



МЕДИЦИНСКИ УНИВЕРСИТЕТ – СОФИЯ
Medical University - Sofia
МЕДИЦИНСКИ ФАКУЛТЕТ
Faculty of Medicine – Dean’s Office

HUMAN PHYSIOLOGY CURRICULUM

Програмата е приета на заседание на Факултетен съвет № 41/08.07.2020

Annotation of the academic discipline

The learning plan in the course is consisted of 90 academic hours: 60 h for practical exercises and seminars; and 60 academic hours for lectures, for the second and third semester of the study. The teaching course is designed to acquaint the pharmacy students in detail with the basic knowledge on the main physiological processes in the organism and their regulation. Students would learn thoroughly the functions of main organs and systems in the body during lectures and the seminars. In laboratories, students work independently and perform experimental practical tasks, using classical and modern devices. The results from experiments are subjected to a preliminary discussion and analysis and consequently recorded in protocols. The study program is additionally focused on body metabolism in relation to future study of pharmacy, pharmacology, chemistry and biochemistry.

Various medical, laboratory and experimental technical devices are used during teaching sessions to record and analyze basic body functions. Experiments and demonstrations are conducted on laboratory animals and on volunteering persons. Records of basic vital functions are analyzed and calculation tasks are worked out.

Lectures

Lecture №1 General Physiology – transport processes across cellular plasma membrane and epithelial layers.

Lecture №2 Physiology of the excitable tissues.

Lecture №3 Physiology of the synapse – mechanisms of synaptic transmission

Lecture №4 Physiology of the synapse – neurotransmitters, membrane receptors.

Lecture №5 Physiology of muscles.

Lecture №6 Blood and lymph. Assoc.

Lecture №7 Physiology of the heart.

Lecture №8 Hemodynamics and arterial blood pressure.

Lecture №9 Physiology of the respiratory function. Mechanics of respiration.

Lecture №10 Gas exchange and regulation of respiration.

Lecture №11 Gastrointestinal system: general overview. Motor functions of the gastrointestinal tract.

Lecture №12 Secretions of the gastrointestinal tract. Digestion and absorption in the gastrointestinal tract.

Lecture №13 Energy balance. Thermoregulation.

Lecture №14 Nutrition, microelements and vitamins. Body metabolism

Lecture №15 Kidney physiology.

Lecture №16 Regulation of fluid-electrolyte and acid-base balance.

Lecture №17 Endocrine physiology. Pituitary hormones.

Lecture №18 Thyroid and parathyroid hormones. Regulation of calcium and phosphate homeostasis.

Lecture №19 Hormones of the adrenal gland. Endocrine pancreas.

Lecture №20 Reproductive physiology. Male and female reproductive physiology.

Lecture №21 General physiology of the nervous system. Neural networks. Reflexes.

Lecture №22 Sensory functions of the nervous system. Sensory receptors. *Assoc. Professor P. Kупenova*

Lecture №23 Visual sensory system.

Lecture №24 Vestibular and auditory sensory systems.

Lecture №25 Olfactory sensory system and taste.

Lecture №26 Somatosensory system. Physiology of pain.

Lecture №27 Regulation of movements.

Lecture №28 Reticular formation, EEG, sleep and wakefulness. Functions of the neocortex.

Lecture №29 Autonomic nervous system. Synapses and neurotransmitters of the autonomic nervous system.

Lecture №30 Actions of the sympathetic and the parasympathetic branches of autonomic nervous system.

Autonomic centers: hypothalamus and limbic system. Memory and learning.

Seminars & practical exercises

No	Theme	hours
1	Transmembrane transport. Membrane potential. Action potential.	3
2	Synaptic physiology - Seminar. Chemical synapses. Neurotransmitters and postsynaptic receptors. Postsynaptic potentials. Application of „Neuron” multimedia software.	3
3	Heart physiology. Physiologic anatomy of cardiac muscle. Electric activity of the heart. Registration and analysis of electrocardiogram.	3
4	Arterial blood pressure. Heart sounds. Regulation of myocardium performance. Control of the circulation. Auscultation. Phonocardiography. Blood pressure measurement. Written exam: <i>CARDIOVASCULAR SYSTEM</i> .	3
5	Respiratory physiology. Ventilation. Gas exchange. Central control of respiration. Lung volumes and capacities measurement using spirometric module „Vacuumed”	3
6	Gastrointestinal physiology. Structure of gastrointestinal tract. Motility, secretion, digestion and absorption. Liver physiology. Smooth muscle physiology.	3
7	Kidney function. Clearance method for evaluation of excretory function. <i>Calculation of glomerular filtration rate; renal plasma and renal blood flow, and clearance of drug.</i>	3
8	Body fluids. Fluid and electrolyte balance. Kidney regulation of body fluid volume and content. Acid-base balance. Calculation of osmolarity. Calculation of plasma and blood volume <i>Written exam: KIDNEY PHYSIOLOGY, BODY FLUIDS AND ACID-BASE BALANCE.</i>	3
9	Nervous system. Sensory functions of the nervous system. Reflexes. Autonomic nervous system. Examination of clinical reflexes. Reaction time measurement.	3
10	Endocrine system - Seminar. Application of „Endocrine cells” & „Autonomic nervous system” software.	3

Syllabus for theoretical year exam

1. Transport across the cellular membrane.
2. Mechanisms for intercellular communication.
3. Excitable membranes. Resting membrane potential.
4. Action potential. Refractory periods. Propagation of action potentials along the nerve fibres. Classification of nerve fibres.

5. Synaptic transmission in the chemical synapse. Postsynaptic potentials.
6. Postsynaptic membrane receptors (ionotropic and metabotropic).
Neurotransmitters: classification and mechanism of action.
7. Physiology of skeletal muscle. Mechanism of muscle contraction. Types of muscle contraction.
8. Muscle energetics. Types of muscle fibres. Neuromuscular junction. Motor unit.
9. Physiology of smooth muscle. Electromechanical and pharmacomechanical coupling.
10. Blood: composition and functions. Blood plasma. Hemopoiesis.
11. White blood cells. Functions of leukocytes. Immunity.
12. Red blood cells. Functions of hemoglobin. Blood types.
13. Hemostasis. Blood coagulation. Fibrinolytic system. Anticoagulants and fibrinolytic substances.
14. Physiology of cardiac muscle. Conduction system. Electrocardiogram.
15. Cardiac cycle. Stroke volume and cardiac output. Regulation of cardiac function.
16. Circulation. Principles of hemodynamics. Factors, which determine arterial blood pressure.
17. Microcirculation. Blood flow in veins. Regulation of vascular tone.
18. Control of arterial pressure: short-term and long-term regulation.
19. Respiratory system: general overview. Mechanics of breathing. Lung volumes and capacities. Airway resistance. Control of bronchial tone.
20. Oxygen and carbon dioxide diffusion in the lungs and tissues. Oxygen and carbon dioxide transport in blood.
21. Regulation of respiration. Central and peripheral chemoreceptors.
22. Gastrointestinal system: general overview. Neural and hormonal regulation of gastrointestinal functions.
23. Motor activity in the various organs of the gastrointestinal tract. Neural and hormonal control of motor function.
24. Secretory activity of the gastrointestinal system: composition and functions of the various gastrointestinal juices. Neural and hormonal control of the gastrointestinal secretions.
25. Digestion and absorption of carbohydrates, proteins and lipids in the gastrointestinal system. Absorption of minerals, water and vitamins.
26. Liver functions.
27. Carbohydrate metabolism. Control of blood glucose level.
28. Protein and lipid metabolism. Regulation.
29. Energy metabolism. Basal metabolic rate.
30. General principles of nutrition. Essential nutrients. Physiological role of vitamins and minerals.
31. Body temperature: normal values. Body temperature regulation. Hyperthermia, hypothermia and fever.
32. The kidney: urine formation. Glomerular filtration. Renal clearance.
33. Renal tubular function. Excretion of exogenous substances. Regulation of tubular function. Concentration and dilution of urine. Urine composition.
34. Body fluids: volume and composition. Regulation of fluid-electrolyte homeostasis.
35. Acid-base balance in the body. Buffer systems. Respiratory and renal regulation of pH.
36. Endocrine system. Mechanism of action of hormones. Regulation of hormonal secretion.
37. Pituitary gland: adenohypophyseal hormones and posterior pituitary hormones.
38. Thyroid hormones: physiological effects and control of their secretion.
39. Adrenal cortical hormones: physiological effects and control of their secretion.
40. Hormones of the endocrine pancreas: physiological effects and control of their secretion.
41. Control of calcium-phosphate balance: parathormone, calcitonin and vitamin D3.

42. Reproductive and hormonal functions of the male gonads.
43. Reproductive and hormonal functions of the female gonads. Pregnancy, childbirth and lactation.
44. General functions of the nervous system. Physiology of the neuron. Amplitude and frequency encoding of information.
45. Reflex activity of the nervous system. Neural networks. Types of inhibition in the central nervous system. Glia.
46. Sensory systems. General principles of information processing in the sensory systems.
47. Somatosensory system: tactile, proprioceptive, and thermal sensation.
48. Nociception. Types of pain. Antinociceptive system and pharmacological modulation of pain.
49. Physiology of the visual sensory system.
50. Physiology of the auditory sensory system.
51. Physiology of the olfactory and gustatory sensory system.
52. General overview of the regulation of movement. Spinal mechanisms for regulation of movement.
53. Regulation of posture and equilibrium: the role of the vestibular apparatus.
54. Regulation of voluntary movement: role of the motor cortex, basal ganglia and the cerebellum.
55. Brain bioelectrical activity: electroencephalogram. Reticular activating system and maintenance of the awake state.
56. Physiology of sleep. Control of the sleep-wake cycle. Biological rhythms.
57. Autonomic nervous system. Sympathetic and parasympathetic division. Neurotransmitters and receptors in the autonomic synapses.
58. Autonomic control of the visceral organs. Autonomic reflexes. Adrenal medulla. Autonomic integrative centers: hypothalamus and limbic system.
59. Higher functions of the nervous system. Neurophysiological basis of learning, memory and language.

Academic literature:

Recommended textbooks:

Mandatory textbook:

1. **Costanzo L. S. Physiology. Fifth Edition, 2014. Saunders Elsevier.**

Additional Reading:

2. Kelly Laurie Mc Corry, Essentials of human physiology for pharmacy CRC Press pharmacy education series, Second Edition, 2008, Boca Raton.