

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

Subject code: **BIO/7/36**
Subject title: **Glia physiology L**
Teacher and Neptun code: **Dr. Környei Zsuzsanna (C63JGU)**
Credits: 4
Class hours: 2 hours/week, lecture

Aims of the course

The presentation provides a detailed overview of the structure and function of glial cells in the peripheral and central nervous systems, and their interactions with neurons.

Contents of the course

1. History of glial cell discovery - historical overview and evolutionary aspects. History of the discovery of different glia cell types; changes in glia-neuron ratio during evolution; potential role of glial cells in non-mammalian / mammalian nervous system.
2. Glia cell types in the central nervous system: astrogia cells. Characterization of astroglia cells, expression markers, radial glia, gliogenesis.
3. Glia cell types: other central nervous system glia types. Bergmann glia, Müller glia, tanicytes, pituitary and pituitary glia, glia limitans and enteral glia.
4. Glia cell types in the central nervous system: oligodendroglia cells. Characterization of oligodendroglia cells, oligodendroglionogenesis, myelin formation, NG2 cells.
5. Glia cell types: glia cell types in the peripheral nervous system. Satellite cells, Schwann cells, olfactory ensheathing glia.
6. Glia physiology: ion channels, receptors. Ion channels, aquaporins, neurotransmitter receptors, etc. glia-specific expression and properties.
7. Glia physiology: connectivity, glia networks, calcium signaling. Expression and role of gap junctions, connexins and pannexins in the establishment and function of the astroglia linkage network. The role of intra- and intercellular calcium signaling.
8. Glia physiology: transporter systems, gliotransmission. Expression and functional role of glial neurotransmitter and other transporter systems.
9. Glia physiology: regulation of ion and water homeostasis in the extracellular space. How do glial cells regulate central nervous system ion homeostasis and water balance?
10. Glia physiology: regulation of extracellular neurotransmitter concentration. The role of glial cells in the removal of neurotransmitters, in creating the conditions for neuronal function. Glutamate-glutamine cycle.
11. Glia-neuron interaction: metabolic relationships. Energy generating processes in glial cells; neuro-energetics. Astrocyte-neuron lactate shunt hypothesis, glutathione synthesis.
12. Glia-neuron interaction: control of neuronal function. Glia-neuron and neuron-glia signaling, gliotransmission, and astrocyte morphological rearrangement.
13. Glia pathophysiology - The role of glial cells in various brain pathologies. Reactive gliosis, Wallerian degeneration, post-injury glia reactions of the central and peripheral nervous system. Astrocyte-specific diseases, tumors of glial origin.
14. The role of microglia in healthy and injured central nervous systems. Origin of microglial cells, characterization of their dormant and activated states, their role in the processes following nervous system injuries.

Requirements

Mid-term presentation recommended.

Written exam.

Grade is determined by the exam result, by taking into account the mid-term presentation.

Literature

lecture slides are available

