



Head of Department.....  
Prof. P. Zagorchev PhD, DBSc

## **Syllabus in Biophysics**

### **Pharmacy 1-st year, 2-nd term**

1. Thermodynamics. Thermodynamic systems and quantities. First law of thermodynamics and bio-systems.
2. Entropy. Free energy. Second law of thermodynamics applied to bio-systems. Stationary systems, Prigozhin theorem.
3. Bio-membranes: structure, dynamics, phase transitions, functions.
4. Passive membrane transport. Gradients. Equilibrium potentials. Diffusion types – nonspecific-, facilitated- and exchange diffusion.
5. Ionophores and ion channels. Pharmaceutical modulation of ion channel activity.
6. Active membrane transport. Primary and secondary active transport. Na-K pump, Ca pump, Ca-Na exchanger.
7. Electric membrane potential. Equilibrium potential. Resting potential.
8. Nernst-Bernstein equation. Goldman equation. Membrane ion permeability.
9. Action potential. Ion currents measurement by fixed voltage scheme.
10. Ion theory of excitation (Hodgkin and Huxley theory).
11. Action potential propagation. Local anesthetics.
12. Bioelectrical activity, structure and contractile types of smooth muscles. Contractile mechanisms of smooth muscles.
13. Structure and mechanical characteristics of striated muscles.
14. Types of muscle contraction. Temporary characteristics of single muscle contraction.
15. Contracting mechanisms by striated muscles. The role of the  $\text{Ca}^{2+}$ .
16. Spreading of the excited process. Electromechanical connection.
17. Smooth muscles structure. Mechanism of smooth muscles contraction. The role of the  $\text{Ca}^{2+}$ . Phasic and tonic contractions.
18. Comparative characteristic between smooth muscle and striated muscle contractions.
19. Double electrical layer. Electrokinetic potential, dependence on the pH of the medium.

20. Electrical permeability of the tissue for constant current. Polarization. Types.

21. Impedance. Dispersion of the dielectric permittivity. Application of the method in the biology and in the medicine.

22.01.2024

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**Adopted by the Department Meeting with №102/22.01.2024**