Physiology (including the physiology of the maxillofacial region)

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Total hours – 216 h:
Lectures: 32 h;
Practical classes: 90 h;
Independent work – 58 h;
Control – 36 h

Course description:

Lecture is an oral presentation of particular branch of science or discipline by the teacher. It is usually held for the course of students at the same time.
Workshop is usually devoted to detailed study of specific topics and it is being held in each academic group separately. The workshop involves active participation of students in problem discussion. It requires preliminary preparation by the student.
Practical training is aimed to apply theoretical knowledge in practice. The skills are developed in problem solving process under the supervision of a teacher.
Laboratory classes contain experimental scientific research activities. It requires the use of special equipment, facilities and materials. To be held in teaching laboratories.
Self-study is work with the special literature or teaching materials (literary sources, video and audio material, multimedia programs and simulators) on the educational portal of the University https://e.kazangmu.ru/enrol/index.php?id=1920

Course objectives: The purpose of mastering the discipline

The goals of mastering the **Physiology (including the physiology of the maxillofacial region)** to form students' systematic knowledge about the vital activity of the body as a whole, the dynamics of vital processes and the interaction of the body with the external environment, as well as an idea of the patterns of functioning of the organs of the maxillofacial region involved in the processes of physiological functions and compensatory reactions in disorders of these functions.

Tasks of the discipline:

The tasks of mastering the discipline (module) are the formation of students' skills in analyzing the functions of an integral organism from the standpoint of analytical methodology;- formation of a systematic approach among students in understanding the physiological mechanisms underlying the implementation of body functions from the perspective of the concept of functional systems;- students' mastering of research methods body functions used both in laboratory experiments and for diagnosis in clinical practice;- students' study of the patterns of formation of maxillofacial functions- the facial area;- students' study of the patterns of interaction of the organs of the maxillofacial region with other body systems; - formation of clinical thinking among students for the future practice of a dentist.

Course topics:

Section 1. Physiology of the cardiovascular system
Section 2. Blood Physiology
Section 3. The physiology of respiration
Section 4. Physiology of excretion
Section 5. Physiology of the endocrine system
Section 6. Physiology of excitable tissues
Section 7. Central nervous system physiology
Section 8. Physiology of sensory systems
Section 9. Physiology of the digestive system and the maxillofacial region

Calendar plan of lectures

II semester

1. Morpho-functional features of the organization of the heart. The cardiac cycle. Valve apparatus. Physiological properties of the heart muscle. Typical and atypical cardiomyocytes, the conduction system of the heart. The nature of electrogenesis of heart cells. Automation, its centers and gradient. Extrasystoles and their causes. Methods of studying the activity of the heart. ECG, Nervous and humoral mechanisms of intracardiac and extracardiac regulation.
2. Vascular physiology. Large and small circulatory circles Functional classification of blood vessels. Main the laws of hemodynamics. Parameters of peripheral blood circulation (blood pressure, linear and volumetric blood flow rates, time blood circulation). The concepts of systolic, diastolic, pulse and average blood pressure. Factors determining the value of blood pressure. Arterial and venous pulse. Microcirculation and its role in the mechanisms of fluid and various substances exchange between blood and tissues. Nervous, humoral and myogenic regulation of vascular tone. Vasomotor center.
3. Blood physiology. Blood functions. The components of blood. Role plasma and shaped elements (erythrocytes, leukocytes, platelets). Red blood cells. The system of human blood groups – ABO and Rh system.
4. Mechanisms of immunity, its types.
5. Platelets. Blood clotting. The phases of primary and secondary hemostasis. Anti-clotting system.
6. The physiology of respiration. The structure and functions of the respiratory organs. External breathing. The structure and functions of the respiratory center. Gas exchange in lungs and tissues. The composition of inhaled, exhaled and alveolar air. Transportation of gases by blood. Regulation of breathing.
7. Physiology of excretion. Excretory organs, their significance. Mechanisms of glomerular filtration, reabsorption, secretion in the nephron, and their regulation. Primary urine. The rotary-countercurrent mechanism of urine concentration. Secondary urine. Mechanism urination, its regulation.

8. General and private physiology of the endocrine system.

III semester

1. The structure and functions of biological membranes. Mechanisms of formation of biopotentials at rest. The action potential and its phases. Refractoriness, its phases.
2. Physiological properties of skeletal and smooth muscles. The mechanism of skeletal and smooth muscle contraction. Electromechanical coupling. Motor units.
3. The physiology of the central nervous system. The structure and general principles of functioning of the central nervous system, interneuronal connections, central nervous system mediators. The reflex principle of the nervous system. The reflex arc. The value of inhibition in the central nervous system. Morphofunctional organization of a neuron as a unit of the nervous system.
4. The role of various parts of the central nervous system (spinal cord, medulla oblongata, midbrain) in the regulation of physiological functions. Functions of the cerebellum, intermediate brain, subcortical nuclei. Afferent, efferent and associative areas of the cerebral cortex.
5. General physiology of sensory systems. The concept of a receptor. The structure of sensory systems. The organization of visual and auditory sensory systems.
6. The structure of sensory systems. Sensory functions of the oral cavity. Taste, pain, temperature, tactile reception.
7. Physiology of digestion. The organization and physiology of the maxillofacial region. Digestion in the oral cavity. Digestion in the stomach. Gastric secretion. Pancreatic secretion.
8. Physiology of digestion. The main functions of the digestive tract. The physiology of the liver. Bile. Biliary excretion. Digestion in the intestine. Defecation and formation of feces. The mechanisms of absorption of digestive products in various parts of the gastrointestinal tract. Motor activity of the gastrointestinal tract. Humoral and nervous regulation of digestive tract functions.

Calendar plan of practical classes

1. Physiology of the heart. Morpho-functional features of the organization of the heart. The cardiac cycle. Valve apparatus. ECG. Regulation of heart activity
2. Hemodynamics. Vascular physiology. Large and small circulatory circles. Blood pressure, Arterial pulse Regulation blood circulation.
3. Module on topics 1-2
4. Components of blood. Shaped elements. Red blood cells. Blood functions. Hemoglobin.
5. Leukocytes. Immunity, its types and mechanisms. ESR of the blood group.
6. Platelets. Blood clotting. The phases of primary and secondary hemostasis. Anti-clotting system.
7. Module on topics 4-6
8. The structure and functions of the respiratory system. External and tissue respiration. Gas exchange. Regulation of breathing.
9. Physiology of excretion. The structure and functions of the organs of the excretory system. Regulation.
10. Issues of general and private physiology of the endocrine system.
11. Bioelectric phenomena. MP, AP.
12. Physiological properties of skeletal and smooth muscles. Muscle contraction, tetanus.
13. Conducting arousal on nervous and muscle fibers. Transmission mechanism a signal in a chemical synapse.
14. Module on topics 11-13
15. General physiology of the central nervous system. The structure and general principles of functioning of the central nervous system. Interneuronal connections.
16. Private physiology of the central nervous system.

17. Regulation of integrative functions
18. Module on topics 15-17
19. General physiology of sensory systems. The organization of visual and auditory sensory systems.
20. Organization of skin sensitivity and sensory function of the oral cavity.
21. Physiology of the digestive system (part 1). Digestion in the oral cavity.
22. Physiology of the digestive system (part 2).
23. Module on topics 21-22

Text books and required supplies:

1. Ganong's Review of Medical Physiology. 26th Edition. MC Graw Hill. 2019. 1792p. ISBN-10: 978-1-26-012241-1.
2. Hall J. Guyton and Hall Textbook of Medical Physiology. 13rd Edition. Elsevier. 2016. 1046p. ISBN 13:9781455770052.
3. W., Boulpaep E. Medical Physiology. 3rd Edition. Elsevier. 2016. 1312p. eBook ISBN: 9780323391597
4. Educational portal course: Normal Physiology for faculty of Dentistry https://e.kazangmu.ru/enrol/index.php?id=1920

Evaluation and grading:

Monitoring progress is carried by the end of each module (colloquia/written papers/oral examination/test/laboratory works assessment/abstracts/reports/medical records, reports or other).

Routine performance assessment (homework, practical work, tests during classes, etc.) is carried out using 10 point scale, where 0-6 – "poor", 7 – "satisfactory", 8 – "good", 9 – "excellent" and 10 – "splendid". Unsatisfactory mark during routine performance evaluation or absenteeism (including lectures) is considered to be a student academic debt. In order to rework the debt the student can attend missed/failed class with a different academic group (the teacher is to be notified in advance) or to do the rework using e-learning or distance technologies or in other ways determined by the teacher. Abandoned academic debt is leading to dismissal from the University.

Midterm assessment is a form of knowledge and skills evaluation on the discipline or on a part of it (test/oral exam/paper). Grading: 0–69 points – noncredit; 70–100 points – credit. Student is given not more than 2 attempts to pass midterm assessment within one year. Failure is leading to dismissal from the University.

Exams are held in forms of MCQ test (one correct answer). Grading: 0–69 – "poor", 70-79 – "satisfactory", 80-89 – "good", 90-100 – "excellent".

Overall student rating is build up from class attendance, module and test results, midterm assessment results.

Classroom rules:

- Be respectful
- Be careful with equipment
- Be disciplined
- Be prepared for the classes
- Be involved, do not hesitate to ask questions
- Look professional: you have to wear clean white coat and change shoes
- Eating is allowed only during brakes
- Using phone is allowed only during brakes

Example of module: Membrane Physiology, Nerve and Muscles

1. The structure and the functions of the cell membrane. Ion channels, their types, functions and mechanisms of activation.
2. The mechanisms of active and passive ion transport through the cell membrane. Ion pumps, their types and functions.
3. Resting membrane potential. The factors underlying causing the formation and maintenance of resting membrane potential. Measurement of the membrane potential. The Nernst equation. The values of membrane potential in different cells.
4. The excitability. The threshold for excitation. The excitability curve. Accommodation.
5. Action potential. The phases of action potential. Changes in sodium and potassium conductances during the course different stages of the action potential. The mechanisms of action potential propagation on the cell membrane. The refractory period.
6. The structure and classification of nerve fibers.
7. Propagation of the action potential in myelinated and non-myelinated nerve fibers. The laws of propagation of the action potential along the nerve fibers.
8. The neuromuscular junction. The mechanisms of quantal acetylcholine release at the neuromuscular synapses.
9. The "end-plate potential" and excitation of the skeletal muscle fiber. Miniature end-plate potentials. Role of acetylcholine-esterase. Drugs that affect transmission at the neuromuscular junction.
10. The types of muscle fibers. Neuromotor unit. Structure of skeletal muscle fibers and myofibrills.
11. Types of contractions of skeletal muscle. Single muscle twitch. Summation of muscle contraction (incomplete and complete muscle tetanic contraction). Isometric and isotonic contraction.
12. Mechanism of skeletal muscle contraction.
13. Excitation-contraction coupling. Role of the calcium ions and ATP in muscle contraction. Rigor mortis.
14. The mechanisms of fatigue in the nerves, muscles and in neuromuscular junction.
15. The smooth muscle. The structure and the types of smooth muscle. Innervation of smooth muscle.
16. Membrane potential and action potentials in smooth muscle. Mechanism of contraction and relaxation in smooth muscle.

Evaluation of the module answer

The question card of the module consists of 2 questions: problem cases, practical exercises, oral and written questions or their combination.

1 correct answer - 50 points

Total for module: **100 points**

Example of exam ticket

Card N

1. Which part of the ECG corresponds to ventricular repolarization? a. The P wave; b. The QRS duration; c. The T wave.
2. The second heart sound is caused by: a. closure of the aortic and pulmonary valves; b. vibrations in the ventricular wall during systole; c. ventricular filling; d. closure of the mitral and tricuspid valves.
3. The main important excitatory neurotransmitter in CNS is: a. glycine; b. GABA; c. glutamate; d. acetylcholine.
4. Which of these statements about hypothalamic-releasing hormones is **false**? a. They are synthesized in the hypothalamus; b. They are transported by portal veins to the anterior pituitary; c. They stimulate the secretion of some specific hormones from the posterior pituitary.
5. What type of nerve fiber has the highest conduction velocity? a) Autonomic fibers; b) Sensory fibers; c) Somatic motor fibers.

Evaluation of exam answer

The question card of the exam (MCQ) consists of 50 questions (only one correct answer).
1 correct answer - 2 points.
Total for exam: 100 points.