**General neurophysiology**

**Laboratory exercise and seminar in medical physiology**

*Home preparation, study materials and learning objectives*

**Learning goals of the seminar**

* You will review how the resting membrane potential is created and what affects the movement of ions across the membrane
* You will learn different mechanisms of signal transmission between neurons (types of synapses)
* You will be able to explain the basics of the effect of individual neurotransmitters and neuromodulators
* You will understand the mechanisms of neuronal processing of input signals, including postsynaptic potentials, spatial and temporal summation
* You will be able to explain the difference between an action potential and postsynaptic potentials
* You will be able to describe the principles of action potential propagation along the axon and its limitations

**Study materials**

* Lectures from general physiology
* Textbook L. Constanzo – Physiology, Chapter 1 – Propagation of action potentials (p. 23), Synaptic and neuromuscular transmission, Chapter 3 – General features of the sensory and motor systems
* Textbook Guyton and Hall – Chapter 5 - Membrane Potentials and Action Potentials, Chapter 46 (from p. 580 - CENTRAL NERVOUS SYSTEM SYNAPSES)

**Home preparation**

1. **Draw a schematic diagram of electrical and chemical synapse. What are the main functional differences between them? Where can they be found in the CNS?**
2. **How does the signal transmission on chemical synapse look like? Draw individual functional components of a chemical synapse.**

**3) Using the Nernst equation calculate the equilibrium potentials for K+ ions in these conditions:**

a) [K+]in = 140 mM and [K+]out = 4.5 mM

b) [K+]in = 140 mM and [K+]out = 7 mM

When can the extracellular K+ concentration in the body be elevated and what functional effect does it have on excitable tissues?

**4) Using the Goldman-Hodgkin-Katz equation calculate the resting membrane potential for a cell in these conditions:**

[K+]in = 140 mM and [K+]out = 4.5 mM

[Na+]in = 10 mM and [Na+]out = 130 mM

[Cl-]in = 7 mM and [Cl-]out = 110 mM

The permeabilities ratio is - K+:Na+:Cl- = 0.85:0.05:0.1

**For neuronerds:**

**5) Using the Nernst equation calculate the equilibrium potentials for Cl- ions in these conditions:**

a) [Cl-]in = 7 mM and [Cl-]out = 110 mM

b) [Cl-]in = 50 mM and [Cl-]out = 110 mM

What effect will this change in the intracellular concentration of Cl- ions have on the function of GABAA receptors? When does such a change occur physiologically? What is the mechanism of maintaining a high intracellular concentration of Cl- ions?