Doctoral School: **Biology Doctoral School**
Doctoral Program: Neuroscience and Human Biology

Subject code: **BIO/7/9**
Subject title: **Cognitive neuroscience L**
Teacher and Neptun code: **Dr. Dobolyi Árpád (GLDXEV), Dr. Andics Attila, Dr. Zelena Dóra, Dr. Vitéz-Cservenák Melinda**
Credits: 4
Class hours: 2 hours/week, lecture

Aims of the course
The lectures present the neurobiological background of cognitive processes.
Contents of the course

- **The human cerebral cortex**

Layers and cell types of the cerebral cortex. Brodmann areas. Thalamo-cortical connections. Neuromodulators and alertness.

- **Overview of cognitive neuroscience methods, experimental and analysis approaches**

The basics of EEG, fMRI and fNIRS. Temporal and spatial resolution. Main design issues. Preprocessing steps. The multiple comparison problem. Univariate and multivariate analyses.

- **Comparative cognitive neuroscience**

Recent methodological developments and challenges in comparative brain imaging of primate and nonprimate mammals. The case of awake dog neuroimaging.

- **Multiple representations of the world in the brain**

Modular and distributed representations. Topographical, tonotopic representations. Hierarchical processing in the visual and auditory modalities -- the cases of object recognition and speech processing.

- **Change detection in the brain**

Repetition suppression and enhancement effects, mismatch negativity, fMR-adaptation. Bottom-up and top-down accounts. Expectation effects. Similarity spaces, norm-based coding and exemplar-based coding.

- **Brain specializations for social stimulus processing**

Selectivity, sensitivity, processing preference. The case of face, body, voice and conspecific processing. Species comparisons.

- **General concepts of medical research**

Evidence-based medicine; demonstration of the characteristics of the most reliable methods for evaluating the effectiveness of therapies, increasing the number of cases by meta-analysis, advantages and pitfalls, possible utilization of this method in biological research, Cohran movement, DSM-V.

- **Development of psychiatric diseases: 3-hit-theory**

Genes and epigenetic changes-inducing early childhood environments as a determinant of vulnerability; stress as an activating factor; epigenetic treatment

- **How we perceive?**
  How different is the vision of the experimental animals. What is the difference between looking and seeing, Paul Bach-Y-Rita's sensory substitution studies. Hearing and balance.
- **Integration of movement and its effect on cognition**

Plasticity of the brain. Neurotrophic Factors (BDNF, NGF) as markers of plasticity and the role of viral vectors in the treatment of neurological diseases; perineuronal nets. Rehabilitation of stroke; early development: Katona and Pető method; movement against Parkinson disease

- **The effect of our intestines, metabolism on brain function**
  Comfort food" - the role of glucocorticoid feedback in obesity. The role of microbiom and vagus in the development of neurological diseases. Post-traumatic stress disorder as a mitochondrial disorder; metabolomica
- **Pain, effector function of sensory nerves**

Role of peripheral vs. central nervous system in pain; plastic brain changes in the treatment of pain; materials produced by peripheral sensory nerves (in memory of János Szolcsányi)

- **The social brain**
  From rodent experiments to human social processing
- **Learning and Memory**
  From elementary learning to mechanisms of storing and retrieving engrams

Requirements
Oral exam
Grade is determined by the exam result.

Literature

Power point slides available