



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

Syllabus in Biophysics

Medicine 1-st year, 2-nd semester (30 lecture classes)

1. Thermodynamic systems and processes. The first principle of thermodynamic. Application : biological systems.
2. The secondary principle of thermodynamic. Entropy. Free energy.
3. Application of the secondary thermodynamic principle by the biological objects. Equation of Prigogine.
4. Biological membranes. Common Features. Construction of the lipid molecules
Organization of the membrane.
5. Membrane proteins and glycoproteins. Localization of the carbohydrates of the membrane.
6. Mobility of the membrane components.
7. Phase transitions in the biological membranes.
8. Gradient. Chemical, concentrational and electrical potential. Electrochemical potential.
Equations potentials.
9. Diffusion, trans-diffusion, osmosis and filtration.
10. Passive transport. Eased and exchanged diffusion.
11. Ionophores. Ion channels.
12. Active transport. Model of sodium – potassium pump. Calcium pump.
13. Diffusion potential. Bernstein's and Goldman's equation. Permeability and conductivity.
Potential of a rest condition.
14. Action potential of nerve cells.
15. Membrane current at the time of the excitation.
16. Ion theory of the excitation. Theory of Hodgkin and Huxley.
17. Refractory period. Following potentials. Accommodation.
18. Spreading of the action potential. Electrotonic potential. Mechanism of conduction. Speed of spreading.
19. Bioelectrical activity of the excitable tissues.
20. Structure and mechanical characteristics of striated muscles.
21. Types of muscle contraction. Temporary characteristics of single muscle contraction.
22. Contracting mechanisms by striated muscles. The role of the Ca^{2+} .

23. Spreading of the excited process. Electromechanical connection.
24. Smooth muscles structure. Mechanism of smooth muscles contraction. The role of the Ca^{2+} . Phasic and tonic contractions.
25. Comparative characteristic between smooth muscle and striated muscle contractions.
26. Double electrical layer. Electrokinetic potential, dependence on the pH of the medium.
27. Electrical permeability of the tissue for constant current. Polarization. Types.
28. Impedance. Dispersion of the dielectric permittivity. Application of the method in the biology and in the medicine.
29. Application of the constant current and low frequencies impulses in the clinic.
30. Application of the alternating current and electromagnetic fields in biological objects.

22.01.2024

/..... /

Prof. P. Zagorchev PhD, DBSc

Adopted by the Department Meeting with №102/22.01.2024