Al-FARABI KAZAKH NATIONAL UNIVERSITY

Approved
at the meeting of the scientific and methodological
council of the al-Farabi Kazakh national University
Vice-rector for academic affairs
_____ A. K. Hikmetov
protocol No. 6 of June 22, 2020

PROGRAM
ENTRANCE EXAM IN THE SPECIALTY FOR APPLICANTS TO THE PhD PROGRAM IN THE SPECIALTY "8D051-BIOMEDICINE"

ALMATY 2020

The program is compiled in accordance with the State educational standard for the specialty "8D051 - BIOMEDICINE".

The program was reviewed at the meeting of the department of biophysics and biomedicine
Protocol No. __ of _____, 2020

Head of department _____ Tuleukhanov S. T.

Approved at the meeting of the methodological bureau of the faculty of biology and biotechnology
Protocol No. __ of _____, 2020

The Chairman of the methodological bureau _____ (Kulbaeva M.S.)

Approved at the meeting of the academic council of the faculty

Protocol No. __ of _____, 2020

Chairman of the Academic council,

Dean of the faculty _____ Zayadan B.K.

Scientific secretary_____ (Altybayeva N.)

CONTENT

Goals and objectives of the entrance exam to the doctoral program in the specialty "8D051-Biomedicine" - to identify the level of theoretical readiness of applicants in various fields of biological science, the ability to navigate the dialectical relationship of various levels of organization of life, to have an idea of the main fundamental, classical branches of Biomedicine, as well as the methods, tasks and achievements of modern innovative sections of biomedical Sciences, to assess the extent of their assimilation of program material and formation, developed during training in bachelor's and master's degrees, the necessary skills and skills for professional activity.

Requirements for the level of training of persons entering the PhD program

The doctoral program in the specialty ***"8D051-Biomedicine"*** provides for the preparation of doctors of philosophy to work in the field of Biomedicine, the versatile use of biological systems for practical and research purposes, the conservation of biodiversity and the environment, able to carry out qualified research and practical development in this area.

Prerequisites of the educational program

Cell biology - 3 credits
The human and animal physiology 3 credit
Organization and planning of scientific research - 3 credits

The course "Cell biology»
List of exam topics

Ways of cell evolution and formation of multicellular organisms. Formation of various cellular phenotypes. The main types and diversity of cells. The separation of the functions of cells in multicellular organism, totipotency and cell differentiation. The phenotypes of mammalian cells. Molecular structure and functional components of cell membranes. Types and functions of membrane lipids. Membrane proteins: physical and chemical properties. Molecular organization of membrane transport systems (mobile carriers, ion channels, transport ATPases). Structure and functions of intracellular organelles. Organelles and vesicular transport. Changing the shape of the cells, endo - and exocytosis. Mitochondria and cellular energy. Cell cycle and cell division. Vegetative and sexual reproduction of cells. Cell death. Non-programmable and programmable pathways of cell death. Apoptosis. System of degradation and utilization of intracellular structures. Cytoskeleton. Structure and conformational rearrangements of the cytoskeleton. The main types, molecular organization and Executive mechanisms of systems that provide movement. Motion systems based on polymerization (depolymerization) and interaction of microtubules and actin filaments. Cellular contacts, intercellular adhesion, and extracellular matrix. Molecular mechanisms of signal transmission: the main pathways of intercellular signaling. Phosphorylation and cellular signaling. Cell pathology and aging. Carcinogenesis.

List of recommended literature

Main literature

1. Chentsov Yu.S. Vvedeniye v kletochnuyu biologiyu [Introduction to cell biology]. M.: «Akademkniga». 2004.-495 s.
2. Alberts B.. Brey D.. Lyuis Dzh.. Reff M.. Roberts K.. Uotson Dzh.. 1994. Molekulyarnaya biologiya kletki [Molecular biology of the cell]. 1-5 t. M: Mir. 1994.
3. Gennis R. Biomembrany: Molekulyarnaya struktura i funktsii [Molecular structure and functions]: Per. s angl. – M.: Mir. 1997.-624s.
4. Findel Dzh. B.. Evanz U.G. Biologicheskiye membrany. Metody: Per. s angl [Biologicheskiye membrany. Metody: Per. s angl]. – M.: Mir. 1990. - 424s.
5. Faller Dzh. M.. Shilds D. Molekulyarnaya biologiya kletki. Rukovodstvo dlya vrachey

[Molecular biology of the cell]: per. s angl. – M.: Binom - Press. 2004.-272s.
6. Epifanova O.N. Lektsii o kletochnom tsikle [Lectures on the cell cycle]. KMK Scientific press . 1997.

Additional literature:

1. Svensen K.. Uebster P. Kletka [Cell]. M.: Mir. 1980.
2. Zavarzin A.A.. Kharazova A.D.. Molitvin M.N. Biologiya kletki: obshchaya tsitologiya [Cell Biology: General Cytology]. SPb.: Izd-vo SPb. un-ta. 1992.
3. Skulachev V.P. Energetika biologicheskikh membrane [The energy of biological membranes]. Moskva. Nauka. 1989 g
4. Metsler D. Biokhimiya. Khimicheskiye reaktsii v zhivoy kletke [Chemical reactions in a living cell]. Moskva. Mir. 1980 g.. t.t. 1-3
5. Spirin A.S. Molekulyarnaya biologiya. Struktura ribosomy i biosintez belka [Molecular biology. Ribosome structure and protein biosynthesis]. Moskva. Vysshaya shkola. 1986 g.
6. Alberts V.. Bray D.. Lewis J.. Raff M.. Roberts K.. Watson J. D. Molecular biology at the cell [Molecular biology at the cell]. 4th ed. N.Y.; L.: Garland Publ.. 2001.
7. Karp G. Cell and molecular biology [Cell and molecular biology]. 2nd ed. N.Y. etc.: John Wiley and Sons. 1996.
8. Lodish H.. Besk A.. Zipursky S.L.. Matsudaira P.. Balximore D.. Darnell J. Molecular cell biology [Molecular cell biology]. 4th ed. L.: Freeman. 2000.
9. Tobin A.J.. Murel R.E. Asking about cells [Asking about cells]. Saunders college publ.. 1997.

Discipline: "Physiology of humans and animals"
List of exam topics

The subject of human physiology and its role in the system of medical education. Object and methods of research. Principles of organization of management of body functions. Functional systems of the body according to P. K. Anokhin. Physiological mechanisms of maintaining homeostasis. Physiology of excitable tissues. Excitability and excitement. General properties of excitable tissues. Nerves, their structure and types of nerve fibers. Vvedensky's doctrine of parabiosis. Modern data on the structure of the neuromuscular synapse. Structure, functions and properties of skeletal muscles. Functional features of smooth muscles. Physiology of the Central nervous system. mechanism of inter-neural connections. Reflex arc. Features of excitation in the reflex arc. Nerve center. Properties of nerve centers. Excitation and inhibition in the Central nervous system. Spinal cord. The General scheme of its structure. Medulla. Vasomotor center. Respiratory center, inspiratory and expiratory neurons. Reticular formation of the brain stem. Midbrain. Cerebellum. Diencephalon. Subcortical ganglia, and their functions. The role of the cerebral cortex in the implementation of higher nervous activity. Integrative functions of the Central nervous system. Sleep and wakefulness. Consciousness and speech. Plasticity, learning, and memory. The autonomic nervous system (sympathetic, parasympathetic, metasympathetic). General characteristics of the endocrine system and its significance in humoral regulation. Endocrine glands. Functions of hormones. Mechanisms of neurohumoral-hormonal regulation of stress. Blood and lymph, their role in ensuring the processes of vital activity of the body. Basic functions of the blood. The amount and composition of blood. Shaped elements of blood and their functions. Physiology of the cardiovascular system. Types of blood vessels: arteries, veins, capillaries, their characteristic morphological features and functional features. Cardiac cycle. Regulation of heart activity. Physiology of the respiratory system. External respiration and transport of gases by blood. Spirometry. Gas exchange in tissues. Respiratory center. Physiology of digestion. General ideas about the functions of the gastrointestinal tract. Types of digestion. Oral digestion. Parietal (membrane) digestion. Metabolism and energy. Methods of research of metabolism. Basic exchange and energy consumption at rest. General exchange. Poikilothermia, homoiothermy and heterodermia. Chemical thermoregulation. Physical thermoregulation. Kidneys, their structure and excretory function. Nephron. Structure of the nephron. The concept of receptors and analyzers. Classification of receptors and analyzers. Physiological bases of mental activity. Higher nervous activity (GNI). The types of GNI.

List of recommended literature

Main literature

1. Fiziologiya cheloveka [Human Physiology]: uchebnik / pod red. V.M.Pokrovskogo. G.F.Korotko. – M.:Meditsina. 2007.
2. Normalnaya fiziologiya [Normal physiology]: Uchebnik dlya med. vuzov / Agadzhanyan N.A.. Smirnov V.M. (red.).- 3-e izd.- M.: Akademiya. 2010.
3. Agadzhanyan N.A.. Tel L.Z.. Tsirkin V.I. Fiziologiya cheloveka [Human Physiology]. - M.. Novgorod: izd-vo NGMA. 2010.
4. Fiziologiya cheloveka i zhivotnykh [Physiology of man and animals]: uchebnik dlya vuzov /avt.: Apchel V.Ya.. Darinskiy Yu.A.. - M.: Akademiya . 2011.
5. Chuvin B.T. Fiziologicheskaya regulyatsiya funktsiy organizma cheloveka [Physiological regulation of human body functions]. – M.: VLADOS. 2003.

Additional:

1. Orlov R.S. Normalnaya fiziologiya [Normal physiology]. – GEOTAR- Media. 2010.
2. Solodkov A.S.. Sologub E.B. Fiziologiya cheloveka [Human Physiology]. Obshchaya. Sportivnaya. Vozrastnaya: uchebnik. – 4 izdaniye: M.: Sov.sport. 2010.
3. Fiziologiya cheloveka i zhivotnykh [The human and animal physiology]: uchebnik dlya vuzov / avt.: Apchel V.Ya.. Darinskiy Yu.A.- M.: Akademiya. 2011.

Discipline "Organization and planning of scientific research"
List of exam topics

Scientific research as an activity aimed at a comprehensive study of an object, process or phenomenon, their structure and relationships, as well as obtaining and implementing useful results for a person. Objects of scientific research: material, ideal systems. The subject of scientific research is the structure of the system, the interaction of its elements, various properties and patterns of development. The methodology of scientific research. History of natural science formation, key stages and aspects. The importance of scientific planning in the modern world. Models and technologies of scientific planning. Diploma work as an independent creative work of students, summarizing the experimental data obtained by them in the course of research work, systematizing their previously acquired theoretical knowledge and providing a platform for mastering the skills of professional presentation, checking their competence in the chosen specialty profile, key elements and requirements for it. The need to use bibliographic references in scientific works, the rules governing it. The concept of copyright and licensing, academic etiquette. Mechanisms for implementing research results. Relevance of the formation of professional and key competencies, over-subject competencies: research (search), organizational and managerial, communicative, reflexive, skills and skills of working in a team. Speech communication as a tool of professional activity. Work with scientific information, its processing and presentation. Technical, graphic, stylistic, grammatical criteria for the design and presentation of the poster, information load. Definition and designation of scientific novelty, relevance, scope of application of research results. Ways and tasks of developing innovative and strategically important scientific technologies. Main stages of development.

List of recommended literature:

"Organization and planning of scientific research»

Main:

1. Aytasheva Z.G. Concise Guidance for Biologists: Preparation of Scientific Publications and Grant Proposals. Kazakh University, 2005, 47 p. (Rus.). and later editions of this guidebook.

Additional:

Day R.A. How to write and publish a scientific paper. 4th Edition. Phoenix, Oryx Press AZ,

1994.
1. Woosley J.D. Combating poster fatigue: How to use visual grammar and analysis to effect better visual communications. Trends Neurosci. 12, 325-332, 1989.
2. Dawkins R. The Oxford book of modern writing. 1st paper edition. Oxford University Press, 2009, 419 pp.
3. Issever C., Peach K. Presenting Science. A practical guide to giving a good talk. Oxford University, Press, 2010, 120 pp.
Online resources:
1. http://highered.mcgraw-hill.com/sites/0767417399/student_view0/chapter1/web_links.html
2. http://wps.ablongman.com/long_aaron_lbb_2/22/5789/1482143.cw/index.html
3. http://college.cengage.com/english/chaffee/critical_thinking/2e/students/links/chap10.html
4. http://bmj.bmjjournals.com/collections/read.htm (how to read scientific papers)
5. http://modeling.asu.edu/modeling/weblinks.html (weblink for the modelers)

The discipline "Human Anatomy"
The list of examination topics

The concept of the musculoskeletal system, its components. The skeleton and its functions. Bone as an organ. Bone tissue and bone substance. Classification of bones. Chemical composition and properties of bones. Types of bone connections. Structure of the joint. Classification of joints. Structure of the cerebral and visceral skull. The axial skeleton and skeleton of limbs.

Muscle tissue. Features of striated muscle tissue. Skeletal muscles are an active component of the locomotor apparatus. The shape of skeletal muscles. Muscle as an organ. The main muscles of the torso, head, neck, upper and lower limbs.

Digestive system: tubular organs and glands. Structure of the oral cavity: lips, tongue, gums, teeth, soft and hard neb. Pharynx, features of its structure, parts. Esophagus: structure of the wall, its parts. Structure of the stomach, its parts, structural features. The small intestine is its divisions. Structure of the small intestine wall. The large intestine, its departments, features of the structure of the wall, gaustra, crypt.

The structure of the salivary glands, the type of secretion, the composition of the secret. Structure of the pancreas, its parts, and surface. Structure of the digestive part of the pancreas. Structure of the liver: surfaces, edges, lobes. Structure of the classical liver lobule. Features of blood supply, structural and functional unit.

Respiratory system. Airways and the respiratory Department itself. Structure of the nasal cavity, nasopharynx; features of the structure of the larynx. The concept of a voice device. Structure of the trachea and main bronchi. The bronchial tree and its components. Structure of the lung; structural and functional unit.

Excretory system: urinary and urinary structures. Structure of the kidneys: cortical and cerebral substances. Nephron-structural and functional unit of the kidney. Structure of the ureter, bladder, and urethra.

Reproductive system. Male genital organs. Structure of the testis. Structure of spermatogenic epithelium: types of male germ cells, periods of spermatogenesis. Appendage of the testis. VAS deferens. The structure of the seminal vesicles. Prostate. Female genital organs. Structure of the ovary: cortical and cerebral substances. The structure of the follicles, types of follicles. Ovogenesis periods, types of female germ cells. Oviducts and uterus.

Vascular system and its components. Circulatory system. Arteries and veins. Regularities of their distribution across the body. Microcirculatory bed, its components, types of capillaries. The heart, its parts, surfaces, and shell. Layers of the heart wall, chambers. Circles of blood circulation. The lymphatic system: its components, connection with the venous system; features of the structure of lymphocapillaries, vessels, collectors. Thoracic and right lymphatic ducts.

Features of hematopoietic organs and immunogenesis. Central and peripheral organs. Structure of the red bone marrow, thymus. Macromorphology of the spleen, white and red pulp. Structure of the lymph node, cortical and cerebral substances, sinuses of the node, lymphoid follicles. Tonsils as a collection of lymphoid tissue. Concepts of Muco-lymphoid structures in the respiratory, digestive, and excretory systems.

Features of the endocrine system. Classification of the endocrine glands. Central and peripheral organs. Hypothalamic-pituitary system. Structure of the pituitary, epiphysis, thyroid and parathyroid glands. The adrenal glands, endocrine part of the pancreas and gonads. The concept of paraganglia.

Nervous system. The concept of neural tissue. Structure of the neuron. Types of neurons. The concept of fleshy and non-fleshy fibers. Gray and white matter. The concept of a nerve. Differentiation of the nervous system into departments. Structure of the spinal cord. Structure of the somatic reflex arc. Brain. The main structures of the oblong, posterior and middle divisions, their functions. The intermediate brain, its parts and functions. The final brain, its parts. Gray and white matter of each Department.

The peripheral nervous system and its components. Spinal nerves, their branches and areas of innervation. Cranial nerves and their nature, areas of innervation. Vegetative nervous system. The sympathetic division. Parasympathetic division.

The concept of the sense organ. Structure of the visual organ. Eyeball. Shells and core. The lacrimal apparatus. Muscles of the eyeball. Organ of hearing. The concept of the outer, middle, and inner ear. Structure of the snail. Structure of the Corti organ. The structure of the semicircular canals and the vestibule. The balance organ. Organ of taste. Olfactory organ. Skin sensory system.

List of recommended literature:
«Human anatomy»

1. Sinelnikov R.D. Atlas anatomii cheloveka [Atlas of human anatomy]. T. 1-3. M.. 1968. 1972. 1974. 1981. 1989. 1990. 2007. 2008.

2. Sapin. M.R.. Anatomiya cheloveka [Human anatomy].- M.. 1989. 1995. 1996. 1998. 2002. 2006. 2008.

3. Kozlov. V.I.. Anatomiya cheloveka [Human anatomy].- M.. 2004. 2005.

Estimation	Evaluation criterion:
Excellent	. 1. This competent, reasonable and complete answers to all the theoretical issues . 2. The practical task is executed in full . 3. Demonstrated vision and creativity of the student . 4 .Theoretical postulates are supported by examples.
Good	. 1. The answers to all theoretical questions are correct and correct, there are minor inaccuracies, or are not supported by examples . 2. The practical task is completed, but there may be technical errors in the calculations.
Satisfactory	. 1. Essentially correct answers to all theoretical questions are given, but either with inaccuracies in logical sequence, without examples, and with errors in wording . 2. The practical task is executed with errors or not in full.
Unsatisfactory	1. 1. The answer is not given, or contains serious errors. 2. 2. Broken a logical sequence. 3. 3. The practical task is not done.

The maximum score is 100 points, and the minimum (passing) score is 51 points.

1 question (theoretical) is evaluated as follows:

Excellent – 30 points (maximum)

Good – 26 points (maximum)

Satisfactory - 23 points (maximum)

Unsatisfactory - 15 points (maximum)

2 question (theoretical) is evaluated as follows:
Excellent – 30 points (maximum)
Good – 26 points (maximum)
Satisfactory - 23 points (maximum)
Unsatisfactory - 15 points (maximum)

3 question (practical) is evaluated as follows:
Excellent-40 points (maximum)
Good – 35 points (maximum)
Satisfactory - 30 points (maximum)
Unsatisfactory - 20 points (maximum)