EXAM QUESTIONS IN THE DISCIPLINES "BIOLOGY"

1. Development of the insights into the essence of life. Definition of life. Fundamental properties of the living systems.
2. Levels of life organization. Elementary units, elementary phenomena and manifestations of the main properties of life at different levels of its organization.
3. Types of cellular organization of pro-and eukaryotic cells. The flow of information, energy and substance in the cell. Common laws of cell existence in time.
4. Mitotic (proliferative) cycle of the cell. Phases of the mitotic cycle, their characteristics and significance.
5. Meiosis as a process of haploid cells formation. Phases of meiosis, their characteristics and significance.
6. Gametogenesis as the process of germ cells formation. Differences between ovogenesis and spermatogenesis.
7. Reproduction as one of the fundamental properties of life. Methods and forms of reproduction of organisms.
8. Parthenogenesis. Forms and prevalence in nature. Sexual dimorphism.
9. Subject, tasks and methods of genetics. Stages of genetics development. The role of domestic scientists (N.I. Vavilov, N.K. Koltsov, A.S. Serebrovskii, S.S. Chetverikov, S.N. Davidenkov, N.I. Timofeev-Resovskii et al.) in the development of genetics.
10. Heredity and variability as the properties determining the continuity of existence and development of a living being. Levels of hereditary material organization. Features of the structure and functioning of the genetic apparatus of prokaryotes and eukaryotes.
11. Chemical organization of the genetic material. DNA structure and properties.
12. RNA structure and properties. RNA functions.
13. Genetic code as a method of hereditary information recording. Properties of the genetic code.
14. Gene as a functional unit of heredity. Properties of genes. Features of the organization of pro- and eukaryotic genes.
15. Functional classification of genes (structural, regulators, modulators). Genes of general cellular functions ("housekeeping") and genes of specific functions ("luxury"). Constitutive and regulated genes. Methods of gene expression regulation.
16. Stages of hereditary information exploitation: transcription, processing, translation, post-translational processes. Features of gene expression in pro- and eukaryotes.
17. Regulation of pro- and eukaryotic gene expression. The theory of operon.
18. Features of the chromosomal organization of the hereditary material depending on the phase of the proliferative cycle (chromatin, metaphase chromosome). Nucleosomal model of the structure of chromosomes.
19. Chromosome, its chemical composition and morphological characteristics. The concept of euchromatin and heterochromatin.
20. Chromosomal theory. Maps of chromosomes (physical, restriction, chemical, genetic). Principles of chromosomes mapping.
21. Karyotype and idiogram of human chromosomes. Denver and Paris classification of chromosomes. Characteristics of the human karyotype in normal and pathological conditions.
22. The concept of genotype and phenotype. Phenotype as a result of hereditary information exploitation in certain environmental conditions. Quantitative and qualitative specificity of gene expression as a trait: penetrance and expressiveness.
23. Regularities of independent monogenic inheritance (laws of G. Mendel). Types of monogenic inheritance: autosomal recessive and autosomal dominant. Conditions of mendelian traits formation. Mendelian characters of humans.

24. Interaction of allelic genes: dominance, incomplete dominance, overdominance, codominance, allele exclusion. Examples of interaction of these genes.
25. Inheritance of blood groups by ABO, Rh and MN systems. Medical significance of blood groups determination. Rhesus incompatibility.
26. Interaction of non-allelic genes: epistasis, polymery, complementarity, position effect, modifying action.
27. Multiple alleles and polygenic inheritance of human traits.
28. Linked inheritance of genes and crossing-over. Works of T. Morgan. Chromosomal theory. Examples of linked inheritance of traits in humans.
29. Sex of the body. Primary and secondary sexual characteristics. Types of sex determination. The role of genotype and environment in the development of sex traits.
30. Features of the structure of X and Y chromosomes. Inheritance of sex-linked sex-dependent traits.
31. Phenotypic variability. Modifications and their characteristics. Reaction norms. Significance of phenotypic variability.
32. Combinative variability and its mechanisms. Medical and evolutionary significance of hereditary material recombination.
33. Mutational variability. Characteristics of mutations. The concept of gene and chromosomal diseases. Biological antimutational mechanisms.
34. Genomic mutations, causes and mechanisms of their occurrence. Classification of genomic mutations. Significance of genomic mutations.
35. Chromosomal mutations, their classification. Causes and mechanisms of chromosomal mutations. The role of chromosomal mutations in the development of human pathological conditions and the evolutionary process.
36. Gene mutations and their classification. Causes and mechanisms of occurrence, incidence, biological consequences of gene mutations.
37. Genetic engineering, its tasks, opportunities, methods, achievements, prospects.
38. The importance of genetics for the medicine. Methods of studying human genetics: biochemical, twin, population-statistical.
39. Features of a human being as an object for genetic research. Methods of studying human genetics: genealogical, cytogenetic.
40. Methods of studying human genetics: hybridization of somatic cells, methods of studying DNA (restriction analysis, polymerase chain reaction, electrophoresis, DNA probes).
41. Non-traditional inheritance of traits (cytoplasmic inheritance, genomic imprinting). Examples of human diseases with non-traditional inheritance.
42. Prenatal diagnostics of hereditary human diseases. Medical and genetic counseling and its medical significance.
43. Monogenic, chromosomal and multifactorial human diseases, mechanisms of their occurrence and manifestation. General approaches to diagnostics, treatment and prevention of hereditary diseases.
44. Regeneration as a process of maintaining the morphophysiological integrity of biological systems at the level of the body. Physiological regeneration, its significance. Manifestation of regeneration at the subcellular and cellular levels. Phases of physiological regeneration, mechanisms of its regulation.
45. Reparative regeneration, its significance. Methods of reparative regeneration. Typical and atypical regeneration. Regulation of regeneration.
46. Features of regenerative processes in mammals and humans. Cellular sources of regeneration. Regeneration therapy.
47. Homeostasis. Mechanisms of homeostasis maintenance: regulating system, regulation according to disturbance, regulation according to deviation, types of feedback, examples.
48. The concept of homeostasis. Mechanisms of cell cycle regulation as an example of homeostasis maintenance (cyclins, cyclin-dependent kinases, checkpoints).

49. Post-embryonic period of ontogenesis and its periodization. Main processes: growth, definitive structures formation, puberty, reproduction, aging.
50. Aging as a natural stage of ontogenesis. Aging manifestation at the molecular-genetic, cellular, tissue, organ and organizational levels.
51. Main regularities of the aging process. Hypotheses of aging.
52. Death as a biological phenomenon (clinical, biological). Social and biological components of health and mortality in human populations. Problems of longevity.
53. The role of the Russian scientists in the development of general and medical parasitology (V.N. Dogel, V.N. Beklemishev, E.N. Pavlovskii, K.I. Scryabin).
54. E.N. Pavlovskii's doctrine on the natural nidality of diseases. Components of a natural focus. Parasitic natural focal transmissible and non-transmissible diseases, their criteria. Transmissible diseases (obligate and facultative, anthroponoses, zoonoses, anthropozoonoses).
55. Parasites development cycles. Alternation of generations in the parasites development cycles (through the example of representatives of different types and classes). The concept of the principal, reservoir and intermediate hosts. Mammals as intermediate hosts and natural reservoirs of the causative agents of human diseases.
56. Protozoa subkingdom. Systematic position and classification of the sub-kingdom. Characteristic features of the organization. Representatives having medical significance.
57. Dysenteric amoeba. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
58. Lamblia, trichomonads. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
59. Leishmanias. Systematic position, morphology, development cycle, routes of infection, localization in the human body, pathogenic effect, justification of laboratory diagnostic methods and preventive measures.
60. Trypanosomas. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
61. Balantidium. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
62. Malaria parasite. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
63. Toxoplasma. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
64. Flukes class. Systematic position. General characteristics of the structure and life activity. Medical significance of class representatives.
65. Liver fluke. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
66. Feline fluke. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures. Foci of opisthorchiasis in the CIS.
67. Chinese fluke. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
68. Lung fluke. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
69. Schistosomes. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
70. Tapeworms class. Systematic position, general characteristics of the structure and life activity, features of the life cycles. Forms of tapeworm measles.
71. Pork tapeworm. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.

72. Cysticercosis. Causative agent, its systematic position, morphology, routes of infection, localization of measles. Methods of diagnostics, treatment and prevention.
73. Beef tapeworm. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
74. Dwarf tapeworm. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
75. Echinococcus, alveococcus. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
76. Broad tapeworm. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
77. Nematodes type. Systematic position, features of the structure and life cycles. Medical significance of class representatives.
78. Human ascarid. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures. The role of various organisms in environment clearance from ascarid's eggs.
79. Pinworm. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics, preventive measures and methods of drug-free treatment.
80. Whipworm. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
81. Hookworms. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
82. Threadworm. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
83. Trichinella. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
84. Guinea worm. Systematic position, morphology, development cycle, routes of infection, justification of the methods of laboratory diagnostics and preventive measures.
85. Filaria: Wuchereria, Brugia, Onchocerca. Systematic position, morphology, development cycle, routes of infection, localization in the human body, pathogenic effect, justification of laboratory diagnostic methods and preventive measures.
86. Methods of diagnostics of parasitic diseases (through the examples of representatives of various types and classes).
87. Arthropods type. Systematic position, classification, representatives. Characteristic features of the structure and life activity. Medical significance of class representatives.
88. Arachnids class. Systematic position, classification, representatives. Characteristic features of the structure and life activity. Medical significance of class representatives.
89. Ticks order: systematic position, morphology, development cycles and medical significance of argasid and acariform ticks.
90. Lice. Systematic position, morphology, development cycle, epidemiological significance, control measures.
91. Fleas. Systematic position, morphology, development features, epidemiological significance, control measures.
92. Family of flies: tsetse fly, housefly, Wohlfahrtia magnifica. Systematic position, morphology, epidemiological significance, control measures.
93. Mosquitos. Systematic position, morphology, development cycle, medical significance, control measures.
94. Mosquitoes. Systematic position, morphology, development cycle, medical significance, control measures.
95. The history of evolutionary ideas formation. The essence of Charles Darwin's views on the mechanisms of living nature evolution. Synthetic theory of evolution.

96. Origin of life: hypotheses of panspermia and abiogenic origin of life. Main stages of life emergence and development.
97. Emergence of the cell as the starting point of biological evolution. Hypotheses of the origin of eukaryotic cells (symbiotic, invaginational). The emergence of multicellularity. Differences between cells of single- and multicellular organisms.
98. Elementary evolutionary factors: mutation process, genetic combinatorics, population waves and genetic-automatic processes.
99. Natural selection as a driving and guiding force of evolution. Forms of natural selection.
100. Species as the result of microevolution. Determination, structure and criteria of the species. Genetic unity, integrity of the species.
101. Main characteristics of population as the ecological and genetic system: population area, number of individuals and its dynamics, sex and age structures, morphological and ecological unity. Genetic pool of natural populations, frequency of alleles and genotypes. Hardy-Weinberg law.
102. Macroevolution. Evolution patterns: aromorphosis, idioadaptation, morphophysiological regression. Forms of groups evolution: phyletic, divergent, convergent, parallel. Evolution routes: biological progress and biological regression.
103. Position of a human being in the animal world system (justification of the systematic position of the Homo sapiens species). Biological prerequisites of the progressive development of hominids (anthropomorphosis).
104. Qualitative features of the Homo sapiens species. Biosocial nature of humans. Correlation of biological and social factors in human development at different stages of anthropogenesis.
105. Modern insights into the origin of a human being. Intraspecific differentiation of humanity.
106. Correlation of ontogenesis and phylogenesis. The law of germ similarity of K. Baer. Primary biogenetic law of F. Muller and E. Haeckel. The concept of recapitulation and caenogenesis. A.N. Severtsov's doctrine on phylembryogenesis. Provisional and definitive, homologous and similar organs.
107. Phylogenesis of the nervous system of vertebrates. Phylogenetically determined malformations of the brain as a result of ontogenesis disorder.
108. Phylogenesis of the blood circulatory system of vertebrates. Phylogenetically determined malformations of the heart and blood vessels as a result of ontogenesis disorder.
109. Phylogenesis of the genitourinary system of vertebrates. Phylogenetically determined malformations of the genitourinary system as a result of ontogenesis disorder.
110. Populational structure of humanity. Bemes, isolates, and non-isolated populations. Distribution and incidence of hereditary diseases in different populations of people.
111. Marriage systems. The role of the marriage system in the distribution of alleles in the population. Intermarriages and assortative marriages.
112. Influence of the mutation process, migration, isolation and gene drift on the genetic constitution of people. Specific character of natural selection effect in human populations.
113. Ecology as a science. Subject, structure, content and methods of ecology. Environmental factors and their interaction.
114. Forms of biotic links in nature. Parasitism as an ecological phenomenon. Classification of parasitism and parasites. Spread of parasites in nature. Routes of origin of ecto- and endoparasitism.
115. Biogeocenoses: definition, structure, properties. Ecological pyramids of quantity, biomass, and energy. Biogeocenoses evolution.
116. The concept of human ecology. Human being as a creative ecological factor. Agrocenoses, their peculiarities and differences from natural ecosystems.
117. Biological variability of people and biogeographic characteristics of the environment. Adaptive types of people (definition, characteristics). The role of environmental factors in their formation.
118. Biological rhythms. Medical significance of chronobiology.