Federal State Autonomous Educational Institution of Higher Education "Moscow Institute of Physics and Technology (National Research University)"

APPROVED
Head of the Phystech School of Biological and Medical Physics
D.V. Kuzmin

Work program of the course (training module)

course: General Biology/Общая биология
major: Biotechnology
specialization: Biomedical Engineering/Биомедицинская инженерия
Phystech School of Biological and Medical Physics
Department of Molecular and Biological Physics
term: 2
qualification: Bachelor

Semesters, forms of interim assessment:
3 (fall) - Grading test
4 (spring) - Exam

Academic hours: 120 AH in total, including:
lectures: 60 AH.
seminars: 0 AH.
laboratory practical: 60 AH.

Independent work: 75 AH.

Exam preparation: 30 AH.

In total: 225 AH, credits in total: 5

Number of course papers, tasks: 4

Authors of the program:

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The program was discussed at the Department of Molecular and Biological Physics 04.06.2020

Annotation

The general biology course is designed to prepare students in the field of natural sciences, and consists of a classical biology course supplemented by modern approaches. The course is taught in two semesters and consists of a lecture course and laboratory classes. The fundamental properties of living systems (self-renewal, self-regulation, self-reproduction) and the attributes of life are studied: metabolism and energy, irritability, homeostasis, reproduction, heredity and variability. The article introduces the levels of organization of living things and the manifestation of the fundamental properties of living things at the main evolutionary-conditioned levels of organization: molecular-genetic, cellular, ontogenetic, population-species, biogeocenological, biosphere. The structure and principles of functioning of the structural components of the elementary unit of life – the cell-are studied. The main metabolic processes occurring in the cell and the types of reproduction in living systems are introduced. The features of sexual reproduction, the formation of germ cells, fertilization, types and features of individual development are studied. The molecular level of the organization of living things is studied: the structure and functions of the main biopolymers (proteins, fats, carbohydrates, nucleotides). The article introduces the molecular mechanism of heredity and variability of living organisms. The basics of plastic and energy metabolism are studied. The main genetic laws are studied: Mendel's laws, non-Mendelian splitting, and gender genetics. Familiarization with the laws and mechanisms of human life activity at the evolutionarily determined levels of its organization is carried out. The principles of functioning of various systems of the human body are studied: musculoskeletal, circulatory, respiratory, digestive, endocrine, nervous; principles of regulation of body functions.

1. Study objective

Purpose of the course

- to create a common understanding of man as part of nature, the unity and value of all living things and the impossibility of the survival of humanity without preserving the biosphere, but also to teach the proper perception of practical problems related to biology, including human health, nature conservation, overcoming ecological crisis; to inculcate the skills of ecological culture.

Tasks of the course

- to study the fundamental properties of living systems (self-renewal, self-regulation, self-reproduction) and the attributes of life: metabolism and energy, irritability, homeostasis, reproduction, heredity and variability;

to be familiar with the organization levels of the living and the manifestation of fundamental properties of the living on the main evolutionary-determined levels of organization: molecular, genetic, cellular, ontogenetic, population-species, biogeocenological biosphere. To study the structure and principles of functioning of structural components of an elementary unit of a living – cell. Get acquainted with the main metabolic processes occurring in the cell;

- get acquainted with the species of reproduction in living systems. To study the features of sexual reproduction, the formation of germ cells, fertilization, species and characteristics of individual development.

- to study the molecular level of the organization of the living: the structure and functions of the main biopolymers (proteins, fats, carbohydrates, nucleotides). Get acquainted with the molecular mechanism of heredity and variability of living organisms. To study the basics of plastic and energy metabolism. To study the basic genetic laws: Mendel's laws, non-Mendelian cleavage, sex genetics. To be able to link the laws of genetics with chromosomal theory and with the molecular foundations of heredity;

- to get acquainted with the laws and mechanisms of human life at evolutionarily determined levels of its organization. To study the principles of functioning of various systems of the human body: musculoskeletal, circulatory, respiratory, digestive, endocrine, nervous. To study the principles of regulation of body functions.

2. List of the planned results of the course (training module), correlated with the planned results of the mastering the educational program

Mastering the discipline is aimed at the formation of the following competencies:

Code and the name of the competence	Competency indicators
Gen.Pro.C-1 Apply knowledge of mathematical, physical, chemical, biological laws, patterns, and interrelation to study, analyze, and utilize biological objects and processes	Gen.Pro.C-1.1 Analyze the task in hand, outline the ways to complete it

Gen.Pro.C-3 Write scientific and/or technical (technological, innovative) reports (publications, projects)	Gen.Pro.C-3.3 Visually and graphically present scientific (scientific and technical, innovative technological) outcomes in the form of reports, scientific publications
Pro.C-1 Plan and conduct scientific experiments (in a selected subject area) and/or theoretical (analytical and simulation) research	Pro.C-1.3 Proficiency in methods of observation, description, identifIcation and scientific classification of biological objects
	Pro.C-1.7 Follow the basic rules of conduct in a modern scientific laboratory
	Pro.C-1.6 Safely use modern scientific tools and other experimental equipment
Pro.C-2 Analyze research data and make scientific conclusions	Pro.C-2.3 Make scientific claims with supporting evidence for a professional audience in verbal and written form, state scientific problems and propose solutions
Pro.C-4 Critically assess the applicability of applied methods and techniques	Pro.C-4.3 Provide evidence to support the cause-effect relationship of applied concepts and models

3. List of the planned results of the course (training module)

As a result of studying the course the student should:

know:

- basic laws of biology and General ecology;
- essence of life, levels and principles of biological organization;
- the main concepts, laws and laws relating to the structure, life and development of plant, animal and human organisms, the development of wildlife;
- features of man as a biological species, features of physiology, somatic, mental and social origin in human nature, health and environmental risk factors, the place of man in the evolution of the Earth;
- fundamentals of ecology (ecology of individuals, populations, communities, the doctrine of the biosphere, the interaction of nature and society, environmental problems of our time);
- basic biological concepts and terms;
- fundamentals of human structure and life;
- basics of General and organic chemistry;
- subject, purpose, objectives of the discipline and its importance for future professional activity;
- structure and functions of proteins, carbohydrates, fats and nucleic acids;
- main stages of cell energy;
- structure of biological membranes; mechanisms of transport of substances through membranes;
- structure and functions of cell organelles;
- classification of cells according to their specialization;
- regularities of structural and functional relationships in cells;
- types of intercellular contacts, structure and functions of synapse;
- the principle and stages of transmission of hereditary information in generations of organisms;
- stages of protein biosynthesis on ribosomes, regulation of these stages;
- the concept of homeostasis;
- basic fundamental approaches to the regulation of cell activity;
- mechanism of asexual reproduction; the essence of mitosis;
- the essence of sexual reproduction, gametogenesis, meiosis;
- stages of individual development of the body;
- origin of specialized body parts from germ leaves;
- regularity of regeneration;

distinguishing characteristics of the tissues of the animal body;

- regularities of the relationship between the organism and the environment from the position of adequate and inadequate reaction of the organism, adequate and inadequate environmental conditions;
- basic concepts of genetics and selection: dominance and recessiveness; chromosomal basis of splitting and independent redistribution of genes; molecular mechanisms and genetic control of recombination; gene interaction;
- basic genetics of sex; heredity linked to sex;
- biological basis of hereditary human diseases;
- social aspects of human biology;
- basic provisions of human ecology.

be able to:

- competently perceive theoretical and practical problems related to biology and ecology, including-human health, nature protection, overcoming the ecological crisis;
- to use the acquired knowledge in practice;
- defend your point of view;
- to assess the consequences of their activities in relation to the environment and their own health;
- to use the knowledge of the structure and functions of biomolecules of the cell to understand the physiological and pathological processes occurring in the cell;
- characterize cell organoids and their role in the implementation of cell life to maintain optimal regulation of cell functions;
- on the basis of knowledge of the stages of protein synthesis and the factors that determine it, to be able to regulate the mechanisms of long-term adaptation of the cell; to solve problems in molecular biology
- explain the patterns of structural and functional relationships in cells and be able to use this knowledge to intervene in the process of cell damage;
- to use the concepts of homeostasis, adaptation in application to specific life situations;
- identifying ways of regulating cell activity and managing this activity;
- establish fundamental differences between mitosis and meiosis to understand the role of these processes in evolution;
- to use the knowledge of inheritance patterns established by G. Mendel to solve genetic problems;
- to work independently with the literature on biology, as well as with educational, methodical and reference literature on medical and biological subjects;
- solve situational problems and test tasks for the formation of heuristic thinking;
- to evaluate the General biological patterns of life of the human body;
- to generalize and comprehend the data of various medical, pharmaceutical Sciences and General biological positions in order to further solve biological problems by methods of analysis.

master:

- methods of solving environmental problems;
- skills of working with literary sources;
- to present the results of their own activities using modern means, focusing on the needs of the audience, including in the form of reports, presentations, reports;
- ability to conduct experimental research, projects and tasks on the subject of the developed scientific problem;
biological terminology;
- understanding the laws of life of the human body, to connect the functions of organs and systems of organs of the body with the physiological processes occurring in them.

4. Content of the course (training module), structured by topics (sections), indicating the number of allocated academic hours and types of training sessions

4.1. The sections of the course (training module) and the complexity of the types of training sessions

№	Topic (section) of the course	Types of training sessions, including independent work			
		Lectures	Seminars	Laboratory practical	Independent work
1	Cell, cell types. Procariotic cell	11		16	5
2	Cell division. DNA replication. Transcription. Features of the genome of eukaryotes	8		8	5
3	Protein biosynthesis	5			5
4	Evolution. Phylogeny	6			5
5	Microscopy			4	5
6	Methods of staining preparations			2	5
7	Phylogenetic lines	6			4
8	Mushrooms	2			4

9	Multicellular animals: coordination and specialization of cells	2		8	5
10	Multicellular animals: General issues, coelenterates, worms, ecdysozoa, vtorichnaya	10			4
11	Multicellular animals: chordates	6			4
12	Structure and diversity of plants	4		4	5
13	Practicum. The properties of the living: nutrition			4	3
14	Practicum. The properties of the living: motion			4	3
15	Practicum. Properties of the living: communication			4	3
16	Hormonal regulation			4	3
17	Human physiology			2	7
AH in total		60		60	75
Exam preparation		30 AH.			
Total complexity		225 AH., credits in total 5			

4.2. Content of the course (training module), structured by topics (sections)

Semester: 3 (Fall)

1. Cell, cell types. Procariotic cell

Differences between eukaryotic and prokaryotic cells. The structure of prokaryotic cells. Basic cellular organelles.

2. Cell division. DNA replication. Transcription. Features of the genome of eukaryotes

Microfilaments, microtubules, intermediate filaments. The cell center. Mitotic cell division. Meiosis. DNA replication. DNA repair, recombination, restriction, and modification. Transcription. Features of the eukaryotic genome.

3. Protein biosynthesis

Protein biosynthesis.

4. Evolution. Phylogeny

Life cycles and life forms. Evolution. Phylogeny. Relatedness of organisms. The phylogenetic line of plants.

5. Microscopy

Microscopy light, fluorescent, confocal. Light microscope, viewing of ready-made preparations

6. Methods of staining preparations

Methods of staining products (classic, fluorescent dyes, immunogene). Identification of organelles, the preparation of their drugs

Semester: 4 (Spring)

7. Phylogenetic lines

Phylogenetic line raznoschikova organisms. Phylogenetic line Alveolata. Phylogenetic lines of Rhizaria and Excavata

8. Mushrooms

Real mushrooms: Diversity, prevalence, life cycles

9. Multicellular animals: coordination and specialization of cells

Multicellularity: coordination and specialization of cells.
Practicum:
- Front and rear end of the body, animals (trichoplax and planaria);
- The axis of the body-type plants (plants cnidarian polyps)

10. Multicellular animals: General issues, coelenterates, worms, ecdysozoa, vtorichnaya

Multicellularity: coordination and specialization of cells.
Multicellular animals. Eumetazoa (”real " Metazoa) as a monophyletic group, their common features.
Groups of multicellular (1) Sponges and coelenterates, Lophotrochozoa.
Multicellular group (2) Lophotrochozoa, flat worms
Group of multicellular (3) Ecdysozoa (Ecdysozoa), vtorichnaya.

11. Multicellular animals: chordates

The origin of chordates and their General characteristics.
The exit vertebrates on land.
Variety of amniotes.

12. Structure and diversity of plants

Structure and diversity of plants

13. Practicum. The properties of the living: nutrition

- The types of food Hydra, fresh-water sponge, planaria, Daphnia;
- Power on the example of Sharovka, Suwalki, ciliates shoes;
- Nutrition of fungi, bacteria, plants.

14. Practicum. The properties of the living: motion

- Movement on the water surface: Basilisk, water meter, pond: movement on water + change in surface tension
- Movement on a solid surface (Gecko and tree frog)
- Movement due to flow of water (flagellates, ciliates, rotifers); swimming (leeches); pacing (leeches)

15. Practicum. Properties of the living: communication

Communication
- sound (cricket song)
- visual (movie reptile)
- chemical transmission of the effects of crowding and stress (crustaceans)
- protective aggregation of E. coli in a semi-liquid medium under the action of hydrogen peroxide
- behavior (courtship of fruit flies of different types)

16. Hormonal regulation

Hormonal regulation
• quorum effect in bacteria
• dictiostelium
• calli (initiating the growth of stems and roots)
• ethylene

17. Human physiology

Measurements of various parameters: ECG, EEG, polygraph, breathing, pulse, etc.

5. Description of the material and technical facilities that are necessary for the implementation of the educational process of the course (training module)

Classroom, multimedia projector and screen.
Light microscopes, laminar box, Petri dishes, prepared specimens, refrigerator, termomaty, sets of reagents, buffer solutions, centrifuge, autoclave.

6. List of the main and additional literature, that is necessary for the course (training module) mastering

Main literature
Recommended additional literature:
1. Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece. Campbell Biology. — Pearson Education, 2017. — 802 p.

Additional literature

7. List of web resources that are necessary for the course (training module) mastering

Not used

8. List of information technologies used for implementation of the educational process, including a list of software and information reference systems (if necessary)

MS Office, MS Windows, Origin, Mathlab.

9. Guidelines for students to master the course

The course consists of 1 lecture and 1 workshop per week. The main idea of the course is to introduce students to the structure and functions of cells in a multicellular organism and the eukaryotic cell as such. The theme of each lecture is somehow studied at the workshop, Topics that can not be studied with our means in practice, are revealed at the lectures, at the workshop there are classes on Mendelian genetics.

For successful completion of the course, in addition to attending lectures and laboratory classes, students are required to work independently in the amount of not less than the hours specified for each section of the program. Basically, this time is given to the study of literature, as well as to repeat the material of lectures and preparation for intermediate tests, which are carried out for the current control over the assimilation of the material. Students who have successfully passed all forms of intermediate control are allowed to pass the test in the 1st semester and the exam in the 2nd semester of the discipline.

SUPPLEMENT

Assessment funds for course (training module)

major:	Biotechnology
specialization:	Biomedical Engineering/Биомедицинская инженерия
	Phystech School of Biological and Medical Physics
	Department of Molecular and Biological Physics
term:	2
qualification:	Bachelor

Semesters, forms of interim assessment:

3 (fall) - Grading test

4 (spring) - Exam

Authors:

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V.V. Marinskiy, associate professor

Y.A. Prokopev, assistant

1. Competencies formed during the process of studying the course

Code and the name of the competence	Competency indicators
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Pro.C-2 Analyze research data and make scientific conclusions	Pro.C-2.3 Make scientific claims with supporting evidence for a professional audience in verbal and written form, state scientific problems and propose solutions
Pro.C-4 Critically assess the applicability of applied methods and techniques	Pro.C-4.3 Provide evidence to support the cause-effect relationship of applied concepts and models

2. Competency assessment indicators

As a result of studying the course the student should:

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- fundamentals of ecology (ecology of individuals, populations, communities, the doctrine of the biosphere, the interaction of nature and society, environmental problems of our time);
- basic biological concepts and terms;
- fundamentals of human structure and life;
- basics of General and organic chemistry;
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- structure and functions of proteins, carbohydrates, fats and nucleic acids;
- main stages of cell energy;
- structure of biological membranes; mechanisms of transport of substances through membranes;
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- types of intercellular contacts, structure and functions of synapse;
- the principle and stages of transmission of hereditary information in generations of organisms;
- stages of protein biosynthesis on ribosomes, regulation of these stages;
- the concept of homeostasis;
- basic fundamental approaches to the regulation of cell activity;
- mechanism of asexual reproduction; the essence of mitosis;
- the essence of sexual reproduction, gametogenesis, meiosis;
- stages of individual development of the body;
- origin of specialized body parts from germ leaves;
- regularity of regeneration;
distinguishing characteristics of the tissues of the animal body;
- regularities of the relationship between the organism and the environment from the position of adequate and inadequate reaction of the organism, adequate and inadequate environmental conditions;
- basic concepts of genetics and selection: dominance and recessiveness; chromosomal basis of splitting and independent redistribution of genes; molecular mechanisms and genetic control of recombination; gene interaction;
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- social aspects of human biology;
- basic provisions of human ecology.

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- explain the patterns of structural and functional relationships in cells and be able to use this knowledge to intervene in the process of cell damage;
- to use the concepts of homeostasis, adaptation in application to specific life situations;
- identifying ways of regulating cell activity and managing this activity;
- establish fundamental differences between mitosis and meiosis to understand the role of these processes in evolution;
- to use the knowledge of inheritance patterns established by G. Mendel to solve genetic problems;
- to work independently with the literature on biology, as well as with educational, methodical and reference literature on medical and biological subjects;
- solve situational problems and test tasks for the formation of heuristic thinking;
- to evaluate the General biological patterns of life of the human body;
- to generalize and comprehend the data of various medical, pharmaceutical Sciences and General biological positions in order to further solve biological problems by methods of analysis.

master:

- methods of solving environmental problems;
- skills of working with literary sources;
- to present the results of their own activities using modern means, focusing on the needs of the audience, including in the form of reports, presentations, reports;
- ability to conduct experimental research, projects and tasks on the subject of the developed scientific problem;
biological terminology;
- understanding the laws of life of the human body, to connect the functions of organs and systems of organs of the body with the physiological processes occurring in them.

3. List of typical control tasks used to evaluate knowledge and skills

Approximate list of questions for ongoing control:

1. The properties of the living.
2. Levels of organization of the living.
3. Theories of the origin of life on Earth.
4. Stages of development of life on earth. Their characteristic.
5. The main aromorphoses in the history of the living.
6. Causes of aromorphoses.
7. Eras and periods, the main stages of life on earth.
8. Structure and functions of the biosphere. Noosphere.
9. The ecosystem, its structure and evolution, the concept of anthropologies.
10. Human impact on ecosystems.
11. The concept of evolution.
12. Basic evolutionary theory.
13. Directions and ways of evolution.
14. Stages and causes of speciation.
15. Evidence of macroevolution.
16. The main provisions of the cell theory.
17. The concept of species, population.
18. Criteria form.

19. Characteristics of populations.
20. The concept of isolation, its causes.
21. Types of insulation and their characteristics.
22. Classification of chemical elements of the cell and their functions.
23. Inorganic substances cells.
24. Their role in life.
25. Carbohydrates and lipids. Their structure and functions in cells.
26. Proteins. Their structure and functions in cells.
27. Nucleotides. Types of nucleic acids. Their structure and functions.
28. Remembrance cell structures. Their structure and functions.
29. Odnoimennyi cell structures. Their structure and functions.
30. Domobrani cell structures. Their structure and functions.
31. Core structure. Its function. Chromatin packing levels.
32. Eukaryotic and prokaryotic gene structure. Similarities and differences. Types of genes.
33. Stages of transcription. Their characteristic.
34. The stages of translation. Their characteristic.
35. Prokaryotes. Features of the structure and life.
36. Viruses. Features of the structure and life.
37. Eukaryotes. Features of the structure and life
38. Metabolism and energy in the cell. Classification of organisms by method of nutrition: autotrophs (phototrophs and chemotrophs), heterotrophs, mixotrophs.
39. Autotrophic nutrition: photosynthesis and chemosynthesis.
40. The light phase of photosynthesis. Photosynthetic phosphorylation: cyclic and non-cyclic.
41. Photobreath. Dark stage of photosynthesis: C3 -, C4-and SELF-types of photosynthesis.
42. Macroergic molecules. ATP: structure, synthesis, value.
43. Phases of energy metabolism: preparatory, anaerobic (glycolysis) of oxygen. Fermentation.
44. Electron-transport respiratory chain: enzymes, localization, energy. Chemiosmotic theory of Mitchell.
45. Interrelation of processes of plastic and energy exchange.
46. Types of cell division. General characteristics of these processes.
47. Mitotic cell cycle.
48. Mitotic cell cycle. Characteristic periods. Mitosis, its biological significance. Amicos.
49. Meiosis. Features of the first and second division of meiosis. Biological significance. The difference between meiosis and mitosis.
50. Reproduction is the basic property of living things. Asexual and sexual reproduction. Forms of asexual reproduction. Definition, essence, biological significance.
51. Ontogenesis and its periodization. Direct and indirect development.
52. Spermatogenesis. Biological significance of sexual reproduction.
53. Oogenesis. Features of formation of female gametes.
54. Fertilization. Parthenogenesis. Forms and prevalence in nature. Sexual dimorphism.
55. The concept of the main stages of embryonic development (crushing, gastrulation, formation of tissues and organs).
56. Postembryonic development.
57. Anthropogenesis. The position of man in the Primate system. General morphophysiological and ecological-geographical characteristics of the order of primates.
58. The time and place of the human line of evolution: the most important hypotheses. The phylogenetic development of man.
59. The oldest (arhantrop), ancient (the palaeoanthropes) and fossil people of modern type (neoanthrope).
60. Driving forces of anthropogenesis: social and biological factors. The leading role of the laws of social life in the social progress of mankind.
61. The origin of races: theories of mono-and polygenism (centrism). The main causes and factors of racial formation. Classifications of human races by F. Bernier, K. Linnaeus, J. Buffon, I. Blumenbach, I. E. Deniker, V. Giuffrida-Ruggeri. Modern classification of races (by Ya Roginsky and M. G. Levin). Morphological description of " big " races.
62. The anti-scientific, reactionary essence of social Darwinism and racism.

63. Parasitism as a biological phenomenon. Classification of forms of parasites. Path of origin of parasitism.

64. Parasite-host interaction. Morphological and physiological characterization of the adaptation of parasites.

65. Pathways of circulation of pathogens in nature. Life cycles of parasites.

66. Ecological basis of classifications of disease: invasive and infectious, transmissible, of feral. The concept of anthroponoses and zoonoses.

67. The theory of academician E. N. Pavlovsky on the natural foci of parasitic diseases. Biological principles of struggle against vector-borne and natural-focal diseases.

68. Type The Simplest. Classification. Characteristic features of the organization. Origin and significance for medicine. Pathogenic representatives of the class Sarkodie: Entamoeba histolytica, an intestinal amoeba, the amoeba of the mouth. Systematic position, morphology, development cycle, justification of laboratory diagnostics, prevention.

69. Pathogenic flagellates: Leishmania, Giardia, trypanosomes. Systematics, morphology, development cycle, infection pathways, justification of laboratory diagnostic methods.

70. General characteristics of class Sporozoa. Coccidia, Toxoplasma. Systematics, morphology, development cycle, infection pathways, justification of laboratory diagnostic methods.

71. The malaria Plasmodium. Systematic position, morphology, development cycle, species differences. Combating malaria. Tasks of antimalarial service at the present stage.

72. General characteristics of the class of infusoria. Balantidij and other parasitic ciliates. Systematic position, morphology, development cycle, pathways of infection, justification of methods of laboratory diagnostics of prevention.

73. Helminths. A type of flatworm, class flukes: liver Fluke, cat Fluke, Schistosoma and others. Systematic position, morphology, development cycle, infection pathways, justification of laboratory diagnostics and prevention methods.

74. Helminths. General characteristics of the class Cestoda. Types of Finn tapeworms. Bovine tapeworm, pork tapeworm, dwarf tapeworm, broad tapeworm, Echinococcus and alveococcus. Systematic position, morphology, development cycle, justification of laboratory diagnostic methods, infection pathways, prevention

75. A type of Round worms. Classification. Characteristic features of the organization. Medical significance. Ascaris, whipworm, pinworm, Trichinella, the Guinea worm, a filarial. Systematic position, morphology, development cycle, justification of diagnostic methods, ways of infection, prevention.

76. Parasitic arthropods: mites – General characteristics of the family Ixodidae, a family of agatovye mites; mites – inhabitants of the home of man. Systematic position, morphology, epidemiological significance, control measures.

77. Parasitic arthropods: abscess beetle, cockroaches, lice, bedbugs, fleas. Systematic position, morphology, epidemiological significance, control measures.

78. Parasitic animals are the causative agents of human diseases. Parasitic arthropods: flies, mosquitoes, mosquitoes, gadflies, midges. Systematic position, morphology, epidemiological significance, control measures.

4. Evaluation criteria

Approximate list of questions for the exam on the discipline "General biology" in the 2nd semester:

1. The concept of hormones, types of hormones, types of physiological action of hormones. Mechanisms of action of hormones.
2. Adrenals. Structure and functions. Hormones of the medulla of the adrenal glands.
3. Adrenal cortex hormones are corticosteroids. The role of mineralcorticoids and glucocorticoids.
4. Thyroid and parathyroid glands: structure, functions. Manifestations of hypothyroidism and hypothyroidism.
5. Endocrine function of the pancreas. Insulin and glucagon: participation in metabolic processes.
6. Functions of sex hormones. Testosterones, estrogens and progesterones. The pituitary gland, its hormones, their physiological effects.
7. Types of hormones of the digestive system, their physiological effect.
8. Interaction of the endocrine glands.
9. Neurohumoral regulation of body functions. The role of the hypothalamus.

10. Homeostasis. Ways of reliability of functioning of an organism as biological system.

11. Regulation. Types of regulation. Local regulation. Nervous regulation. Humoral regulation.

12. The internal environment of the body. Functions and composition of blood.

13. Physical and chemical properties of blood plasma. Osmotic and oncotic pressure.

14. Composition and properties of blood plasma.

15. The cellular composition of blood. Red blood cells: structure and functions. Hemoglobin, types of hemoglobin. Eritropenia and causes of polycythemia.

16. Blood group. Agglutinogens and agglutinins. Donors and recipients.

17. The cellular composition of blood. Leukocytes. Granulocytes: number, species, structure and function. Leukocytic formula. Leukocytes. Agranulocytes: number, species, structure and function.

18. Platelets. Stages of blood clotting. Fibrinolysis.

19. Hemopoiesis. Hematopoietic organs. Regulation of hematopoiesis. Specific and nonspecific factors of erythropoiesis.

20. Immunity and immune system. Specific and nonspecific immunity. Active and passive immunity.

21. Cellular and humoral immunity: definition, meaning and functions. Antigens, their recognition, types of immune response.

22. Immune system organs

23. Cellular and humoral immunity: definition, meaning and functions.

24. Antigens, their recognition, types of immune response.

25. Antibodies, their species, origins, significance.

26. The concept of allergic reactions. Autoimmune disease

27. Definition of immunodeficiency. Primary and secondary immunodeficiency.

28. Lymph and lymphatic system. The difference between the lymphatic system and the circulatory system. Lymphokinesis.

29. Circulatory system. Types of blood vessels.

30. The main indicators of hemodynamics: volume and linear velocity of blood flow, blood pressure in different parts of the circulatory system. Arterial and venous pressure.

31. Continuity of blood flow. Pulse and pulse wave. The movement of blood through the capillaries. The value of venous tone.

32. The structure of the heart. Functional properties of the myocardium. Manifestations of myocardial contractions.

33. Automatism of the heart, its nature and mechanism. Cardiac conduction system. Pacemaker. The gradient of automatie.

34. The work of the heart and its characteristics. Cardiac cycle.

35. ECG. Type, value of its elements.

36. Regulation of the function of the cardiovascular system. Nervous and humoral regulation of cardiac activity.

37. Breathing: definition, functions, research methods. Stages of the breathing process.

38. Structure and functions of the respiratory system.

39. Respiratory cycle. Lung ventilation. Factors contributing to external breathing. Surfactant properties.

40. Mechanisms of inhalation and exhalation. Tidal volume. Lung capacity. Gas exchange in the lungs. Transport oxygen and carbon dioxide by blood. Tissue respiration.

41. Regulation of respiration. Respiratory center. Mechanoreceptors breath control. Hemoretseptornoy breath control.

Examples of exam tasks:

1. Continuity of blood flow. Pulse and pulse wave. The movement of blood through the capillaries. The value of venous tone.

2. The structure of the heart. Functional properties of the myocardium. Manifestations of myocardial contractions.

3. Automatism of the heart, its nature and mechanism. Cardiac conduction system. Pacemaker. The gradient of automatie.

4. The work of the heart and its characteristics. Cardiac cycle.

5. Breathing: definition, functions, research methods. Stages of the breathing process.

Assessment excellent (10 points) - exposed to the student who showed a comprehensive, systematic, deep knowledge of the curriculum discipline, showing interest in the subject area, demonstrated the ability to confidently and creatively apply them in practice in solving specific problems, free and correct justification of decisions.

Assessment is excellent (9 points) - is exposed to the student who has shown comprehensive, systematized, deep knowledge of the curriculum of discipline and ability to confidently apply them in practice when solving specific problems, free and correct justification of the decisions made.

Assessment is excellent (8 points) - exposed to the student, who showed a comprehensive, systematic, deep knowledge of the curriculum discipline and the ability to confidently apply them in practice when solving specific problems, the correct justification of the decisions, with some shortcomings.

Rating good (7 points) - is assigned to the student if he knows the material, competently, and essentially presents it, is able to apply the acquired knowledge in practice, but has not been properly justifies the results obtained.

Rating good (6 points) is assigned to the student if he knows the material, competently, and essentially presents it, is able to apply the acquired knowledge in practice, but admits in the answer or in the task some inaccuracies.

Rating good (5 points) - is assigned to the student if he basically knows the material, competently, and essentially presents it, is able to apply the acquired knowledge in practice, but admits in the answer or in the task of quite a number of inaccuracies.

Evaluation satisfactory (4 points) - is given for student, who showed the fragmented, piecemeal nature of the knowledge is not enough for the correct formulation of the basic concepts, disorders of logical sequence in the presentation of program material, but he mastered parts of the curriculum necessary for further learning, and can apply the knowledge modeled in the standard situation.

Evaluation of satisfactory (3 points) - is given for student, who showed the fragmented, piecemeal nature of knowledge makes a mistake in the formulation of the basic concepts of violation of logical sequence in the presentation of program material, has little major parts of the curriculum necessary for further studies and work applies the knowledge gained even in the standard situation.

Assessment unsatisfactory (2 points) - exposed to the student who does not know most of the basic content of the curriculum discipline, makes blunders in the wording of the basic principles and does not know how to use the knowledge in solving typical problems.

Assessment unsatisfactory (1 point) - exposed to the student who does not know the basic content of the curriculum discipline, makes gross errors in the wording of the basic concepts of discipline and does not have the skills to solve typical practical problems.

5. Methodological materials defining the procedures for the assessment of knowledge, skills, abilities and/or experience

During the exam, the student is given at least 40 minutes to prepare. The ticket survey and answers to additional questions should not exceed two astronomical hours.