, PTSD, and coping with chronic pain. Although awareness of interoceptive sensations can be maladaptive when associated with hypervigilance and anxiety, interventions that target interoceptive bodily awareness in specific ways appear to be beneficial for these health conditions.

Interoception lies at the heart of mind-body interaction. This presentation will introduces the concept, its operationalization and neurological basis, and give an overview about the current state of research. It will present a theoretical model how mind-body interventions may affect health conditions through enhancing regulatory dimensions of interoception. Objective measures, e.g. heart-rate detection, assess interoceptive accuracy. Numerous studies used self-report measures of interoceptive awareness, also labeled 'interoceptive sensibility'. Subjective and objective measures capture dimensions of interoception that are relative independent of each other. By applying the 8 scales of the self-reported Multidimensional Assessment of Interoceptive Awareness (MAIA), numerous studies have shown that mind-body interventions can differentially effect these dimensions and, in parallel, provide benefits for mental health and pain conditions.

Studies of interventions that enhance specific aspects of interoceptive awareness will be presented as examples for the clinically important role that interoception plays in mental and physical health.

LIGHT ON CLOCKS, COGNITION AND SLEEP IN HUMANS

C. Cajochen

Centre for Chronobiology, Psychiatric Hospital Basel, Basel, Switzerland
Christian.Cajochen@upk.ch

Background and aim: The human eye has a dual function, enabling vision and circadian entrainment to the daily light-dark cycles. Light entering the eye is captured by 5 different photoreceptors comprising the rods, the three different cones and the intrinsically photosensitive retinal ganglion cells (ipRGCs). While the function of the classical photoreceptors (i.e. rods and cones) is pretty well understood in the context vision, the role for ipRGCs in visual processes is yet unclear. However, ipRGCs containing the photopigment melanopsin are considered to play an important role in conveying the light information via the retinohypothalamic tract to the suprachiasmatic nuclei (SCN), the central circadian pacemaker, in the anterior hypothalamus. Thus, ipRGCs are crucial for the control of circadian photoentrainment, pupillary light reflex, and sleep. Recent research in animals has shown that there are at least 5 different subtypes of melanopsin which serve different functions and can directly project to brain areas which are important in the regulation of the affective state (i.e. mood) and learning independent of the circadian timing system. One research line at the Centre of Chronobiology in Basel is aiming at testing non-image forming effects of light on circadian rhythms, cognition and sleep in stringently controlled human laboratory conditions.

Materials and methods: Light effects on the following endpoints will be reported: polysomnographically assessed sleep and wakefulness, circadian melatonin profiles, neurobehavioral performance and cardiovascular variables. The independent variable, artificial light, has been modified by its spectral components such as metameric and daylight mimicking lighting conditions. Individual factors such as age and sex will be considered as important modulators of light effects. All data have been gathered in healthy volunteers or cataract patients.

Results: Results from current studies in our lab will be reported in the context of other published recent studies.

Conclusions: The non-image forming effects of light in humans are more complex than previously thought.

COLORIMETRY AND CIRCADIAN LIGHT CHARACTERISTICS OF SKYLIGHT: COMPARISON OF TWO DATASETS

S. Fomins[1,2*], M. Ozoliņš[2]

[1] Institute of Solid State Physics, Visual Perception Lab, University of Latvia, Riga, Latvia
[2] Faculty of Physics, Mathematics and Optometry, Optometry and Vision Science Department, University of Latvia, Riga, Latvia
*sergejs.fomins@lu.lv

Background and aim: In the northern latitudes seasonal change manifests as a reduction of the amount of light and shortening of daytime. The narrowing of the color gamut and CCT fluctuations happen with seasonal change. Light has a strong role not only in providing object vision, but also in the management of non-visual physiological functions. The melanopsin pigment-containing retinal cells provide this information to several parts of the brain (SCN, OPN), which controls the regulation of the 24-hour cycle and the response of the pupil to the light.

Materials and methods: To identify the dynamics of the potential components of circadian light, we have begun spectro-radiometric acquisition of daylight in Latvia. Quasi-continuous data is collected for a whole year, starting March 2016 till February 2017. Spectrometric data is obtained using calibrated spectrometer and optical fiber in the range of 380 nm to 800nm. Small expositions (100 ms) were applied with a large number of measurements during five minute acquisition. The cosine corrected calibrated fiber was pointed 45 degree angle in the northern part of the hemisphere to avoid the direct beams of sunlight. We compare our results with the Granada Spectral Database (Hernández-Andrés et al., 2001)

Results: Our results show a discrepancy in the proportion of circadian light to the luminance, which is almost linear function in Hernández-Andrés et al. (2001). Colorimetrically our data is well suited to Granada database, especially at high light intensities. We have not found the prominent dynamics in colorimetric changes during the seasons. However, there is a substantial difference in the proportion of luminance to the amount of circadian component.

Conclusions: In general, comparing two datasets we can conclude that the colorimetry of the skylight is not significantly different. The major changes is in the proportion of the circadian light to luminance which turns to be double linear functions in pronounced in the autumn and winter months.

ADAPTATION ACTS AS A POWERFUL SPATIOTEMPORAL FILTER OF VISUAL RESPONSES IN THE RAT COLLICULAR NEURONS

G. Baranauskas

Neuroscience Institute, Lithuanian University of Health Sciences, Kaunas, Lithuania
gytis.baranauskas@lsmuni.lt

Background and aim: Adaptation to light in the retina enhances subsequent visual information processing in the brain by mainly preserving the full dynamic range of neuronal responses under changing light conditions. Although the main properties of this adaptation have been known for decades, it was usually assumed that its dynamics was too slow to significantly affect visual responses to standard small visual stimuli such as gratings. To determine the adaptation effects on visual responses to small stimuli in rodents, we investigated the dynamic and spatial properties of the visual response adaptation in the rat superior colliculus neurons.

Materials and methods: Experiments were performed in urethane-anaesthetized rats by employing single unit recordings with tetrodes.

Results: We found that collicular visual responses are influenced by at least two types of adaptation. The local form of adaptation affected only the responses to stimuli presented in the same small area of the receptive field (RF) in which the adaptor stimulus was presented. The other form of adaptation affected responses to all visual stimuli presented within RF and we called it a 'non-local adaptation'. The properties of the local adaptation could be entirely explained by the retinal adaptation to light. This form of adaptation developed very rapidly, within 40 ms after the stimulus onset. Therefore, it might affect responses that changed their brightness sufficiently slowly, in >40 ms, corresponding to frequencies below 50 Hz. Simulations showed that, indeed, the local form of adaptation acted as a powerful spatiotemporal filter and could explain several tuning properties of collicular neurons.

Conclusions: These results demonstrate that in rodents the adaption of visual responses has a complex spatiotemporal structure and can profoundly shape visual information processing.

BRAIN-COMPUTER INTERFACE IN VR

S. Chomentauskas

Gluk Media, Vilnius, Lithuania
simas@gluk.lt

With Gluk Media we dived into Virtual Reality right from the dawn of it. Today, looking at experience gathered from numerous personal projects and learned in a dozen of world-class VR training events one thing is clear – Virtual Reality affects brain very differently than traditional media. It becomes a very compelling tool, which provides a direct way to stimulate ones senses and emotions. So as content creators we get a huge responsibility – to keep the intended effect within tolerance limits of each individual user. A custom network of biological/neural sensors is being used in real time to adjust the intensity of the content being displayed, which generates a unique content for each user.

ELECTROMAGNETIC STUDIES OF AUDITORY INFORMATION PROCESSING: CLINICAL APPLICATION

M. Korostenskaja[1,2,3,4*]

[1] Functional Brain Mapping and Brain Computer Interface Lab, Florida Hospital, Orlando, FL, USA;
[2] MEG Lab, Florida Hospital, Orlando, FL, USA
[3] Department of Psychology, College of Arts and Sciences, University of North Florida, Jacksonville, USA
[4] Department of Neurobiology and Biophysics, Institute of Biosciences, Life Sciences Center, Vilnius University, Vilnius, Lithuania
milena.korostenskaja@gmail.com

The neurophysiological and neurochemical changes in the auditory cortex are shown to underlie cognitive impairments in a number of mental and neurological conditions. Functional state of the neural substrate of auditory information processing could be objectively probed by means of electroencephalography (EEG) and magnetoencephalography (MEG). In a number of consecutive studies, we explored the neural origins of auditory information processing in relation to schizophrenia spectrum disorders, obsessive-compulsive disorder (OCD), epilepsy and migraine. Possible clinical applications of obtained results have been proposed.

First, by means of averaged auditory MEG and EEG responses (event-related potentials – ERPs and event-related fields – ERFs, respectively) we aimed to determine how neural substrates of auditory information processing are modulated by the antipsychotic medication in patients with schizophrenia spectrum and by the neuropharmacological challenges in healthy human subjects. A complex pattern of neurochemical influences has been demonstrated, pointing towards the need of a shift in the pharmacological management of patients with schizophrenia spectrum.

Further, we demonstrated significant ERFs changes related to auditory information processing in youth with obsessive-compulsive disorder (OCD). This was tied with the changes in a resting-state MEG activity. Supporting findings from both studies provide a ground of utilizing MEG as a biomarker of OCD in pediatric patient population.

Finally, the changes in ERFs were revealed when assessing auditory information processing in patients with neurological conditions, such as epilepsy and migraine. The pattern of these changes differed between groups. Our results indicated that changes in the early stages auditory information processing can result in altered processes of reading and word recognition. Application of these results for epilepsy surgery and post-surgical rehabilitation has been recommended.

HOW TO INTERPRET DISCREPANCY BETWEEN FUNCTIONAL AND HISTOPATHOLOGICAL READOUTS IN PRECLINICAL MODELS?

G. Kalesnykas[1,2*], S. Ragauskas[2]

[1] Experimentica Ltd., Kuopio, Finland
[2] Experimentica UAB, Vilnius, Lithuania
[*]giedrius.kalesnykas@gmail.com

Recent translational and clinical work in ophthalmology highlighted discrepancies between functional and morphological parameters of visual system. In our internal research programme we studied neurodegeneration and neuroprotection using mouse retinal *ex vivo* explant model, rodent optic nerve crush model as well as mouse light damage model. Our findings confirm recently published data and indicate discrepancies between visual functional and histopathological readouts. These observations call for more work dedicated at identifying an underlying biology.

INFLUENCE OF SPECTACLE LENSES ON RETINAL STRAYLIGHT MEASUREMENTS

G. Ikaunieks*, K. Mieze, G. Krūmiņa

Department of Optometry and Vision Science, University of Latvia, Riga, Latvia
*gatis.ikaunieks@lu.lv

Background and aim: one of optical factors which reduce optical quality of perceived image is retinal straylight (light scattering). This optical factor increases with age and mostly is related with changes in optical parts of the eye (development of cataract etc.). Also, external factors such as spectacle lenses could influence retinal straylight level. Sometimes yellow tinted lenses or lenses with blue light filtering coating are suggested for decreasing retinal straylight level. Aim of this research was to test this assumption.

Materials and methods: straylight meter (C-Quant, Oculus Optikgerēate GmbH) was used for straylight measurements. Measurements were performed in 4 conditions: without spectacle lens in front of the eye; using plano lens without antireflecting (AR) coating; using lens with standard AR coating; using lens with blue light filtering coating and using yellow tinted lens. Measurements were done for 20 subjects (average age 22 years).

Results: results showed that straylight parameter S was not significantly different between measurements done without lens (logS=0.89±0.03); looking through uncoated lens (logS=0.89±0.03) and using lenses with AR (logS=0.92±0.03) and blue light filtering coatings (logS=0.91±0.04). Yellow tinted lens significantly increased retinal straylight (logS=0.96±0.03) comparing to other conditions ($p<0.05$).

Conclusions: results showed that clear spectacle lenses with or without AR coating do not significantly affect retinal straylight level. Data also show that it is not possible to significantly reduce light scattering in the eye with special coated or yellow tinted lenses.

Acknowledgment: The study supported by SIA "Mikrotīkls" and administrated by University of Latvia Foundation (project No 2184).

THE USE OF VIRTUAL REALITY (VR) TO INVESTIGATE THE NEURON-GLIA METABOLIC COUPLING

C. Calì

King Abdullah University of Science and Technology, Thuwal, Saudi Arabia
corrado.cali@kaust.edu.sa

Virtual Reality (VR) is a rapidly expanding field, with growing number of applications in medical disciplines, ranging from education, up to diagnostic and surgery tools. Similarly, thanks to the technological advancement in 3D cellular imaging, VR is making its way into neuroscience, and we are pioneering the use of Head-Mounted Displays (HMD) to develop tools for explorative analysis of the finest three-dimensional arrangement of brain neuropil. In particular, we are interested in the complex structural arrangements between neurites and glial processes, contextually to a process of reverse-engineering of the so called Neuro-Glia-Vasculature (NGV) activity. We take advantage of 3D reconstructions from electron microscopy to infer the morphological relationship between the three components, as well as distribution of intracellular organelles (such as glycogen), during physiological conditions, such as learning and ageing. This approach is similar to what early observers like Golgi and Ramon y Cayal used to do, by hypothesizing the functional role of brain components by their morphology but revised using much higher resolution imaging techniques and VR visualization.

CHANGES IN EYE ACCOMMODATION AND PUPIL SIZE AFTER PROLONGED NEAR WORK WITH VOLUMETRIC 3D IMAGE COMPARED TO ANAGLYPH 3D IMAGE

K. Panke[1*], T. Pladere[1], M. Velina[2], A. Svede[1], G. Krumina[1]

[1] Department of Optometry and Vision Science, University of Latvia, Riga, Latvia
[2] Laboratory for statistical research and data analysis, University of Latvia, Riga, Latvia
[*]karola.panke@lu.lv

Background and aim: Virtual 3D systems include spectacles-and-screen systems (e.g. anaglyph method or polarization), head-mounted displays, autostereoscopic displays and quasi-holographic displays. Most of these applications use image separation for both eyes producing possible eye discomfort and fatigue because of accommodation-vergence conflict. Volumetric display is real-three-dimensional system that allows to embrace the advantages of 3D imaging with promising applications for healthcare. The aim of our present research is to evaluate and compare how prolonged near work with volumetric display influence eye accommodation compared to anaglyph method.

Materials and methods: Eye accommodation and pupil was measured with eccentric photorefractor PowerRef3 (PlusOptiX, Germany) with 50Hz frequency. Participants (n = 40) performed relative depth estimation task with three distances between stimuli (1.9°, 3.8° and 7.6°) on two displays. For volumetric display we divided our stimulus presentation blocks in four depth segments starting from front of the screen I, II, III and IV where each segment consisted of 5 screen plates. For anaglyph technique we adjusted display distance in order to maintain the same stimulus distance as for volumetric display.

Results: Accommodative microfluctuations were significantly larger at near distance compared to far distance ($p < 0.01$), there was no difference in microfluctuations after work with volumetric or anaglyph technique ($p = 0.82$) and they were constant during the three sessions ($p = 0.11$). Relationship between pupil size and subjective task difficulty was observed ($p < 0.05$).

Conclusions: Both volumetric and anaglyph technique for creating 3D images can be used for at least 1h near work without objective refraction shifts of eye accommodation. Advantages that volumetric display can offer include possibility to involve multiple simultaneous viewers without additional head mounted or spectacle-based accessories.

SENSORY SYSTEMS IN PLANTS

V. Kisnierienė

Department of Neurobiology and Biophysics, Life Sciences Center, Vilnius University, Vilnius, Lithuania
vilma.kisnieriene@gf.vu.lt

Plants stimulate our senses constantly, but most of us never consider them as sensory beings. They lack a nervous system and other features we associate with complexity, but as sentient organisms plants supremely adapted for solving problems by using elegant strategies. The lack of obvious centres of sensory input makes it harder to understand plant senses. The main living functions of the plant are distributed through the whole organism and each small part of a plant has usually the necessity and the capacity to perform most of the living activities including environment sensing. Without single organs or centralised functions plants may tolerate elimination without losing functionality. Widely distributed network of small nodes can be very intelligent.

Plants have senses that roughly correspond to our five, but also have additional ones to monitor conditions in their own way. Despite lacking eyes, plants possess at least 11 types of photoreceptor. This helps optimize photosynthesis, to detect neighbours, train their circadian clocks, determine when to start flowering, and when to start going dormant for the winter. Plants don't have noses, but they have an olfactory sense. Plants smell other plants moreover smell allows plants to communicate. Plants under attack emit a variety of volatile chemicals to warn their neighbours. Plants contain receptors for different soluble molecules, including jasmonic acid, a stress hormone, therefore plant possess taste senses. Plants can sense touch, gravity and sound. Sounds around plants include not only vibrations produced by insects – plants even benefit from the ability to detect certain sounds produced by other plants. Another ability we share with plants is proprioception. Plants sense their health status, whether they're getting enough water or nutrients.

In conclusion, plants have an integrated network of sensory systems that trigger short-term responses and long-term adaptation for living with ever-changing environment.

OLFACTORY DYSFUNCTION IN ALZHEIMER'S DISEASE: A POSSIBLE BIOMARKER FOR THE EARLY DIAGNOSIS

E. Audronyte

Department of Neurology, Institute of Clinical Medicine, Faculty of Medicine, Vilnius University, Vilnius, Lithuania
egle.audronyte@gmail.com

Olfactory dysfunction (OD) is present in up to 96% of patients with Alzheimer's disease (AD). It is also one of the earliest symptoms, preceding cognitive decline by several years.

OD was proven to be a reliable predictor of future episodic memory decline which is a hallmark of AD. Cognitively normal elderly adults with OD have a higher risk of developing mild cognitive impairment (MCI, prodromal AD). In patients with MCI presence of OD is associated with a higher risk of conversion to dementia.

OD is also associated with structural changes that are characteristic of early AD. Subjects with OD have more pronounced hippocampal atrophy and higher amyloid-β load on positron emission tomography, which are both recognized biomarkers of AD.

OD could also be helpful in differentiating cognitive decline caused by non-degenerative conditions, such as normal pressure hydrocephalus, depression and vascular dementia.

Despite the accumulated data, the exact mechanism by which olfactory dysfunction is related to AD remains unclear. Central and peripheral structures associated with olfaction are early targets of AD pathology. It is hypothesized that cholinergic dysfunction, which is prominent in AD, might play an important role. Besides, the olfactory system is unique in several ways and that could also contribute to its vulnerability in AD.

Research is ongoing. Not only could OD be helpful in early diagnosis of the disease. Identification of the exact mechanism by which it is related to AD could provide some insight into AD pathogenesis itself.

DYNAMICS OF VISUAL PATHWAYS IMPAIRMENTS IN DEVELOPING AMBLYOPIA

S.V. Alekseenko, P.Yu. Shkorbatova

Pavlov Institute of Physiology Russian Academy of Science, St.Petersburg, Russia
binocularity@yandex.ru

Amblyopia is a neurodevelopmental disorder associated with disrupted binocular vision during early childhood. In unilaterally convergent strabismic (SK) and monocularly deprived kittens (MDK) we investigated changes in the functional activity and density of Y-cells in the eye-specific layers of the lateral geniculate nucleus (LGN).

The activity in the LGN was assessed by histochemical staining for cytochrome oxidase (CO) and Y-cells were detected by neurofilament staining using the SMI-32 antibody.

Differences between CO-activity in layers innervated by intact and impaired eyes were revealed in the projection of the entire visual field in MDK, but only in the projection of central part of the visual field in SK.

In MDK, a relative decrease of CO-activity in deprived eye layer was observed earlier in the hemisphere ipsilateral to the deprived eye (at the age of two months) than in the contralateral (from three months). A decrease in the density of Y-cells in the deprived eye layer was observed in both hemispheres already at the age of one month.

In SK at the age of two months, the CO-activity in the LGN layers innervated through the crossed paths from the retinae was higher, despite the fact that one eye was deviated. After that, the activity of the squinting eye layer in both LGNs gradually decreased relative to the layer of the intact eye, and at the age of five months the differences between the activities in the layers increased to about the same level in both hemispheres. We assume that during development of strabismic amblyopia, alternating fixation changes to suppression of squinting eye. A relative decrease in the density of Y-cells in SK was observed at the age of two and three months in the peripheral part of the ipsilateral LGN only.

The observed differences in the development of deprivation and disbinocular amblyopia strongly suggest various mechanisms involved in them.

POSTER PRESENTATIONS

P1. EFFECT OF INTERFERENCE ON REACTION TIME AND EVENT-RELATED POTENTIAL MICROSTATES IN MODIFIED MULTI-SOURCE INTERFERENCE TASK (MSIT+)

I. Antonova[1*], P. Dzianok[1], J. Wojciechowski[1, 2], J. Rogala[2], E. Kublik[1]

[1] Laboratory of Emotions Neurobiology, Nencki Institute of Experimental Biology, Warsaw, Poland
[2] Bioimaging Research Center, World Hearing Center of Institute of Physiology and Pathology of Hearing, Kajetany, Poland
*ingrida.antonova@gmail.com

Background and aim: Task difficulty has impact on reaction time (RT), shape and timing of event-related potentials (ERP). Simple RT (SRT) task is one of the easiest while paradigms with stimulus and/or response conflict are cognitively demanding. Standard Multi-Source Interference Task (MSIT) with two conditions (no-interference – 00, and multi-source (flanker and spatial) interference – FS) has been frequently used in fMRI and less often in EEG studies of conflict processing.

In MSIT+, we added two uni-source (spatial only – S0, and flanker only – F0) interference conditions to study ERP differences related to steadily increasing levels of difficulty and possibly separate two interference mechanisms.

Materials and methods: Healthy subjects performed MSIT+ and SRT task while EEG was recorded from 128 active electrodes. Lines of three zeros were stimuli in SRT task. Lines of two same and one distinct digit were stimuli in MSIT+. ERP microstate analysis was applied to evaluate differences in ERP microstates duration and amplitude (Area Under the Curve – AUC) between MSIT+ conditions only and between two tasks.

Results: RT indicated gradually increasing task difficulty: SRT < 00 < S0 < F0 < FS, which was partially reflected in ERP.

Early, P1-related microstate did not differ between tasks. Later, endogenous components differentiated SRT from MSIT+ and flanker interference from spatial in MSIT+. N2b/P3-related microstate occurred much earlier and lasted shorter in SRT task. In MSIT+, N2b/P3-related microstate lasted longer and had larger AUC, however, with lower peak amplitude in flanker interference compared to non-flanker conditions. There were no ERP differences between 00 and S0 and between F0 and FS stimuli.

Conclusions: MSIT+ dissociates difficulty level expressed by RT from interference effects seen in ERP proving a promising tool to study various aspects of cognitive control mechanisms.

P2. FORM AND COLOR PERCEPTION IN CHILDREN

M. Bambane[1*], J. Skilters[2], B. Pinna[3], G. Krumina[1]

[1] Department of Optometry and Vision Science, University of Latvia, Riga, Latvia
[2] Laboratory for Perceptual and Cognitive Systems, University of Latvia, Riga, Latvia
[3] Department of Biomedical Science, University of Sassari, Sassari, Italy
*megija.bambane1@gmail.com

Background and aim: Asking Italian children to draw a yellow square, they took a black pastel, drew contour of the square and only then colored it yellow (Pinna & Deiana, 2015). Mostly 13 years old children drew only a yellow contour of the square and a full-filled yellow square. These results and the first measurements lead to questions – is there the impact of language, where the first is a noun and second is an adjective – Quadrato giallo, or the impact of kindergarten teachers' training method? The purpose of this research was to explore the language influence on form and color perception in Latvian and Russian children.

Materials and methods: 121 preschool children (4–7 years old) and 130 primary school children (7–10 years old) from Latvian and Russian groups were asked to draw colored geometrical figures. Every child had a paper and 6 pastels (blue, green, black, yellow, red, brown). The task was to draw a color and a figure (for example "zils trijstūris", "sarkans kvadrāts"). For Latvian children these tasks were presented in Latvian and for Russian children in Russian.

Results: 84% children presented only the contour of the figure in the named color, 13% drew the contour of the figure and full-filled the figure in the named color, and two children drew and colored the circle, but not full-filled other figures. No difference was found between Latvian and Russian children. Everyone drew contours in the named color. 22 children (14%) did not distinguish triangles from other geometric figures, especially 4–5 years old. 69% four years old and 8% five years old children did not know the geometric figure – triangle.

Conclusions: The idea and the ability to identify and distinguish geometric shapes significantly improve at the age of 6. We suppose that the amodal perception has the influence of kindergarten's teaching methods more than the impact of language.

P3. TWO TYPES OF OFF RESPONSES ARE PRESENT IN THE RAT SUPERIOR COLLICULUS NEURONS

G. Baranauskas

Neuroscience Institute, Lithuanian University of Health Sciences, Kaunas, Lithuania
gytis.baranauskas@lsmuni.lt

Background and aim: The superior colliculus (SC) is responsible for covert visual attention and a number of visually driven behaviors such as avoidance of dangerous objects. It is known that two types of visual responses in the SC neurons can be found – ON and OFF responses, triggered by a bright stimulus onset and offset correspondingly. Here we demonstrate that actually two types of OFF responses exist in the rat SC neurons.

Materials and methods: Experiments were performed in urethane-anaesthetized rats by employing single unit recordings with tetrodes.

Results: Although both types of OFF responses are trigged by the bright stimulus offset, their other properties differed dramatically. The fast OFF responses last less than 1 s and vanish completely when a bright visual stimulus does not disappears abruptly but dims slowly. In contrast, the slow OFF responses usually last more than 1 s, up to 20 s, and can be detected even when a bright visual stimulus dims gradually in 2 or 4 s. The peak firing frequency of the slow OFF responses depended little on the speed of the stimulus disappearance. Moreover, both the peak firing frequency and the number of evoked action potentials during the slow OFF responses correlated with the total light flux of the stimuli lasting from 50 ms to 1.5 s and varying in size from few degrees to 70^{o} in diameter. The slow OFF responses persisted in the visual cortex lesioned rats, indicating that the slow OFF responses were independent of the cortical circuitry.

Conclusions: We conclude that the slow OFF responses can provide information on the time-averaged local illumination levels while ON and the fast OFF responses communicate the details of visual stimuli. This ability to integrate the light flux over 1 s can be considered the simplest form of a short term memory present at very early stages in the visual pathway.

Acknowledegments: This work was supported in part by the Faculty of Medicine of the Lithuanian University of Health Sciences.

P4. ACCOMMODATIVE RESPONSE IN VARIOUS CONTRAST CONDITIONS

L. Berklava*, P. Vinogradova, K. Panke, G. Ikaunieks, V. Karitāns, A. Švede, G. Krūmiņa

Department of Optometry and Vision Science, Faculty of Physics, Mathematics, and Optometry, University of Latvia, Riga, Latvia
*laura.berklava@gmail.com

Background and aim: Accommodation is the ability of the eye to change its power to bring objects of interest into focus. The accommodative response is based on the information generated from the retinal image and can be affected by various psychological and physiological factors. The aim of the experiment was to evaluate the effect of one of the physiological factors – stimulus contrast – on the accommodative response.

Materials and methods: 10 participants (20-30 y.o.) with uncorrected visual acuity at least 0.8 (dec.u.) both for near and far distance were asked to look at stimuli (3-5 letters long logical Latvian words) with positive Weber contrast (1043 units) and various negative Weber contrast level (-0.16, -0.31, -0.44, -0.61, -0.86, -0.98, and -1.00). The accommodative response and pupil diameter changes were measured using PowerRef-3.

Results: The results show that the accommodative response and the diameter of the pupil are slightly increasing looking on the white letters on a black background (positive Weber contrast) compared to the black letters on a white background (negative Weber contrast). If level of negative Weber contrast is decreasing, the accommodative response increases only for low contrast values. No significant changes in pupil diameter were observed changing the level of negative Weber contrast.

Conclusions: It is important to take into account the stimulus contrast level and polarity in studies of accommodative response, especially using low contrast stimuli.

Acknowledgment: The study supported by SIA "Mikrotikls" and administrated by University of Latvia Foundation (project No 2184).

P5. OPPEL-KUNDT ILLUSION BALANCE

A. Bertulis[1,2*], T. Surkys[1], A. Bielevičius[2], E. Loginovič[2], I. Česnavičienė[2]

[1] Laboratory of Visual Neurophysiology, Lithuanian University of Health Sciences, Kaunas, Lithuania
[2] Institute of Biological Systems and Genetics Research, Lithuanian University of Health Sciences, Kaunas, Lithuania
*bertulis@vision.lsmu.lt

Two factors of excitation which contribute to the Oppel-Kundt illusion -the filled space borders and the filling mode – became the present study targets.

For psychophysical experiments, the representative stimuli formed of uniform vertical stripes (3.6×36 arc min in size and 50 cd/m2 in luminance) were modified by complementary objects: a contour frame or solid block situated in the unfilled interval of the stimulus. Subjects adjusted the complementary objects length to make it perceptually equal to the length (198 arc min) of the referential interval filled by stripes. The errors made were considered the illusion strength values.

The control experiments with the unaltered Oppel-Kundt stimuli established a typical non-monotonic dependence of the illusion magnitude on the number of the filling stripes, n. The curves started at 0 but shortly climbed up to the maximum and leisurely declined afterwards. The combined stimuli produced much weaker distortions of the perceived length. The curves were situated far below the control ones. Within the 0 – 5 filling stripes interval, the curves were ascending alongside the negative values scale. When n exceeded 5, the profiles appeared more flat. Maximum values were less prominent if any. Evidently, the supplementary objects balanced the Oppel-Kundt illusion to various extents by inducing expansion effects on their own and not by suppressing the illusory mechanisms activity. The contour frame appeared less influential object than the smooth filling. According to the data average, the contour frame induced 106 % of the control illusion mean while the solid block (combined action of the contour and interior) produced 156% of the value.

One may assume that any visual object triggers distortions of the observed extent and size due to percept of the contours and surfaces. The Oppel-Kundt illusion may appear a distinct case of a consolidated phenomenon, “objects’ size illusion”: visual objects are perceived larger than the areas engaged.

P6. THE EFFECT OF COMPUTER USE AND BLINKING QUALITY AND QUANTITY ON TEAR FILM STABILITY

I. Berzina*, A. Petrova, E. Kassaliete, G. Krumina

Department of Optometry and Visual Science, University of Latvia, Riga, Latvia
*inese.loca@fizmati.lv

Background and aim: Dry eye disease (DED) is multifactorial illness of anterior eye structures. One of the causes of dry eye is incomplete blinking when patients work on a computer (*Friedman,* 2010), spending time on average 6 hours per day looking at the computer screen directly correlates with DED symptoms *(Portello et al.,* 2012). The quality and quantity of blinking determines the stability of tear film. Amount of times the participants blinks reduces, doing tasks that require high amounts of concentration (*Hirota et al*. 2013), frequency of the blinks decreased and amplitude of the blinks changed and the amount of incomplete blinks – increased (*Cardona et al. 2011)*. The position of the computer screen also affects the stability of tear film. If the screen is higher than horizon, the ocular surface area is greater and the frequency of the blinks increases (*Nielsen et al.* 2008).The purpose of this study was to evaluate tear film stability and blinking quality and quantity for computer users.

Materials and methods: Study had three parts. First part was questionnaire. Second part was assessment of eye structures, tear film stability and blinking. Third part was assessment of blinking and tear film stability at various heights of computer screen. There were 125 participants in the first part and 55 participants in the second part.

Results: Average TBUT before reading was 7.5 s but after reading 5.7 s, and average NIBUT before reading was 10,2 s but after reading 7,4 s. Average blinking while participants were reading was 7 times/min but before reading it was 20 times/min. The computer height and used text size do not show an effect on blinking and measurements of the stability of the tear film.

Conclusions: The results show that after the reading task, the tear film stability decreases. High concentration tasks on computer correlates with destabilization of tear film. When people are working with computer their average number of blinks decrease.

Acknowledgements: Research has been supported by LU, LU Foundation and SIA «Mikrotīkls» project Nr.2184.

P7. A MOTOR IMAGERY-BASED BRAIN-COMPUTER INTERFACE SYSTEM IMPROVES UPPER LIMB FUNCTION IN PATIENTS POST-STROKE

G. Cepanonyte[1*], A. Heilinger[2], R. Ortner[2], N. Murovec[2], W. Cho[2], Ch. Guger[2,3]

[1] Department of Neurobiology and Biophysics, Life Sciences Center, Vilnius University, Vilnius, Lithuania
[2] g.tec medical engineering GmbH, Schiedlberg, Austria
[3] Guger Technologies OG, Graz, Austria
*gintaaare@gmail.com

Background and aim: motor disfunction after stroke remains the main cause of disability among patients even after long rehabilitation treatments. The main conventional rehabilitative techniques such as physical/occupational therapy are based on active movement training, however, some patients are so severely impaired that they cannot engage into active exercises. Moreover, they do not measure a person's task engagement. However, adaptive neurotechnologies, such as brain-computer interface (BCI), help create a sensorimotor loop even for severely disabled patients. Importantly, they require a full task engagement from the patient. This may facilitate brain plasticity and result in favourable functional outcomes. The aim of this study was to evaluate the effect of a motor imagery- based BCI system *recoveriX* on upper limb motor function after stroke.

Materials and methods: recoveriX system was used as a therapeutic tool for chronic (> 6 months) patients after stroke. The system records and processes brain activity via electroencephalography (EEG) in real-time and provides a dual feedback: functional electrical stimulation and hand movements in virtual reality. To evaluate the the effect of the therapy, the pre- and post- scores of Fugl-Meyer Assessment and Modified Ashworth Scale of 34 patients were compared. Furthermore, it has been attempted to find possible correlations between functional variables and time after stroke, as well as to find possible reasons for what might have caused different therapy outcomes among patiens.

Results: after 25 sessions of the recoveriX therapy, patients' upper limb function has significantly improved and their muscle spasticity has significantly decreased. Moreover, moderately impaired patients imrpoved more than severely impaired. Neighther patient's sex nor paretic side had the effect on the therapy's functional outcomes. Finally, no correlations were found between functional variables and time after stroke.

Conclusions: this research suggests that recoveriX is a promising tool for neurorehabilitation as it improves upper limb function post-stroke. Moreover, it goes deeper into trying to reveal different therapy outcomes in various subgroups. It is improtant to note that unlike the conventional therapies, recoveriX outcomes do not depend on patient's gender or paretic side and that functional impairement can be achieved even years post-stroke. All the patients in this study were in chronic stroke stage, thus it is hard to predict the effect of the therapy in the acute phase. Finally, it would be useful to look for the changes in EEG induced by the therapy.

P8. DOUBLE-STEP ADAPTATION OF SACCADIC EYE MOVEMENTS IN FRISBEE AND TABLE TENNIS PLAYERS

I. Ceple*, I. Cehanovica, G. Krumina

Department of Optometry and Vision Science, Faculty of Physics, Mathematics and Optometry, University of Latvia, Riga, Latvia
*ilze.ceple@lu.lv

Eye movement and body coordination play an important role in the performance of different physical activities (Griffiths, 1999). Previous studies demonstrate more successful gaze paths, shorter reaction times, as well as faster saccades and shorter saccadic eye movement latencies for athletes comparing to non-athletes (Kato & Fukida, 2002; Paul *et al*., 2011). Still it is not clear whether athletes are also more successful in saccadic eye movement adaptation than non-athletes (see Elsway, 2011; Paul *et al.*, 2011; Babu 2004).

Current study addresses saccadic eye movement adaptation to double-step stimuli, exploring adaptation processes in table tennis and frisbee players. The parameters of saccadic eye movement adaptation, reaction time to stimulus onset, as well as saccadic eye movement duration were recorded using IViewX HiSpeed (*Sensomotoric Instruments*) video-oculograph.

Study results demonstrate that participants that perform different physical activities on daily basis (frisbee or table tennis) have a more rapid saccadic eye movement adaptation to double step stimuli and reduced saccadic eye movement latency than non-athletes. No significant differences in saccade duration were observed when comparing the performance between non-athletes and table tennis and frisbee players.

The results of the current study outline two aspects of saccadic eye movement programming. First, it has been demonstrated that the performance of saccadic eye movements is improved for those participants who regularly engage in different activities that require fast reaction times and eye-hand coordination (e.g. frisbee and table tennis), indicating that the saccadic eye movement system might be capable to short-term and long-term adaptation to different conditions. Secondly, the results do not demonstrate significant differences between the performance of both groups of athletes, indicating that the performance can be improved by non-specific activities which include eye-hand coordination.

P9. ANALYSIS OF REAL MOTOR AND MOTOR IMAGERY MOVEMENT AND ITS POTENTIAL APPLICATION TO FUNCTIONAL MOTOR REHABILITATION IN STROKE PATIENTS

A. F. Diaz[1, 3], J. Kaufman[1, 4], T. Kleineschay[2], E. M. Castillo[2], A. Chaudhry[3], M.Korostenskaja[1, 2*]

1 Functional Brain Mapping and Brain Computer Interface Lab &
2 MEG Lab, Florida Hospital for Children, Orlando, FL, United States
3 Univesity of Central Florida, Orlando, FL, United States
4 Rollins College, Winter Park, FL, United States
*milena.korostenskaja@gmail.com

Background and aim: Magnetoencephalography (MEG) is a noninvasive brain imaging modality that can be used for brain mapping and has the potential to be clinically significant in stroke rehabilitation. Our lab used a functional MEG methodology combined with structural MRI to form a normative data set for real *vs*. imagined hand motor activation. Understanding and characterizing cortical activation in both real and imagined movement can lead to the development of therapies and devices to help stroke patients regain functional motor movement.

Materials and methods: 10 healthy participants (7 males, 3 females; age (MEAN ± SD): 25.3 ± 6.9 years; 9 right-handed and 1 left-handed) participated in this study. All patients completed a hand dominance questionnaire. A 3T MRI scanner was used to reconstruct the participant's individual cortical brain surface in 7 cases; for subjects without an MRI scan, a default structural brain model (ICBM 153) with digitized head points was used. Upon presentation of a visual stimulus, participants were prompted to clench their right or left fist. On a separate trial, they were prompted to imagine clenching their fist. A 306-channel MEG system (Elekta, TRIUX) was used to record cortical activation.

Results: Real Motor (RM) and Motor Imagery (MI) movement recordings had detectably different signatures on the motor cortex in mean normalized activation signatures from the control (visual imagery). RM displayed prominent activation in the pre-central gyrus with some detectable activation in the post-central gyrus. MI displayed prominent activation in the post-central gyrus. RM presented contralateral activation and MI presented both contralateral and ipsilateral activation. Frontal lobe activation was more prominent in MI than RM. Somatosensory activation was observed in both paradigms (post-central gyrus).

Conclusions: While brain activity during RM and MI movement was largely shared within the motor cortical network, RM activity was generally more closely related to motor-execution (pre-central gyrus) areas, whereas MI activity was more closely related to sensory (post-central gyrus) and planning areas (frontal lobe). A gradient of activity in non-motor areas reflects how these areas contribute to execution and planning of movement. We plan on expanding this data analysis approach by increasing our healthy control group sample size and comparing this data to the functional activation and cortex reorganization of stroke patients. In the future, we plan to directly utilize knowledge gained from this study to improve the functional deficits of post-stoke patients by evaluating how brain-computer interface (BCI) therapy can restore, enhance, and supplement their limited motor function.

P10. EYE MOVEMENT TRACKING METHOD IN A STUDY OF VISUAL PERCEPTION OF AMBIGUOUS IMAGES

V. Dranseika, A. Bielevičius*

Institute of Biological Systems and Genetics, Lithuanian University of Health Sciences, Kaunas, Lithuania
*arunas.bielevicius@lsmuni.lt

Background and aim: Analysis of ambiguous images observation via psychophysical eye tracking experiments.

Materials and methods: Monocular observation from 1.1m distance was used. 8 images (1 control and 7 ambiguous images) were presented nose-to-tail on a screen. Participants' eye movements were recorded. Gaze positions were plotted as x, y coordinates in time. This allowed to extract following: saccade onset time, text reading time and perception duration. An ANOVA analysis was used to look for statistically significant differences amongst these times for ambiguous images. Then, a t-test was used to check for statistically significant differences in control vs. ambiguous images. Areas of highest visual attention were illustrated using heatmaps.

Results: Data from 7 subjects for 8 images was analyzed. Mean saccade onset time was 0.3407 s. The mean reading time was 0.6187 s. The average time to perceive the control was 2.362 s for simple vs. 4.048 s for ambiguous images. All images had 2 areas that attracted most attention. In one group (3 images) these locations could clearly be attributed to specific percepts, whilst in the other group (4 images) both percepts could be established by looking at the same location.

Conclusions: 1. Eye movement recording was implemented in a psychophysical experiment with text reading and ambiguous vs control images perception. 2. There was no significant difference in saccadic onset times and text reading times in simple vs. ambiguous images ($P > 0.05$). 3. Perception time was longer for ambiguous images compared to control 4.048 s vs. 2.362 s ($P < 0.05$). 4. Each image contained 2 attention areas. However, in a subset it was impossible to determine which rival meaning was perceived by focusing on that specific area. 5. Longer perception times as well as the inability to determine an exact perceived meaning based on gaze position indicate, that higher cognitive factors may also play a role in the perception of ambiguous images.

P11. EFFECTS OF ENVIRONMENTAL FACTORS ON TEAR OSMOLARITY

K. Dumberga*, E. Kasaliete, A. Petrova, G. Krumina

Department of Optometry and Vision Science, University of Latvia, Riga, Latvia
*kristinedumberga@inbox.lv

Background and aim: Efficient tear production and turnover is essential to protect ocular surface. Elevated tear osmolarity is a key factor in the chain of events leading to dry eye disease (DED). Tear hyperosmolarity results from reduced tear flow and- or increased evaporation of aqueous tear phase, that leads to tear film breakup (Potvin, 2015.). Tear osmolarity is influenced by many inner and external factors. There is positive correlation between hydration level of whole body, expressed as plasma osmolarity, and tear film osmolarity (Bron, 2017.). Quality and thickness of tear film of lipid layer affects evaporation rates from tear film (Arciniega, 2011.). To evaluate effects of individual and environmental factors on tear osmolarity such factors as humidity, temperature, air flow and personal habits were considered. Correlation with other tear film parameters were analysed.

Materials and methods: The aim of the work was to evaluate the effects of environmental factors on tear osmolarity and the results of examinations of the frontal structure of the eye, as well as to find out the interactions between these parameters. The study was conducted in 3 parts: within the Part 1 – ”Questionnaire Part” – 125 participants were surveyed; within the Part 2 – “Examination Part” – 54 participants took part, and within the Part 3 – “Repeated Measurements Part” – 21 participants were involved.

Results: The results gave evidence that relative humidity of the air affects the osmolarity of tears. The osmolarity of the tears correlates with the results of the Schirmer test, the coloration of the cornea and the TBUT time. A link was found between tear osmolarity and the roughness of the eyelid, corneal coloration and the Schirmer test.

Acknowledgements: Research has been support by LU, LU Foundation and SIA «Mikrotīkls» project Nr.2184.

P12. EFFECTS OF ENVIRONMENTAL FACTORS ON ANTERIOR EYE STRUCTURES

L. Eglite*, E. Kassaliete, A. Petrova, G. Krumina

Department of Optometry and Visual Science, University of Latvia, Riga, Latvia
*lindish211@gmail.com

Background and aim: Office workers spend most of their work time on a computer. At intense work, many of these employees experience a computer vision syndrome (Tauste et al., 2015; Tilborg et al., 2017). They may have several eye-related problems, such as reduced tear stability, incomplete blinking and reduced blinking. There are several factor affecting the air quality in the office: low relative humidity, high air temperature, high air pollution, high air ventilation. The aim of the research was to find out the influence of environmental factors on eye structures at the Academic centre of University of Latvia.

Materials and methods: The task was to evaluate air humidity and temperature at Academic centre for Natural Sciences of University of Latvia and to assess the environmental factors and its' correlation to complaints of visual discomfort and clinical state of the eyes.

Results: 6 percent of office workers have seen moderate or severe complaints of visual discomfort and dryness after Mc Monnies questionnaire. The highest number of complaints was about air quality (64% of n=123 were dissatisfied) supported by the fact that air humidity was below the norm (11.14 ± 0.84 %). Between changes in the anatomical structure of the eye (LIPCOF, LWE, tear meniscus, limbal/bulbar hyperemia and corneal neovascularisation, we found significant correlations, where LIPCOF shows the highest correlation with tear meniscus ($r = 0.78$, $p<0.001$). All clinical signs of anatomical structure of the eye show a significant correlation with the Mc Monies dry eye syndrome questionnaire.

Conclusion: LWE and LIPCOF are easy to test in the optometrist's office and do not require extra equipment like tear scope to detect dry eye syndrome.

Acknowledgements: Research has been support by LU, LU Foundation and SIA «Mikrotīkls» project Nr.2184.

P13. DEVELOPMENT OF PORTABLE SENSOR PLATFORM FOR LIGHT AND USER EXPERIENCE MONITORING IN OFFICE WORKERS

S. Fomins[1,2*], R. Trukša[1], G. Krūmiņa[1]

[1] Optometry and Vision Science Department, University of Latvia, Riga, Latvia
[2] UL Institute of Solid State Physics, Riga, Latvia
*sergejs.fomins@lu.lv

Background and aim: Some decades ago new retinal circuit that controls sleep and wake periods in humans was discovered. It is proven that alongside with visual pigments cyanolabe, chlorolabe, erythrolabe (cone photopigments), rhodopsin (rod photopigment), there is third type of photopigment class, called melanopsin, which is found in intrinsically photosensitive retinal ganglion cells (ipRGCs). Melanopsin absorbs more effectively in short wavelength spectrum than in rest parts of visible light spectrum. Our aim is to develop portable device that monitors light intensity in short wavelength spectrum and change in distance between person and monitor during office day as a tool for visual ergonomics.

Materials and methods: System consists of 3D printed spectacle frame that is equipped with CIE system colour sensor, additional circadian light blue sensor, and proximity sensor VL53L0X for the control of working distance. Sensors are wired to standalone microcontroller board that receives information from sensors and carries out primary analysis and passes sensor data to PC.

Results: Hardware and software for monitoring light spectrum and distance during office day was developed. By using current technical solution, we can monitor radiance spectrum at corneal level and identify the viewing distance during office work.

Conclusions: Data acquired by developed device are suitable to provide feedback to persons whose work duties require long office hours in order to reduce visual fatigue and improve the overall wellbeing.

Acknowledgement

The study is an activity in the project No 2184, donation of SIA "Mikrotīkls", which is managed by the Foundation the University of Latvia.

P14. DRY EYE DISEASE: CURRENT TREATMENT OPTIONS

A. Hartwig[1,2]

[1] Hartwig Research Center, Heikendorf, Germany
[2] Aston University, Aston Express Way, Birmingham, England, UK
andreas.hartwig@firma-hartwig.de

Globally dry eye disease is the most frequent ocular disease and optometrists are increasingly exposed to patients complaining about dry eyes. Risk factors for dry eye disease can be ocular surgery, contact lenses, systemic diseases such as diabetes, climatic conditions etc. Typically artificial tears are dispensed to relieve ocular discomfort. A variety of other potential solutions is nowadays available to provide good patient care. The therapy needs to be based on a proper diagnosis of the type of dry eye.

In a first instance artificial tears can lead to a relief. However, artificial tears need to be well chosen and factors such as preservatives need to be considered.

Other options to improve quality of life for patients are lid hygiene, thermal therapy and light therapy. Those approaches aim to improve the quality of the lipid layer of the tear film. Some of those treatments promise effects that last for more than one year.

Nutrition also plays a vital role in the disease and specific supplements can lead to an improvement of the ocular surface. Anti-inflammatory drugs are another option, that are usually prescribed by ophthalmologist.

In case of contact lenses users, specific contact lenses and care regime exist that lead to better wettability of the contact lenses and improved comfort.

Finally, blink frequencies have an impact on the patients' comfort. Therefore, optometrist and ophthalmologists should guide patients to improve their blinking habits.

In summary, a variety of options is available to reduce discomfort in dry eye disease patients. The role of optometrists and ophthalmologists is to guide the patient to the appropriate treatment for each individual suffering from dry eye disease.

P15. EFFECT OF DISPARITY AND VIEWING DISTANCE ON DEPTH PERCEPTION FOR A VOLUMETRIC DISPLAY

G. Jankovska*, T. Pladere, V. Konosonoka, K. Panke, G. Krumina

Department of Optometry and Vision Science, Faculty of Physics, Mathematics and Optometry, University of Latvia, Riga, Latvia
*gunita.jankovska@lu.lv

Background and aim: The volumetric multi-plane display is capable of demonstrating three-dimensional images with consistent depth cues. The location of visual stimuli on different planes contributes to the depth perception based on relative binocular disparity. The binocular disparity is one of the key cues in depth estimation, but its impact changes dramatically while increasing the distance. How does it influence the depth perception for the volumetric display? This study aims to explore the relationship between the accuracy of depth perception and the viewing distance till the volumetric display.

Materials and methods: Young individuals completed a set of visual tasks, following a four-interval forced-choice procedure. In each trial, four 0.5° circles were presented on the volumetric multiplanar display (LightSpace Technologies, x1405) and the retinal target size was met at all test distances. Nine test distances for the examination varied from 0.5 m till 2.5 m, and the sequence was randomized. Thus, the relative disparity of stimuli varied from 286''±9'' to 12''±0'', respectively. The individuals were asked to choose which of the four stimuli was the closest to the observer and submit the answer using the keyboard.

Results: As expected, at the nearest distances (0.5 m and 0.75 m), the participants completed the depth estimation task equally well – the correct response rate was about 98%. However, the rate dropped gradually for the larger viewing distances and reached 43%±9% at 2.5 m. Thus, the obtained data demonstrated that the depth estimation task became difficult to be completed correctly when the relative disparity of stimuli was less than 25''. It also reflected in the average time required for the task accomplishment. It grew linearly with a decrease of the viewing distance.

Conclusions: For the volumetric display, the depth perception based on binocular cues is the most accurate when the viewing distance is less than 1 m.

P16. EFFECTS OF CATARACT SURGERY ON PATIENT COLOR VISION SENSITIVITY

Z. Jansone[1*], M. Ozolinsh[1,2]

[1] Optometry and Vision science department, University of Latvia, Riga, Latvia
[2] Institute of Solid State Physics, University of Latvia, Riga, Latvia
*jansonezane1993@gmail.com

Background and aim: In optometrist practice, we are dealing with patients who have cataract or have had cataract removal surgery. We check their vision functions as visual acuity, contrast vision but usually optometrists do not check color vision. Color vision tests can give information about pathological changes in eye structures. Our aim was to evaluate if the color vision chromatic resolution changes before and after cataract surgery.

Materials and methods: We used saturated and unsaturated Farnsworth D15 Color vision arrangement test to check color sensitivity changes in confusion line directions. The results were analyzed: by summing the color differences between adjacent caps according to Bowman (Bowman, 1982) by averaging color difference vectors according to Vingry and King-Smith (Foutch et al. 2011) and using linear regression line that is made from error cap arrangements (Foutch et al. 2011). In our research participated 26 eyes with cataract.

Results: All three tests showed that cataract caused lens opacities to decrease significantly in visible light chromatic resolution. After Intaocular lense implantation (IOL) two patients showed improvements in color vision sensitivity, but they still had deviations from the norms, meaning that the color vision sensitivity changes not only due to the lenses' light absorption but from other pathological factors as well.

Conclusions: Color vision tests can give us information how cataract envolves. Test results can be as indicator for IOL selection.

P17. THE USE OF SPECIALIZED COMPUTER GAMES IN THE TREATMENT OF AMBLYOPIA

K. Kalnica[1,2*], S. Valeina[2], A. Svede[1]

[1] Department of Optometry and Vision Science, Faculty of Physics, Mathematics, and Optometry, Latvian University, Riga, Latvia
[2] Children's Eye Diseases Clinic, Children's Clinical University Hospital, Riga, Latvia
*kristinekalnica@gmail.com

Background and aim: Amblyopia or a disorder of early development of the brain cells results in decreased visual acuity in one or both eyes that cannot be simply improved by refractive correction. The classical treatment option is occlusions of non-amblyopic eye. The newest methods involve specialized computer games that involve both eyes in visual processing during treatment as well as stimulate binocularity. These games are mainly used in children under the age of seven years and adults. The aim of this study was to assess the efficiency of specialized computer games in the treatment of amblyopia in school-age children.

Materials and methods: There were 22 participants (7-18 years old): 11 participants had occlusion therapy, 11 participants played the specialized computer game Tetris®. The visual acuity of amblyopic eye, as well as stereopsis was evaluated at near and far distances before the treatment, 2 and 4 months after the treatment.

Results: The results show statistically significant improvement in visual acuity in both treatment groups after four months of therapy. The extent of improvement is similar in both groups. Stereo acuity improved at near in patients with anisometropic amblyopia, but there was no improvement in stereo acuity for distance.

Conclusions: Specialized computer games for amblyopia treatment may be recommended to patients at any age (also after age of seven years) if they want to improve their visual acuity in the amblyopic eye and are not willing to use occlusions. The only requirement for using specialized games – patients need to have binocular single vision. In conclusion, the use of specialized computer games is an alternative type of amblyopia treatment compared to occlusion therapy.

P18. DOES IMPULSIVITY PREDICT RISKY ALCOHOL USE?

M. Kaminskaite[1*], J. Janaviciute[2], I. Lelyte[2], L. Sinkariova[2**], R. Jokubka[1]

[1] Neuroscience Institute, Lithuanian University of Health Sciences, Kaunas, Lithuania
[2] Departmen of Psychology, Vytautas Magnus University, Kaunas, Lithuania
*migle.kaminskaite@lsmuni.lt; ** liuda.sinkariova@vdu.lt

Background and aim: Alcohol addiction risk is predisposed by both sociocultural and biological factors. The attenuation of brain reward system converged by environment, manifest in personality traits, that are typical to addiction disorders. As the substance use disorders are characterized by obsessive – compulsive pattern of use with loss of control, impulsivity is considered one of the main endophenotypes that increases addiction risk. This study aims to clarify the impact of several impulsivity dimensions to risky alcohol use.

Methods and results: Three hundred seventy-five (160 males, mean age=37.78, SE=0.96; 215 females, mean age 36.42, SE=0.73) respondents were surveyed on risky alcohol use via Alcohol Use Disorder Identification Test (AUDIT). Impulsivity and its dimensions were evaluated via Barratt Impulsivity Scale-11 (BIS-11).

Dimensions of impulsivity and AUDIT correlate significantly for males: Attention $r=0.38$, $p<0.01$, Cognitive Instability $r=0.22$, $p<0.05$, Motor Impulsivity $r=0.29$, $p<0.01$, Self-Control $r=0.22$, $p<0.05$, Cognitive Complexity $r=0.28$, $p<0.01$); and for females: Motor Impulsivity $r=0.16$, $p<0.05$, Cognitive Complexity $r=0.20$, $p<0.05$. Multiple regression analyses show that risky alcohol use is significantly associated with gender ($p<0.05$), explaining 20.5% of risky alcohol use variance ($p<0.01$) for males in Lithuanian population-based cohort.

Conclusions: Results of partial correlations and multiple regression analyses show risky alcohol use significantly associated with impulsivity. Divergent findings of impulsivity association to risky alcohol use for genders suggest a different ways of pathogenesis. These findings are not surprising as in males *ventral striatum* dopaminergic neurons typically have greater reactivity to cue. Next, our focus are on dopaminergic system associated genes to determine impulsive endophenotype role in alcohol addiction risk.

P19. MEIBOMIAN GLAND DYSFUNCTION (MGD) AND EYELID THERAPY

E. Kliesmete[1], E. Kassaliete[1*], A. Petrova[1], G. Krumina[1], K. Detkova [2]

[1] Department of optometry and Vision Science, university of Latvia, Riga, Latvia
[2] OPTIO, SIA"OC VISION", Riga, Latvia
*evita.kassaliete@lu.lv

Background and aim: Meibomian glands are large glands present in eyelids, which secrete lipids that form the superficial layer of tear film to protect evaporation of the aqueous phase. Meibomian Gland Dysfunction (MGD) is a chronic, diffuse abnormality of the meibomian glands, commonly characterized by terminal duct obstruction and/or qualitative/ quantitative changes in the glandular secretion (Nelson et al., 2011). The purpose of study was to evaluate the importance of warm compresses and eyelids massage on improving the quality of the activity of the Meibomian glands and stabilizing the tear film.

Materials and methods: Study had three parts. First part was McMonnies and OSDI dry eye questionnaires. Second part was assessment of eye structures, tear film stability (NiBUT), estimation of lipid layer thickness after interferometric image of tear film. Third part was assessment of tear film stability, Meibomian gland expression and Meibography after warm compress therapy of 16 patients. We used "Eye Mask" compresses, heating for 7 minutes twice a day. There were 125 participants in the first part and 55 participants in the second part.

Results: Meibomian gland quality and quantity show a close correlation (r = 0.73). The second-degree of MGD was find to 38% of patients who work by the computer. The degree of Meibomian gland atrophy correlates with gland secretion quality (r = 0.66), quantity (r = 0.63) and lipid layer thickness (r = 0.63). Ten days of warm compress therapy, in grade 2 of MGD enhances NiBUT by 29%, gland secretion quality by 11% and quantity by 9% and lipid layer thickness by 3%.

Conclusions: Eyelid therapy (warm compresses and lid massage) can be used for treatment of Meibomian gland dysfunction. It reduce discomfort signs and tear film evaporation, and stabilize lipids in tear film.

Acknowledgements: Research has been supported by LU, LU Foundation and SIA «Mikrotīkls» project Nr.2184, and optician company SIA "OC VISION".

P20. COMPARISON OF FOUR CHARTS FOR VISUAL ACUITY IN VIEW OF REPEATABILITY

A. Kazakova[1,2*], M. Gracheva[2]

[1] Pirogov Russian National Research Medical University, Moscow, Russia
[2] Institute for Information Transmission Problems (Kharkevich Institute), Moscow, Russia
*annekazakova@mail.ru

Background and aim: Visual acuity (VA) assessment is one of the most common procedure in optometry. The most fruitful period for VA charts development was in 70-80ies of XX century in Europe and in USA. However, in spite of all the recommendation proposed, the most common chart in Russia is still Sivtsev-Golovin chart, published in 1920th.

The aim of this work was to compare four VA charts: widely used (1) Lea and (2) ETDRS, (3) Sivtsev-Golovin chart (the most common chart in Russia) and (4) chart with the optotypes recently developed in IITP (Patent RF 2447826).

Materials and methods: Subjects were tested with four charts in random order. Each subject was tested in monocular conditions for both eyes, then in binocular conditions. After a break time (at least 1 day), subjects were tested again (retest).

Viewing distance was 4 m. If needed, the subjects used optical correction, providing BCVA. Ambient lighting corresponded to 250 lx, illumination of charts – to 160 Cd/m^2.

The subjects were 27 young adults, 6 females, 21 males. Mean age – 26.37 years (min – 19, max – 33, median – 27, std – 3.39). 12 subjects were emmetropic; 9 – with light myopia; 4 – with mild myopia; 1 with light hypermetropia.

Results: In decimal units the difference between mean VA for retest and test was 0.07 for ETDRS, 0.06 for Lea, 0.07 for Sivtsev-Golovin, 0.02 for IITP chart. We compared the test and the retest data for each chart by Wilcoxon signed-rank test. The only chart with no significant difference between test and retest values is IITP chart, that means best repeatability in our sample.

Conclusions: In our sample, the best repeatability was obtained for the IITP chart with modified 3-bar optotypes.

P21. VISUAL SEARCH PERFORMANCE DEPENDING ON A TYPE OF DISPLAY

V. Konosonoka*, T. Pladere, M. Seleznova, K. Klava, K. Panke, G. Krumina

Department of Optometry and Vision Science, Faculty of Physics, Mathematics and Optometry, University of Latvia, Riga, Latvia
*vita.konosonoka@gmail.com

Background and aim: In diagnostic radiology, stacks of numerous medical images are commonly shown on flat panel computer displays. This type of visualization is unable to provide full information about the third dimension and it limits the efficiency of visual search. In contrast, it is possible to show all images simultaneously in a true depth on an innovative volumetric display. Therefore, the purpose of this study was to determine how visual search performance changed for different displays.

Materials and methods: The visual search task was presented on a volumetric display (LightSpace Technologies, x1405) and a computer display (Samsung Electronics, S24E650). There were 40 or 50 circles presented on the ten slices in the task and the target circle altered from the other stimuli by 10%, 15%, 20% and 25% of line thickness. On the volumetric display, all slices were shown simultaneously in the beginning, but on the computer display – one after another. The participants were asked to determine the location of the target stimulus in a stack of ten slices within which they could navigate forth and back in depth.

Results: The correct response rate did not differ for the most of viewing conditions when the task was accomplished on the volumetric display or on the flat panel computer display. But the mean response time was approximately 1.6 times shorter for a volumetric display. In addition, the number of moves made within the stacks of images was significantly higher when the stimuli were presented on the flat panel display and the target altered from the other stimuli more than by 10%.

Conclusions: The study has showed that the correct response rate is similar for both displays, however, the visual search task on the flat panel computer display is more time consuming than on the volumetric display. More moves are required to be done through the stacks of images if the visual task is presented on the flat panel computer display.

P22. GAZE PARAMETERS FOR ANALYSIS OF AMBIGUOUS GEOMETRIC SHAPES

L. Krauze[1*], I. Ceple[1], J. Skilters[2], G. Krumina[1]

[1] Department of Optometry and Vision Science, University of Latvia, Riga, Latvia
[2] Laboratory for Perceptual and Cognitive Systems, University of Latvia, Riga, Latvia
*lindakrauze@inbox.lv

In human visual system, grouping principles combine individual elements into larger groups. Pinna (2010a, 2015) demonstrated that visual grouping affects shape perception, which can easily be altered by changing the location of additional elements. Although the impact of visual grouping on shape perception has been extensively studied before (e.g., *Wagemans et al.,* 2012; *Peterson & Salvagio*, 2010), their link to direct attentional processes and gaze parameters has not.

The aim of the current study is to analyze gaze parameters in visual grouping tasks. Eye movements were analyzed using IViewX RED500 eye tracker. 8 stimuli were presented to the participants: a square, a diamond, and a diamond with an additional element at its vertex or edge in 3 different positions. In the first part of the study, the participants looked only at 1 stimulus; in the second part – sequentially on all stimuli; in the third and fourth part, participants did a forced-choice task where they had to determine the shape of the object (i.e., whether the object is perceived as a square or as a diamond).

Results indicate that the position of the ball and the distance to the additional element do not show a significant impact on the participants' perception of the shape. Gaze was more divided between the objects when located further away from each other. The response time for determining the shape of an object was not dependent on the type of stimuli. There was no significant difference in perception of the shape, depending on the location of an additional element, and its distance to the object.

P23. THE DEVELOPMENT OF STEREOTEST FOR THE EVALUATION OF STEREOANOMALY

G. Krumina[1*], E. Eldmane[1], A. Gulbe[1], V. Lyakhovetskii[2]

[1] Department of Optometry and Vision Science, University of Latvia, Riga, Latvia
[2] Pavlov Institute of Physiology, Russian Academy of Sciences, Saint-Petersburg, Russia
*gunta.krumina@lu.lv

Background and aim: Using standard clinical stereotests it is possible to evaluate the stereothreshold, but not stereoanomaly because all clinical stereotests are presented with unlimited time. Stereoanomaly is a condition where the subject cannot distinguish one or two of three disparities types. It has been reported that approximately 30% of the population fails to detect the object orientation in depth making a false judgment on perceived object being closer (crossed disparity) or further (uncrossed disparity) in the local 3-dimensional test (*Richards*, 1971). Purpose of our study was to develop the new clinical global and local stereotests and to evaluate the stereothreshold and stereoanomaly using these new stereotests with the possibility to change the time limit and the disparity size.

Materials and methods: The new stereotests were based on the global and local stereopsis, designed as red-green anaglyph and random dot computer program. The test generated the stimuli with different disparities and the staircase method principle was used for the evaluation of stereothreshold in case of crossed and uncrossed disparity. Stimuli duration were with the restricted (200 ms) and with the unlimited presentation time. The distance between test and subject was fixed at 1 m. The subject was introduced with the task before any data recording. The total amount of subjects was 55. All subjects had the stereovision detected using the clinical TNO and Titmus stereotests.

Results: The first results presented that 17 subjects (31%) had the stereoanomaly in case of the global stereotest and three subjects did not have the stereovision using the new global stereotest with limited (200 ms) time. Half of the subjects had the problem in case of the local stereotest with limited time. Subjects with normal stereopsis had better stereoacuity, response time and accuracy then stereoanomalous in the local and global stereotests.

Conclusions: The developed local and global stereotests are useful for the evaluation of stereothreshold depending on stimuli presentation time and are useful for the detection of stereoanomaly.

P24. DEEP BRAIN STIMULATION FOR MORBID OBESITY

A. Kupryjaniuk*, M. Sobstyl

Institute of Psychiatry and Neurology, Department of Neurosurgery, Warsaw, Poland
*kupryjaniukanna@gmail.com

Introduction: The prevalence of morbid obesity (MO) has increased in the last few decades in both developed and the developing countries. MO is associated with a significantly impaired quality of life, severe comorbidities, and premature death. Currently three deep nuclei were studied in humans as possible neuromodulating targets for MO. These nuclei include: the lateral hypothalamus (LH), the ventramedial hypothalamus (VMH), and nucleus accumbens (NAc).

Methods: We have performed a literature search of all available reports which relate to deep brain stimulation (DBS) for MO in humans. Experimental studies on animals showed the beneficial effect of hypothalamic, and NAc stimulation on reduction of hunger, inhibition of food intake and weight loss. These experiments promoted DBS procedure for MO in humans. The stereotactic targets chosen were as follows: NAc = 3 patients, VHM = 9 patients, and LH =7 patients.

Results: We were able to find 26 studies which described the effects of DBS on MO. Generally, all patients with MO responded well two bilateral DBS involving the LH, VHM, and NAc. The main drawback is still the small number of operated patients for MO.

Conclusions: DBS, although studied in a few patients with MO has been shown to be effective, safe and well tolerated. More studies with longer follow-up, incorporating more individuals are needed to established DBS for this severe appetite disorder.

P25. DEEP BRAIN STIMULATION FOR ANNOREXIA NERVOSA

Kupryjaniuk*, M. Sobstyl

Institute of Psychiatry and Neurology, Department of Neurosurgery, Warsaw, Poland
*kupryjaniukanna@gmail.com

Introduction: The mechanisms of anorexia nervosa (AN), have been vigorously studied over the last century, and these studies have shown that the central nervous system especially the brain areas of limbic circuit has significant involvement within this pathology. Young females have the highest prevalence rate, estimating to be 0.3% in this population, also with the highest accompanied mortality rate. Despite all available treatment modalities for AN the success rate is low. The new treatment approaches are needed.

Methods: We have performed a literature search of all available reports which relate to deep brain stimulation (DBS) for AN in humans. We were able to identify 13 studies accumulating 59 patients. The stereotactic targets chosen were as follows: subgenual cingulate (25 Brodmman area) in 35 patients, nucleus accumbens (NAc) in 22 patients, and ventral capsule/ventral striatum in 2 patients.

Results: Generally, the safety profile of DBS in severe AN patients was good with very low rate of adverse effects. Most patients studied gained significant improvement in mean Body Max Index (BMI) and concomitant psychiatric comorbidities like depression, anxiety, and affective regulation.

Conclusions: DBS has showed to be effective, safe and well-tolerated procedure in patients affected by severe AN. Not only BMI responded well to bilateral DBS of subgenual cingulate and NAc but also psychiatric comorbidities. These results highlight the promise and hope for AN patients but further studies with larger patient's populations are warranted to shed light on long-term outcomes and its effects in AN treatment.

P26. VISUAL ACUITY, REFRACTION, AND PACHYMETRY IN DIFFERENT KERATOCONUS STAGES AFTER CROSS-LINKING

S. Liduma*, E. Vavzika, G. Krumina

Department of Optometry and Vision Science, University of Latvia, Riga, Latvia
*sanita.liduma@gmail.com

Background and aim: Keratoconus is a progressive eye disease in which the corneal shape is changed, the optical properties of cornea are destroyed, and the visual quality is reduced. The collagen cross-linking operation using riboflavin and the UVA is the best method to control and stop the keratoconus progression at present time (*Khattak, Nakhli & Cheema*, 2015). The cross-linking has an impact by stopping the formation of irregular astigmatism, by reducing the rapid changes of corneal curvature, spherical equivalent, and astigmatism (*Coskuseven et al*, 2009). The aim of our study is to analyze the cross-linking results in patients with different keratoconus stages.

Materials and methods: In the study, the Dr. Lukins' eye clinic's cross-linking patients' data were analyzed before and six months after the treatment. In total we analyzed 49 patients' eyes with the first, second and third keratoconus stages. We evaluated the best subjective refraction (including sphere, astigmatism, and spherical equivalent), the changes of uncorrected visual acuity the corneal thickness before and after treatment in this study.

Results: Visual acuity in patients with first stage keratoconus improved by 0.17 decimal values, in patients with second and third stages improved accordingly 0.07 and 0.08. Patients' average value of sphere was -1.43±0.08 D before treatment and it reduced in six months to -1.22±0.09 D; the value of astigmatism increased from -2.93±0.07 D to -2.96±0.06 D, and spherical equivalent increased from -2.74±0.09 D to -2.77±0.09 D. The corneal thickness in all keratoconus stages reduced respectively by 7.56%, 6.54% and 9.27%.

Conclusions: The cross-linking method can significantly improve the visual acuity in patients with the first stage keratoconus. We could not find any statistically significant changes in visual acuity and correction parameters (sphere, astigmatism and spherical equivalent) in patients with second and third stage keratoconus before and after six months treatment.

P27. NEUROMODULATION OF SYNAPTIC PLASTICITY AT SCHAFFER-COLLATERAL SYNAPSES ON A HIPPOCAMPAL CA1 PYRAMIDAL NEURON DURING THETA OSCILLATIONS: A COMPUTATIONAL MODELING STUDY

D. Linkevičius[1], M. Mittag[2], P. Jedlicka[2], A. Saudargienė[1*]

[1] Neuroscience Institute, Lithuanian University of Health Sciences, Kaunas, Lithuania
[2] Justus-Liebig University, Giessen, Germany
*ausra.saudargiene@lsmuni.lt

Background and aim: Hippocampal CA1 pyramidal neurons receive excitatory synaptic inputs from entorhinal cortex (EC) and CA3 neurons, inhibitory synaptic inputs from many classes of interneurons, and can oscillate in a theta rhythm (4-10Hz). Synaptic plasticity varies across the theta cycle, from strong long-term potentiation (LTP) to long-term depression (LTD), corresponding to the memory encoding and retrieval cycles. Learning in hippocampus is also affected by cholinergic neuromodulation: acetylcholine (ACh) enhances long-term potentiation (LTP), increases neuron excitability, suppresses synaptic transmission (Hasselmo, Curr Opin Neurobiol, 2006), and its function is impaired in Alzheimer's disease. We aim to analyze the modulatory effect of ACh on synaptic plasticity at Schaffer-collateral synapses in a CA1 network during theta oscillations.

Materials and methods: We employ a multicompartmental model of CA1 pyramidal neuron embedded in a model of the CA1 pyramidal neuron microcircuit (Cutsuridis et al., Hippocampus, 2010; Saudargiene et al, Hippocampus 2015). The influence of ACh is modeled by reduction of potassium IA and IAHP current density and increase in maximal synaptic conductance of NMDAr channels.

Results: Weak CA3 inputs paired with the EC inputs evoke large calcium transients and result in LTP at Schaffer-collateral synapses activated in encoding phase even when somatic spiking is inhibited by perisomatic basket cell activity. Weak CA3 inputs alone induce lower calcium transients and cause LTD. Neuromodulation enhances LTP or switches LTD to LTP. In retrieval phase, strong CA3 inputs alone induce lower calcium transients due to bistratified inhibition and cause LTD. Neuromodulation converts this LTD to LTP.

Conclusions: The results imply that cholinergic neuromodulation plays an important role in synaptic plasticity and together with the spatio-temporal pattern of synaptic inputs defines the properties of learning in the CA1 region of the hippocampus in health and disease.

P28. AN INFLUENCE OF DRY IMMERSION ON THE PERCEPTION OF ILLUSORY AND NEUTRAL STIMULI

V. Lyakhovetskii[1*], I. Sosnina[2], K. Zelenskiy[2], V. Karpinskaya[3], E. Tomilovskaya[2]

[1] Movement Physiology Laboratory, Pavlov Institute of Physiology RAS, St. Petersburg, Russia
[2] Institute of Biomedical Problems RAS, Moscow, Russia
[3] The Department of General Psychology, Faculty of Psychology, St. Petersburg State University, St. Petersbourg, Russia
*v_la2002@mail.ru

Background and aim: the visual information is processed in a multi-modal reference frame combining both proprioreceptive and gravitational cues. The dry immersion allows us to study the influence of prolonged gravitational unload onto the visual processing on Earth.

Materials and methods: we studied the perception of neutral stimuli as well as Ponzo and Müller-Lyer illusions in 6 subjects laying at 5-days dry immersion. The test had performed before and after they put on the suit "Penguin" providing the axial load for compensation of the gravitational unload. The 5 pairs of the neutral horizontal shafts, 5 Müller-Lyer and 5 Ponzo illusions were presented successively. The shafts were equal in 3 of the 5 pairs of each sort, the top/bottom shaft was larger at 1 pair of each sort. First, the subjects gave the verbal response about the lengths of the stimuli shafts. Second, they performed the sensorimotor task, open-loop pointing by their index finger over the both shafts of each stimuli.

Results: both types of illusions became stronger at the sensorimotor response but not at the verbal one after the subjects put on the suit "Penguin". At the same time they percieved the neutral stimuli having shafts of the unequal length more similar to the neutral stimuli having equal shafts.

Conclusions: the gravitational unload leads to diminish the illusions strength at the sensorimotor domain presumably due to the lowering of the activation level of the left hemisphere that leads to use of metric representation mainly located in right hemisphere. The increase of axial load with the help of the suit leads to the restoration of the illusions strength. This restoration is accompanying by the increase of the indistinguishability range of the neutral stimuli. Probably, there is a general decrease in the ability to estimate the size the differential threshold is increased so that the segments having small differences are considered to have one size.

P29. PSYCHOPHYSICAL STUDY OF AN EFFECT OF FILLED-SPACE ILLUSION CAUSED BY DISCRETE DISTRACTOR

V. Marma[1, 2*], A. Bulatov[1, 2], T. Surkys[1, 2], N. Bulatova[2]

[1] Laboratory of Visual Neurophysiology, Lithuanian University of Health Sciences, Kaunas, Lithuania
[2] Institute of Biological Systems and Genetics Research, Lithuanian University of Health Sciences, Kaunas, Lithuania
*vilius.marma@lsmuni.lt

Background and aim: The aim of present study was to develop a quantitative model of the filled-space illusion (the filled part of stimuli seems longer in juxtaposition with the empty one) and examine its capability to account for the effects induced by stimuli with discrete distractors.

Materials and methods: In the three series of experiments of the present study, we investigated the illusory effect as a function of distance between the distracting dot and lateral terminator of the reference spatial interval of the three-dot stimulus. It was demonstrated that the model calculations properly predict all the illusion magnitude changes for stimuli with a single distracting dot placed both within and outside the interval as well as for stimulus with two distractors arranged symmetrically relative to the lateral terminator.

Results: The dependencies established were used for further development of our quantitative model, which was successfully applied to fit the experimental results obtained earlier for conventional Oppel-Kundt stimuli.

Conclusions: A good correspondence between the experimental and theoretical results supports the suggestion that perceptual positional biases induced by the context-evoked increase in neural excitation can be considered as one of the main causes of the filled-space illusion.

P30. THE EFFECT OF ISEIKONIC LENSES ON PERCEIVED IMAGE MAGNIFICATION

A. Matīse*, G. Ikaunieks, A. Švede, G. Krūmiņa

Department of Optometry and Vision Science, University of Latvia, Riga, Latvia
*matise95@inbox.lv

Background and aim: an ocular condition, where there is a significant difference in the perceived size of images between the two eyes, might reduce the quality of binocular vision. Such condition is called aniseikonia. Most often aniseikonia is induced by glasses, when there is a large difference in refraction between the eyes. In the case of aniseikonia, iseikonic lenses (size lenses) is a good opportunity for vision correction. Afocal iseikonic lenses are lenses without refractive power, but with an optical magnification. For the most of vision specialists trial iseikonic lenses, which they could use in clinical practice, are not available. In our research we wanted to make such lenses and set a dependency between calculated magnification of iseikonic lenses and amount of aniseikonia induced by these lenses.

Materials and methods: afocal iseikonic lenses with magnification 2.01%; 4.05% and 6.38% were used to induce aniseikonia for 10 study participants (average age 20 years) with normal binocular vision. Modified New Aniseikonia Test was used to evaluate amount of aniseikonia. This test consists of green and red stimuli presented haploscopically on the display. During measurements, iseikonic lens was placed in front of dominant eye to induce aniseikonia. By pressing a key on the keybord study participants changed the size of one stimulus until both stimuli looked similar.

Results: for all subjects amount of induced aniseikonia significantly increased with increase of magnification of iseikonic lens used in measurements. Binocular vision was significantly affected when the magnification of iseikonic lens was 6% or more. *Conclusions:* afocal iseikonic lenses (with our calculated parameters) might be used to demonstrate effect of aniseikonia on vision quality and will help the vision specialists to understand better which iseikonic lenses might be useful for a particular patient.

Acknowledgment: The study was supported by SIA "Mikrotīkls" and administrated by University of Latvia Foundation (project No 2184).

P31. THE IMPACT OF DISTANCE ON INATTENTIONAL BLINDNESS

S. Matulevica[1]*, J. Skilters[2], G. Krumina[1]

[1] Department of Optometry and Vision Science, University of Latvia, Riga, Latvia
[2] Laboratory for Perceptual and Cognitive Systems, University of Latvia, Riga, Latvia,
*sabinematulevica@gmail.com

Background and aim: To detect something, just looking at it is not enough. Inattentional blindness is a cognitive phenomenon when people fail to notice a completely visible, but unexpected object while attention is engaged on another object, task or event (*Simons*, 2000). It could affect us when we are working, interacting with others, while we are driving, and more. Our research aim is to determine whether the distance and accordingly the angular size of the stimulus on the retina impact the results of inattentional blindness task.

Method: 207 women and 71 men (age 13-56 years) participated in our study. They were seated in different rows from the projection screen, which allowed us to get the different distances and the object angular sizes on the retina. Two inattentional blindness videos were shown and a primary task was given. At the end of each video, observers were asked a series of questions to determine whether or not they saw the unexpected object and how precisely the primary task was done. Angular size of the video and the unexpected object were calculated for each distance.

Results: Of all participants, only 0.7% responded correctly to all questions about both videos. 42% of participants were inattentional blind to the presence of unexpected object in the first video "invisible gorilla" (*Simons & Chabris*, 1999) and 13% of participants in the second one "candy eating" (*Frischer et al*., 2011). Regardless of the distance and the angular size of the object, the number of participants (%) with the inattentional blindness was similar.

Conclusions: Statistically significant relationship between the presence of inattentional blindness and the angular size of the object is not obtained, but this tendency is present in case of men in the first video. Observers with inattentional blindness do not complete the primary task more precisely than the observers who spot the unexpected object. The level of inattentional blindness is higher in the first video ("invisible gorilla").

P32. LOW SPATIAL RESOLUTION OF THE OPTOKINETIC SYSTEM IN BIRDS

M. Mitkus[1,2,*], R. D. Johnsson[1,3], S. Potier[1], K. Shiomi[2], A. Takahashi[2], A. Kelber[1]

[1] Department of Biology, Lund University, Lund, Sweden
[2] Bioscience Group, National Institute of Polar Research, Tokyo, Japan
[3] School of Life Sciences, La Trobe University, Melbourne, Australia
*mindaugas.mitkus.lt@gmail.com

Background and aim: Moving animals need constant information about position of surrounding objects in order to avoid collision or to reach a target. Stereopsis or accommodation cues for sensing depth are unreliable to judge distances during fast locomotion due to their limits in working range or speed. However, translational optic flow – a pattern of image motion across the retina – contains useful information about relative object position. Optokinetic responses stabilise gaze to minimise image rotations and aid extraction of distance cues from the translational optic flow. Few studies have investigated behavioural spatial thresholds of these reflexes in birds. We aimed to determine the contrast sensitivity function of optokinetic response in four avian species: budgerigars (*Melopsittacus undulatus*), domestic chickens (*Gallus gallus domesticus*), Harris's hawks (*Parabuteo unicinctus*), and rhinoceros auklets (*Cerorhinca monocerata*).

Materials and methods: Achromatic sinusoidal gratings were displayed on computer monitors positioned in an arc around the bird, covering a large part of the visual field. Spatial frequency, contrast, and drift velocity of the stimuli were varied and only when a bird could resolve the spatial detail in the pattern, the optokinetic reflex was released.

Results: The spatial resolution limit was lowest in rhinoceros auklets (1.4±0.2 cycles/degree; mean±*s.d.*) and highest in Harris's hawks (2.8±*0.2* cycles/degree). The peak contrast sensitivity was lowest in chickens (10.6±*2.0*) and highest in rhinoceros auklets (37.5±*11.2*).

Conclusions: Previous studies report large differences in maximum visual acuity for stationary object detection among these species (6–60 cycles/degree). The spatial resolution limit of the optokinetic system found in this study is surprisingly similar. As tested species differ in eye size, ecology, and flight capabilities, our results indicate that high spatial detail is not needed to aid avian flight control in general.

P33. NITRIC OXIDE MAY PLAY A ROLE IN VAGAL AFFERENT INNERVATION OF THE HEART

I. Navickaitė*, N. Paužienė, D. H. Pauža

Institute of Anatomy, Lithuanian University of Health Sciences, Kaunas, Lithuania
*ieva.navic@gmail.com

Background and aim: In the nervous system, nitric oxide (NO) acts as a neurotransmitter. Nitrergic neuronal somata and nerve fibers (NFs) are amply distributed within the heart. However, there is evidence of extrinsic origin of majority of these NFs. This study aimed to determine the potential source of nitrergic cardiac innervation.

Materials and methods: Sections of the brainstem, vagal sensory ganglia, dorsal root ganglia of C8-Th5 spinal nerves and stellate ganglia from twelve rats were examined applying double immunohistochemical staining for neuronal nitric oxide synthase (nNOS), choline acetyltransferase (ChAT), calcitonin gene-related peptide (CGRP) and substantia P (SP) and a laser-scanning microscopy.

Results: Nitrergic neuronal somata were amply distributed within vagal sensory ganglia. Its axons composed an abundant population of nitrergic NFs in the cervical vagus nerve. In the vagal sensory ganglia, coexistence of nNOS and CGRP or SP was uncommon. Numerous small nitrergic somata and NFs were spread within the solitary nucleus. Several nitrergic neuronal somata were found in the dorsal nucleus of the vagus. Only individual nitrergic somata were found in the nucleus ambiguus. However, both vagal nuclei received nitrergic NFs that terminated on the cholinergic neurons. In the dorsal root ganglia, a small population of nitrergic neuronal somata was observed. A significant part of them also expressed CGRP, while coexistence of nNOS and SP was less common. Only solitary nitrergic somata were found in the stellate ganglia.

Conclusions: The potential source of nitrergic cardiac innervation is vagal sensory ganglia. Ample distribution of nitrergic neuronal somata within sensory ganglia and solitary nucleus and NFs positive for nNOS in the vagal nuclei imply that NO may play a role in vagal afferent innervation and integration of sensory information within the brainstem circuits.

Research was funded by the European Social Fund under the measure No 09.3.3-LMT-K-712.

P34. NEURONAL PHOSPHOLIPID SCRAMBLASE MEDIATES SYNAPTIC PRUNING IN DEVELOPING BRAIN

U. Neniskyte[1,2*], A. Vadisiute[1,2], D. Ragozzino[3], A. Gozzi[4], C. Gross[2]

1 Department of Neurobiology and Biophysics, Life Sciences Centre, Vilnius University, Lithuania
2 Epigenetics and Neurobiology Unit, European Molecular Biology Laboratory, Rome, Italy
3 La Sapienza University, Rome, Italy
4 Istituto Italiano di Tecnologia, Genova, Italy
*urte.neniskyte@gf.vu.lt

The development of complex nervous system is accompanied by a generation of superfluous neuronal connections that are removed when neural circuits mature. Why are so many synapses lost, what determines which synapses are eliminated, what are the molecular mechanisms involved, and what are the consequences of not getting it right? Synaptic pruning appears to be highly selective process that ensures selective elimination of some synapses and the maintenance of others. Structural and functional refinement of synaptic network is tightly related to the presence of brain immune cells microglia that actively contact and engulf unnecessary synapses. Using organotypic hippocampal slice cultures and in vivo mouse models we investigate the role of phosphatidylserine as a neuronal surface signal that labels synapses for elimination thus ensuring proper circuit maturation. We use neuron-specific knock-outs and cell-specific genetic labelling to dissect molecular pathways leading synapse elimination and to visualise microglia-synapse interactions in developing brain. Morphological studies are complemented with electrophysiological profiling and fMRI for brain activity measurements.

P35. COMPUTATIONAL MODELING OF BETA AMYLOID EFFECT ON SYNAPTIC PLASTICITY IN HIPPOCAMPAL CA1 PYRAMIDAL NEURON AND IMPLICATIONS FOR ALZHEIMERS DISEASE

I. Oksman, D. Linkevičius, A. Saudargienė*

Neuroscience Institute, Lithuanian University of Health Sciences, Kaunas, Lithuania
*ausra.saudargiene@lsmuni.lt

Background and aim: Alzheimer's disease (AD) is steadily growing to be the leading cause of death in the 1st world countries, with incidence of dementia doubling every 10 years after the age of 60 and almost 90% suffering from it at 90 years of age. The two hallmark features of AD are beta-amyloid (Aβ) accumulation and Tau protein aggregates in the brain. Aβ increase in the brain has an effect on intra/extracellular calcium homeostasis and leads to progressive dendritic atrophy, synaptic and neuronal loss. The mechanism by which Aβ mediates cell death and initiates degenerative processes of AD continues to elude the scientific community to this day. The aim of the study is to analyze the effect of Aβ accumulation on dendritic excitability and synaptic plasticity in CA1 pyramidal neurons using computational modeling methodology.

Materials and methods: We use a multicompartmental model of CA1 pyramidal neuron (Poirazi et al., Neuron, 2003) and synaptic plasticity model (Graupner and Brunel, PNAS, 2012) to investigate the influence of Aβ accumulation on intracellular calcium dynamics and synaptic plasticity at excitatory synapses in CA1 pyramidal neurons. The influence of pathological Aβ changes is modeled by blocking A-type K+ channels (IA) in pyramidal cell dendrites and increasing NMDA glutamate receptor maximal conductance in Schaffer collateral synapses.

Results: Aβ accumulation leads to the enhanced CA1 pyramidal neuron dendritic excitability, increased amplitude of back-propagating action potentials, higher intracellular calcium transients and promotes long-term potentiation.

Conclusions: The results show that prior to cell death Aβ accumulation alters properties of synaptic plasticity and learning in hippocampal CA1 pyramidal neurons.

P36. 40HZ ASSR RELATION TO COGNITIVE PERFORMANCE

V. Parčiauskaitė[1*], A. Voicikas[1], P. Tarailis[1], M. Kraulaidis[1], V. Jurkuvėnas[2], I. Griškova-Bulanova[1]

[1] Vilnius University, Institute of Biosciences, Vilnius, Lithuania
[2] Vilnius University, Institute of Psychology, Vilnius, Lithuania
[*]vykintaparciauskaite@gmail.com

Electroencephalographic (EEG) activity in the gamma frequency (30-80 Hz) range is associated with normal cognitive functions and its impairment underlies at least some of the deficits observed in schizophrenia patients. To test brain's ability to generate synchronous responses, repetitive auditory stimulation that elicits an auditory steady-state response (ASSR) is used. The ASSR at 40 Hz shows altered synchronization processes in the brain in schizophrenia patients. It is not clear how 40Hz ASSRs relate to cognitive processing. Since earlier studies are sparse and inconsistent, the present study evaluates the relationship between cognitive performance and 40 Hz ASSR in the healthy population.

29 healthy volunteers participated (all males, 25.7±3.3 years old) in the study. Cognitive functions were estimated using Psychology Experiment Building Language (PEBL) Test Battery on the following tasks: Yes/No test (verbal recognition memory), Choice response time task (reaction time), Stroop test (detection and decision making), Berg Wisconsin Card Sorting Test (concept information and conceptual flexibility), Corsi Block Test (short-term memory), Tower of London test (planning and problem-solving), Lexical decision task (lexical memory), and Semantic categorisation task (semantic processing). During EEG recording the 500 ms click trials of 40-Hz were presented 150 times in a pseudo-randomized order with an inter-train interval set at 0.7-1 s to elicit the ASSR. Mean PLI (phase-locking index), event-related spectral perturbation (ERSP) and global field synchronisation (GFS) were obtained by averaging values in the 38–42 Hz frequency window for the late gamma response (200–500 ms). The Spearman correlation coefficient (two-tailed, $p < 0.05$) was used to evaluate the relationship between ASSR measures and scores of cognitive tasks.

Several significant relationships were observed between PLI and GFS values in response to 40-Hz stimulation and cognitive variables: a positive relationship between a mean time in congruent Stroop test condition and GFS ($r=0.40$, $p=0.031$), and a positive correlation between PLI ($r=0.39$, $p=0.038$) and GFS ($r=0.45$, $p=0.015$) values and a total number of moves in the Tower of London task.

The results indicate that phase-locking of 40Hz ASSRs might be related to some domains of cognitive performance.

Acknowledgements: we thank Evaldas Pipinis for collaboration and cooperation.

P37. ACCOMMODATIVE MICROFLUCTUATIONS AFTER NEAR VISUAL STRESS

D. Pikuļina*, K. Panke, A. Švede, G. Krūmiņa

Department of Optometry and Vision Science, Faculty of Physics, Mathematics, and Optometry, University of Latvia, Riga, Latvia
*diancik_p@inbox.lv

Background and aim: Microfluctuations of accommodation have been studied over 80 years, but their nature and purpose is still not quite clear. High frequency fluctuations are addressed as neural noise, but low frequency fluctuations seem to play active role in the process of accommodation itself. There is controversial data about the effect of eye fatigue and visual stress on microfluctuations and no or minimal amount of information about how they are influenced by blue light filter, which is claimed to be antifatigue and is offered on majority of modern display electronic devices to prevent eye strain. We evaluated the impact of the blue light filter on accommodative microfluctuations before and after near visual stress.

Materials and methods: PowerRef3 was used to measure refraction and microfluctuations (50 Hz, 0.1 D step). Fixation target was Maltese cross (3º) placed at 33, 50 cm, and 4 m. Refraction state at far and near was measured in 22 participants (11 young (19-24 y.o.) and 11 prepresbyopic and early presbyiopic (32-46 y.o.)) before and after visual stress simulated for 1 hour (*Bubble Shooter* game, Samsung A5, 33 cm distance) without blue filter (Day 1) and with blue filter (Day 2).

Results: Accommodative response and amplitude of microfluctuations did not change significantly after visual stress neither with nor without blue filter. No difference between two age groups was found at different measuring distances. Root mean square value remained at a similar level due to high within-subject distribution of microfluctuation amplitudes.

Conclusions: The response of accommodation and microfluctuations of accommodation cannot serve as fatigue indicators. Blue filters have no effect on the response of accommodation; the impact on microfluctuations is not completely clear.

Acknowledgment: The study supported by SIA "Mikrotikls" and administrated by University of Latvia Foundation (project No 2184).

P38. AGE-RELATED DIFFERENCES IN VISUAL SEARCH PERFORMANCE THROUGH VOLUMETRIC IMAGES

T. Pladere*, V. Konosonoka, K. Panke, G. Krumina

Department of Optometry and Vision Science, Faculty of Physics, Mathematics and Optometry, University of Latvia, Riga, Latvia
*tatjana.pladere@lu.lv

Background and aim: The visual search behavior is being widely investigated to describe the influence of expertise on the task outcome. However, the age-related differences and the specifics of the monitor may also reflect in the way we search for a target and navigate through volumetric images. Thus, our study aimed to determine whether there were differences in search performance and navigation through volumetric images for people of different age.

Materials and methods: Ten older (mean age: 45 ± 2 years) and ten younger participants (mean age: 17 ± 1 years) took part in this study. The visual tasks were demonstrated on the LightSpace Technologies volumetric display x1405. The viewing distance was 45 cm from the closest display plane. The amount of visual information and the target-distractor similarity varied within the sets of search tasks. The constant angular size stimuli were shown on ten out of twenty display planes in two depth segments (the stimuli distance from the eyes: 45-51 cm in the I segment, 51-57 cm distance in the II segment). The individuals could navigate through the volumetric images using the keyboard as long as they wanted to and determine the pace of their movement through the stack.

Results: The older participants tended to make significantly less moves through the volumetric images comparing to the younger ones. In all viewing conditions, the younger participants made about three times more moves. On average, the younger participants outperformed others when stimuli were located in the closest depth segment but not in the furthest one. Regardless of age, the performance varied according to the target-distractor similarity when the stimuli were presented in the furthest segment.

Conclusions: Although the older participants navigated less actively through the volumetric images comparing to the younger ones, the response rate was influenced in a similar way by the properties of visual stimuli on a volumetric display.

P39. FOVEAL SHAPE VARIATION IN BLACK KITES (*MILVUS MIGRANS*) AS REVEALED BY SD-OCT IMAGING

S. Potier[1,*], M. Mitkus[1,2,#], T. J. Lisney[3], P.F. Isard[4], T. Dulaurent[4], M. Mentek[4], R. Cornette[5], A. Kelber[1]

1 Department of Biology, Lund University, Lund, Sweden
2 Bioscience Group, National Institute of Polar Research, Tokyo, Japan
3 Centre d'Écologie Fonctionnelle et Évolutive, CNRS, Montpellier, France
4 Unité d'Ophtalmologie, Centre Hospitalier Vétérinaire, Saint-Martin-Bellevue, France
5 Institut de Systématique, Evolution, Biodiversité, Sorbonne Universités, Paris, France
*sim.potier@gmail.com, #presenting author: mindaugas.mitkus.lt@gmail.com

Background and aim: Foveae are retinal specialisations for high visual acuity found in many vertebrates. They constitute pit-like depressions resulting from the displacement of the inner retinal layers, and are associated with the highest photoreceptor and ganglion cell densities. Several optical functions have been proposed for the fovea and the magnitude of their effects depends on foveal shape. While the considerable interspecific variation in the size and shape of the fovea is well documented, very little is known about intraspecific variation in foveal shape. Here, we assessed this in a raptorial bird, the Black kite (*Milvus migrans*), a species with a well-developed central fovea.

Materials and methods: We examined fovea in both eyes of 47 black kites (23 males, 24 females, 1-10 years old) using Spectral Domain Optical Coherence Tomography (SD-OCT). We used the corneal diameter to estimate size and focal length of each eye and to correctly scale the cross-sectional retinal images (B-scans). We quantified foveal shape by morphometric methods (quantitative analyses of forms) using 3 landmarks and 80 data points covering 500µm of the retina with the fovea in the centre. Principal components were determined from the analysis and tested for relationship with the eye size, sex and age.

Results: Foveal shape varied significantly with age. Younger individuals had more pronounced foveal rim and wider fovea than older birds. Foveal shape did not differ between males and females or between the left and right eyes of each individual. While eye size did not differ with age, birds with larger eyes had deeper fovea, but this was true only for the left eyes.

Conclusions: Our study indicates that avian foveal depth might be related to eye size and that foveal shape might change with age. A longitudinal, SD-OCT based study on avian foveal development is needed to evaluate the magnitude of these changes on the individual level.

P40. THE EFFECT OF EYE EXAMINATION ROOM SIZE ON THE VISUAL ACUITY ASESSMENT

I. Rumjanceva[1*], A. Švede[1], K. Detkova[2]

[1] Department of Optometry and Vision Science, Faculty of Physics, Mathematic and Optometry, University of Latvia, Riga, Latvia
[2] Ltd "OC VISION", Riga, Latvia
* rumilonv@gmail.com

Background and aim: New projectors adapt the size of the optotypes to the size of the rooms. Therefore, smaller (less than 5-6 m long) optometrist's offices are set up in the optics without mirror systems. However, the effect of accommodation on visual function evaluation is not taken into account. Accommodation is not completely relaxed if the viewing distance is smaller than 4 m. The aim of this study was to evaluate the effect of the viewing distance on the accuracy of the visual acuity evaluation.

Materials and methods: We evaluated parameters of optometrist's offices; correspondence of the optotype size (for 1.0 dec.units) to the viewing distance; visual acuity at various viewing distances. FrACT program was used to measure monocular visual acuity in 20 participants at 6 viewing distances (1.5, 2, 2.5, 3, 4, 5 m).

Results: The results demonstrate that the size of the optometrist's offices does not meet the standards. The length of the rooms ranged from 2.8 m to 5 m in 16 optometrist's offices. The viewing distance was less than 5 m in all the rooms (1.75 – 4.4 m). The size of the optotypes did not match the theoretical requirements: optotypes were larger in two offices, smaller in five offices, and appropriate in eight offices. The visual acuity was overestimated in participants with myopia at smaller viewing distances. Decreased viewing distance did not affect the visual acuity in emmetropes.

Conclusions: Optometrist's offices should allow at least 4 m viewing distance for visual acuity evaluation to take into account the physiological principles of the eyes. Mirror systems have to be used in smaller offices.

Acknowledgment: The study supported by Ltd "OC Vision" and Ltd "Mikrotikls" and administrated by University of Latvia Foundation (project No 2184).

P41. LONG NONCODING RNAS (LNCRNA) *HOTAIR* AND *CASC2* GENES EXPRESSION IN DIFFERENT MALIGNANCY GRADE ASTROCYTOMAS

A. Stefanskytė[1], P. Vaitkienė[2], D. Skiriutė[2*]

[1] Life Sciences Centre, Vilnius University, Vilnius, Lithuania
[2] Laboratory of Molecular Neurooncology, Neuroscience institute, Lithuanian University of Health Sciences, Kaunas, Lithuania
*daina.skiriute@lsmuni.lt

Background and aim: Astrocytomas are the most common brain tumors, while the malignant type astrocytomas known as glioblastomas are characterized by morphological and molecular heterogeneity, invasive growth, resistance to therapy and short survival of patients. Long noncoding RNAs are functional protein-non-coding RNA molecules that act in a various key biological processes. LncRNAs could act as oncogenes or as tumor suppressors in various cancers. *HOTAIR* is a long noncoding RNA that regulates gene expression through chromatin-modifying enzymes. *CASC2* gene in the colorectal and uterine cancer acts as a tumor suppressor. The aim of our study was to investigate gene expression of *HOTAIR* and *CASC2* in different malignancy grade astrocytomas and evaluate its association with tumor malignancy and patient outcome.

Materials and methods: 76 samples of different malignancy grade astrocytomas were analyzed using RT – qPCR SYBR Green assay. Statistical analysis was applied to find the associations between gene expression, tumor grade and patient clinical data.

Results: *HOTAIR* expression in glioblastomas was higher as compared to the lower malignancy grade astrocytoma. The expression of the *CASC2* in glioblastomas showed the tendency of decreasing gene expression with the tumor grade. Kaplan-Meier analysis showed that the expression of the *HOTAIR* gene was not related to patient survival and in the *CASC2* gene a trend was observed when higher gene expression was associated with better patient survival.

Conclusions: *HOTAIR* and *CASC2* genes are closely associated with astrocytoma progression.

P42. CONTOUR PERCEPT IN THE OPPEL-KUNDT ILLUSION

T. Surkys[1*], A. Bielevičius[2], A. Bertulis[1,2], I. Česnavičienė[2], E. Loginovič[2]

[1] Laboratory of Visual Neurophysiology, Lithuanian University of Health Sciences, Kaunas, Lithuania
[2] Institute of Biological Systems and Genetics Research, Lithuanian University of Health Sciences, Kaunas, Lithuania.
*tadas.surkys@lsmuni.lt

The present experimental study aims to display that the contour percept weakening decreases the Oppel-Kundt illusion strength.

In psychophysical experiments, the Oppel-Kundt white figures of varied luminance (0 – 5.3 cd/m^2) were exposed against the gray (2.8 cd/m^2) background, and the blue figures (0.4 – 4 cd/m^2 in luminance) – against the green (0.4, 2, or 3 cd/m^2) background. The filled reference intervals were formed by a solid block 198×108 arc min in size or by 8 equidistantly dispersed stripes (7.2×108 arc min each). Subjects adjusted the empty stimulus interval length to form it perceptually equal to that of the filled interval. The errors made were considered the illusion strength values.

For the black/white Oppel-Kundt figure formed of stripes or solid filling, the illusion strength did not changed significantly when the luminance contrast varied, but at the threshold values, the strength dropped downward nearly to zero. At the sub-threshold values, the stimuli could not be discerned. The experimental curves resembled horizontal profiles with the funnel shapes in the region of the lowest contrasts. For the blue/green stimuli formed of stripes, the illusion strength decreased at the lowest contrasts as well but did not reach zero. The experimental curves possessed the dimple shapes pointing out the individual isoluminance positions. For the blue/green solid filling, the experimental curves had less prominent indentations at isoluminance.

In general, Oppel-Kundt illusion occurred, when the real or illusory contours could be perceived due to presence of the luminance or color contrast in the stimulus. The illusion was not triggered by the isoluminant stripes, presumably, because the absence of the contour percept: the illusory contours did not arise in the isoluminant Kanizsa and Ehrenstein patterns. One may assume that the continuous excitation pathways produced by real or illusory contours of the stimuli are relevant factors in the Oppel-Kundt illusion genesis.

P43. VISUAL SYSTEMS IN INTERPERSONAL NEUROBIOLOGY AND PSYCHOTHERAPY: CRITICAL REVIEW

A. Tarabanov

Institute of Neurocommunications and Psychotherapy, Vilnius, Lithuania
tarabanov@inncp.com

Background and aim: Visual system can be observed and analysed in the frames of interpersonal neurobiology as:

Attachment and family interrelations (Cozolino, 2013; Reissland, 2002; Serrano, 1992).

Toolkit of social control (Freire, 2004; Kleinke, 1986; Guastella, 2008).

As a part of resonance behavior in connection with mirror neuron system (Rizzolatti & Arbib, 1998; Rizzolatti, 1999).

The aim of actual research is to define the applicability of theoretical understanding of visual systems in interpersonal neurobiology to psychotherapeutic process.

Materials and methods: critical review

Results: The therapeutic process focused on visual systems of therapists and patients have demonstrated evident sufficiency in diadic affect regulation and distorted behavioral patterns correction.

Conclusions: Interpersonal neurobiology is focused on the visual systems observed in the context of social relations and particularly in the context of psychotherapeutic process. The initial priming of the visual system to attend to faces creates networks designed for bonding and the growth of neural systems. Visual engagement and the constant mutual exchange of information between child and parent or other caregiver encourage the growth of social brain systems dedicated to attachment and affective attunement.

Interpersonal neurobiology stresses that eye gaze also is involved into regulation of interactions by expressing intimacy or aggression or as a tool of social control.

Important in the psychotherapy is "resonance behavior". Visual systems bridge neural networks dedicated to perception and movement, mirror neurons connect the observed and the observer by linking visual and motor experience**.** The mirror systems and resonance behavior involved into human ability to attune to the emotional states of other social actors. They provide therapist with empathic attunement based on a visceral-emotional experience of the patient and allow him to use relevant psychotherapeutic interventions.

P44. COLOUR CATEGORY BOUNDARIES IN LATVIAN AND RUSSIAN LANGUAGES

R. Trukša[1*], S. Fomins[1,2], S. Gabrāne[1], K. Lazdāne[1], G. Krūmiņa[1]

[1] Optometry and Vision Science Department,University of Latvia, Riga, Latvia
[2] UL Institute of Solid State Physics, Riga, Latvia
*renars.truksa@lu.lv

Background and aim: Humans are able to distinguish up to $3*10^5$ color stimuli, but all of those can be divided into 11 color categories - basic color terms (BCT). More specific is twelveth colour category dedicated to shortwave spectrum, as found in Italian and Russian. Native russian speakers have tendency to categorize stimuli in short wavelength in two distinct colour categories – "sinij" and "goluboj". Aim of this research is to identify the colour category boundaries for "sinij" and "goluboj", as also for blue and light blue, by psychophysical method; and the impact of instruction language on colour categorization task in shortwave spectrum.

Materials and methods: SpectralScan spectroradiometer PR-655 was used to calibrate the display and characterization routines were applied for colorimetrically precise control of the stimuli. Munsell chips are correspondence stimuli. Boundaries of color categories were determined using originally developed computer application. Two degrees chromatic patch appears in front of the subject for 1 sec and the task is to categorize the stimuli into predefined categories.

Results: The boundaries of two categories under revision identified for 10 persons are represented similarly in Latvians and bilinguals with the same language of instructions. The distributions of the answers are different in the groups of separate instruction languages. However, no significant different could be identified due to the limited number of subjects.

Conclusions: It is confirmed that language of instruction has an impact on colour categorization task. Method proposed in scope of this research might be considered as platform for further research in colour categorization, because it overcomes problems of conventional colour categorization test designs, impacted by illumination environment.

P45. FUNCTIONAL CONNECTIVITY UNDER THE EMOTIONAL BURNOUT FORMATION

S.V. Tukaiev[1,2*], I.G. Zyma[1], Y.D. Havrylets[2], V.V. Rizun[2]

[1] Taras Shevchenko National University of Kyiv, Institute of Biology and Medicine, Department of Physiology of Brain and Psychophysiology, Kyiv, Ukraine
[2] Taras Shevchenko National University of Kyiv, Institute of Journalism, Department of Social Communication, Kyiv, Ukraine
*tukaev@univ.kiev.ua

The aim of this study is to reveal the factors responsible for the development of burnout in students along with the EEG correlates of burnout. Burnout is a mechanism of psychological defense, responsible for partial or total loss of emotions in response to stressful situations during interpersonal communication. In order to determine the stages of burnout, the test Boyko Syndrome of Emotional Burnout was we adapted. Results suggest that both behavioral manifestations of aggression and aggressiveness as a feature of personality influence the development of burnout. There was detected that the changes of functional connectivity between different regions of brain in the rest state depend on the current level of brain activation, which, in turn, depends on the initial emotional state. The development of emotional burnout is characterized by decrease of information capacity of the brain: reduction of spatial synchronization causes delayed and less efficient spread of excitation in the cerebral cortex. The decrease of interhemispheric coherence of low- and high-frequency components of EEG may indicate the increase of level of differentiation of neuronal groups. In women, the decrease of coherence in theta-subband indicates the influence of burnout on attention concentration, working memory, and emotional processes. In men, weakening of the relationship between the left frontal and the right occipital zones points to the weakness of informational aggregation, reducing readiness of the neural centers for processing information in the "cognitive axis". Reduction of the level of coherence of alpha band may indicate problems of psychological adaptation within the experiment in examined groups of men with the Resistance stage of burnout. These EEG features allow concluding that participants with Resistance stage of burnout were concentrated on negative emotional reactions. The study indicates also that men are more vulnerable to stress-induced conditions, which lead to burnout.

P46. EYE-HAND COORDINATION INTERACTION WITH VISUAL FUNCTION

J. Turlisova*, E.Kassaliete

Department of Optometry and vision science, University of Latvia, Riga, Latvia
*jelena.zinkevich1@gmail.com

Background and aim: Visual Motor Integration involves effective, efficient communication between the eyes and the hands, so that you are able to copy, draw or write what you see. The aim was to study the performance of pre-school and primary school children in an eye-hand coordination tests, evaluating the stereovision values in a sample group and detecting the correlation between both factors.

Materials and methods: We test the eye-hand coordination performance of children in standardized DTVP-2 and evaluate the correlation between the quality of stereo vision and performance in eye-hand coordination test. We analyze the DTVP-2 scores using computer program ImageJ. For 56 participants we evaluate visual acuity, stereo vision by TNO and eye-hand coordination.

Results: The results of the TNO test showed that 54% of children between the ages of 5.5 and 9 years old had 60 arc sec, 18% - 120 arc sec and 29% - 240 arc sec. DTVP-2 performance coefficient related to stereovision value – higher the eye-hand coordination performance coefficient the lower are the stereo threshold value. The DTVP-2 test execution rate shows a very strong correlation with the stereo acuity ($r = 0,90$; $p < 0,05$). A computerized DTVP-2 test performance coefficient shows a higher correlation with stereo ($r = 0,99$ $p < 0,05$).

Conclusions: Visual Motor Integration skills and competences are still improving in pre-school age children. Eye-hand coordination test performance is depending on quality of stereo vision. A computerized DTVP-2 test analysis tool helps more precisely get the performance coefficient of eye-hand coordination test. The DTVP-2 test realization of the coefficient size does not depend on cognitive process; it only affects the visual or motor processes.

P47. ISOLUMINANT STIMULI IMPACT ON HUMAN VISUO-SPATIAL PERCEPTION AND RESPONSE TIME

E. Vevere*, G. Krumina
Department of Optometry and Vision Science, University of Latvia, Riga, Latvia
*elina-vevere@inbox.lv

Introduction: The statement-image comparison is applied in many cognitive tasks, where you need to build a concept, solve problems and create a visual image. In cognitive tasks, use of color is widely used. There are studies in which color perception is studied when the stimuli are located at the periphery of the field of vision:

colors affect response time and in the case of red color, response time is faster (*McKeefry, Parry & Murray,* 2003; *Pomerleau et al*., 2014);

longer wavelength colors compared to shorter, impairs performance to complex tasks *(Elliot et al.,* 2007).

Method: The research included 25 participants. In study computerized test was used. The stimuli are two isoluminant objects – X and O and four statements. Each participant was individually evaluated for color brightness perception using heterochromatic flicker photometry. Participant's task was to give the fastest possible response time whether a statement corresponds with an image.

Results: When statement "true" and the layout of objects matched each other, participant gave a faster response than if the statement did not coincide with the picture. The use of prepositions "above" and "below" had an effect on response times as well – in case of "below" it was longer than "above". Comparing differences between each color and statement, there were no significant differences in response times, which was also expected. The only exception was the statement "X below O", where response time for red color was longer. Looking at each participant's data, we concluded that the data of 5 participants "pop-out". Comparing them with each other, there were no significant differences between colors.

Conclusion: The greatest impact on the response time was in the case, when statement "true" and the layout of objects matched each other. Also important is the use of prepositions – faster response time was observed in the case of preposition "above". Isoluminant stimuli do not have a significant impact on the response time. The amount of errors does not depend on the type of color, but on the human concentration and perception capabilities during the test.

P48. FIXATION DISPARITY IN VARIOUS CONTRAST CONDITIONS

P. Vinogradova*, L. Berklava, K. Panke, G. Ikaunieks, V. Karitāns, A. Švede, G. Krūmiņa

Department of Optometry and Vision Science, Faculty of Physics, Mathematics, and Optometry, University of Latvia, Riga, Latvia
*classicpolly@gmail.com

Background and aim: Fixation disparity is a small error of vergence response. There is still discussion about effect of contrast and brightness on the fixation disparity evaluation. Some studies demonstrate that crossed fixation disparity dominates while reading black letters on white background and uncrossed fixation disparity dominates while reading white letters on black background. The aim of our study was to analyze the effect of stimulus contrast on fixation disparity.

Materials and methods: All 10 participants (21-24 y.o.) had uncorrected visual acuity at least 0.8 (dec.u.), binocular single vision and stereovision both for near and far distance. The experiment had two parts: (1) participants read 3-5 letters long logical Latvian words with positive (1043 units) and negative (-1.00) Weber contrast; (2) participants read the same stimuli but with various negative Weber contrast level (-0.16, -0.31, -0.44, -0.61, -0.86, and -0.98). Objective fixation disparity was measured using eye tracker IViewX Hi-Speed.

Results: The results show statistically significant difference between fixation disparity and pupil size in positive and negative contrast conditions; fixation disparity became more uncrossed and the pupil dilated in positive contrast conditions. Decreasing the contrast of the stimuli, the tendency was observed only in low contrast conditions; fixation disparity became less uncrossed and the pupil contracted.

Conclusions: Fixation disparity change depending on the stimulus's contrast level and polarity, especially using low contrast stimuli.

Acknowledgment: The study supported by SIA "Mikrotikls" and administrated by University of Latvia Foundation (project No 2184).

P49. GAZE FIXATIONS ON SPATIALLY MODULATED TEXTURES

D. Yavna*, D. Alekseeva, V. Babenko

Academy of Psychology and Educational Sciences, Southern Federal University, Rostov-on-Don, Russian Federation
*yavna@fortran.su

Background and aim: Our work is devoted to the oculomotor fixations recorded during the inspection of spatially modulated textures. We are aimed to discover factors explaining stimulus-driven visual fixations. It is known that spatial modulations of textures are detected by so-called second-order visual mechanisms that operate at preattentive level of visual processing. There are psychophysical and psychophysiological data consistent with the assumption that channels that detect modulations of contrast, orientation, and spatial frequency operate independently in the human visual system. The authors have proposed appropriate computer models (demodulators based on "filter-rectify-filter" scheme) and assumed that the information extracted by these models can be used to predict the positions of visual fixations.

Materials and methods: We conducted an eye-tracking study, in which subjects (32 people with normal or normalized vision) examined the modulated textures. Their task was to detect the tilt of the modulation axis. Eye movements were recorded by the SMI Red-m tracker at 60 Hz. The duration of the stimuli was not limited.

Results: An analysis of the location of all fixations made it possible to determine that when observers searched for the tilt of the contrast modulation axis, the fixations were mainly located in areas with high contrast, and when they dealt with textures modulated in spatial frequency, the gaze was mainly fixed in low-frequency areas. The distribution of fixations on orientationally modulated textures was more random, but the probability of fixations on areas with the same axes orientation of both the carrier and envelope were increased.

Conclusions: A general conclusion is that spatial modulation detector models are useful in predicting visual fixations. The role of the relationship between the orientation of the axes of the carrier and the envelope in the programming of early fixations is also shown.

Supported by RFBR grant No. 17-06-50141.

P50. OPTICAL LITHOGRAPHY FOR STUDYING VITREOUS FLOATERS

V. Karitans[1,2], A. Antoņuka[1]

[1] **Department of Optometry and Vision Science, Faculty of Physics, Mathematics, and Optometry, University of Latvia, Riga, Latvia**

[2] **Institute of Solid State Physics, University of Latvia, Riga, Latvia**

variskaritans@gmail.com

Vitreous floaters are known as chains, bubbles, cobwebs floating in the field of view and following the movements of eyes. The vitreous floaters are actually diffraction patterns caused by cells, complexes of proteins, vitrosin fibrils floating in a liquified vitreous humour in front of retina. The aim of this study is to find the most appropriate shape and size of transparent microstructures simulating the vitreous floaters.

The vitreous floaters are simulated by creating transparent microstructures of various size and shape in a photoresistive layer using direct write lithography. A photoresist AZ40-XT-11D was applied to a glass substrate and mounted in an eye model. Just behind the glass substrate a camera was placed simulating the retina. The vitreous floaters were imaged on a uniform background and intensity distribution was recorded using a program *ImageJ*.

Intensity redistribution of the diffraction patterns revealed appearance of the vitreous floaters characteristic in a living eye, i.e., increase in intensity relative to the background. Size of a pupil is critical for successful observation of the vitreous floaters.

Transparent microstructures of size from several microns to several tens of microns are suited for studying the vitreous floaters. For successful observation of the vitreous floaters the geometrical and optical parameters of the model eye must be close to the real ones.

THE WORLD LEADER IN SERVING SCIENCE

Thermo Fisher Scientific is the world leader in serving science, with revenues of $20 billion and 70,000 employees. Our mission is to enable our customers to make the world healthier, cleaner and safer. We help our customers accelerate life sciences research, solve complex analytical challenges, improve patient diagnostics and increase laboratory productivity.

Thermo Fisher Scientific Vilnius site (Thermo Fisher Scientific Baltics, UAB) has world-class capabilities in manufacturing products for the life science market, specifically in molecular, protein, and cellular biology, and has an outstanding research and development (R&D) center, focused on the development of new products in all aspects of molecular, protein, and cellular biology.

These products are broadly used worldwide to study gene structure, expression and variety, to create new diagnostics methods for innate, hereditary and infectious diseases.

More about us: www.thermofisher.com

OC VISION
together for perfect sight since 1991

TOGETHER FOR PERFECT SIGHT

E. Petrauskas
General director, Lithuania operations
ernestas.petrauskas@ocvision.eu

OC VISION is the largest eye care retail and wholesale group in the Baltic region. We provide accessible and accurate eyecare including diagnostics and vision correction by employing the most qualified optometrists and by using the latest technologies and trends in all eyecare fields.

OC VISION is proud of having 70 stores in the biggest cities in Lithuania and Latvia, pan-Baltic internet store Lensor.eu, which is expanding to Northern Europe and wholesale operations with OPPTICA brand name, serving optician and ophthalmic equipment, products and services for customers in Eastern Europe and CIS countries.

OC VISION is the official representative of following eyecare products, services and medical instruments in the Baltic States:

Ophthalmic lenses - Essilor group, Nikon, Kodak, Seiko, Jet-Star;

Contact lenses and lens care products - Alcon, Coopervision-Baltics, Bausch & Lomb;

Squares and sunglasses - Economic and Medium, Private Label products;

Accessories - Centrostyle, Hilco;

Tools and equipment - Essilor (lens edging systems, laboratory equipment), Tomey Corp. (Optometry-Ophthalmology), Keeler (Optometry-Ophthalmology); ARC Lasers (Ophthalmology), Meccanottica Mazza (refraction units), Huvitz (Optometry-Ophthalmology), Centrostyle (laboratory equipment, materials and tools).

OC VISION was established in 1991, operations in Lithuanian market were started in 1995 and since then, has grown into a country wide network of 11 VISION EXPRESS and 12 OPTIO stores, located in the best locations and employing the best specialists, supported by local back-office and warehouse located in Vilnius.

One of our core strengths is competent and experienced staff company wide. Thanks to the professional, caring and positive team of 350+ OC VISION employees in Latvia and team of 150+ employees in Lithuania and fueled by strong relationships with educational institutions in eyecare field in Baltic states, OC VISION has become the eyecare leader and market maker in Baltics.

EXPERIMENTICA
Scientific Excellence in Ocular Models℠

ADVANCING OPHTHALMIC DRUG DISCOVERY™

Experimentica Ltd. is a global contract research organization (CRO) that specializes in preclinical models of ophthalmology. Our world class scientists and technicians apply a comprehensive set of skills to model ocular diseases using multiple experimental platforms, from cell culture-based systems to complex surgical and pharmacologic small animal models. With proprietary laboratories in Kuopio, Finland and Vilnius, Lithuania, global representation, and an industry-leading portfolio, Experimentica Ltd. delivers the highest quality science to assist you in advancing your drug discovery and drug development portfolio.

Contact us: infolt@experimentica.com, phone: +370 60 468 127, www.experimentica.com

FINDING NEW WAYS, METHODS AND SOLUTIONS TO ERADICATE TODAY'S MAJOR DISEASE CHALLENGES

Kent Langel
Kent@lanlab.ee
+372 5835 9059

TSE Systems is the leading manufacturer of high-quality research instruments.

Since our beginnings in 1886, we have committed ourselves to scientific innovation, reliability, quality and excellent support. Our team of engineers, biologists and physiologists are continually researching ways to upgrade our systems and create new products to meet your scientific demands.

Today it is our goal to maintain our position as number one manufacturer of highly sophisticated life science research instrumentations in each market we serve.

Stellar Telemetry is the newest generation of implantable telemetry technology, allowing you to collect vital signs while performing phenotypical, physiological, pharmacological, behavioral, metabolic and inhalation studies in and outside of your facility. An unlimited number of animals can be monitored by one receiver, facilitating group housing and social interaction studies while monitoring individual animals without having to place a receiver under each cage

The IntelliCage allows you to assess the home cage behavior and cognitive performance of up to 16 individual mice or rats separately while they are living in a social environment. This unique experimental setup fosters natural social behavior in a biologically relevant, enriched but highly standardized home cage context. In this way, the IntelliCage minimizes the need for handling and human intervention, thereby increasing task validity, data reproducibility and ensuring a high level of animal welfare.

More information can also be found at www.TSE-Systems.com

Lanlab OÜ is the official distributor of TSE Systems in Estonia and Lithuania.

ISBN 978-609-07-0061-7