

PROGRAMME OF ENTRANCE EXAM FOR THE MASTER'S DEGREE IN "BIOTECHNOLOGY"

General Biology

Fundamentals of cytology. The cell as an elementary form of organization of living matter. Properties of life and levels of organization of living things. The life cycle of a cell. Amitosis. Mitosis. Meiosis. Metabolism and energy (photosynthesis, biosynthesis, energy metabolism). Genetics. Ontogenesis and phylogeny of organs. Fundamentals of general genetics. The patterns of G. Mendel. The interaction of genes. The chromosomal theory. Concatenated inheritance. Morgan's Law. The molecular basis of heredity. Patterns and mechanisms of variability of signs. Fundamentals of medical genetics. Ontogenesis. General patterns of embryonic development. General patterns of phylogeny of vertebrates (circulatory system, genitourinary system, nervous system). Elementary factors of evolution. Type, Type criteria. The population. The biosphere and its borders. Problems of environmental protection and human survival.

Microbiology

Morphology of bacteria and fungi. Morphological forms of bacteria. Simple and complex coloring methods, Gram coloring. The structure of a bacterial cell. Morphology of actinomycetes and fungi. The physiology of bacteria and viruses. Bacterial physiology: cultured bacteria, nutrient media, isolation of pure bacterial culture. Constructive and secondary metabolism of bacteria. BAS producing strains. Bacterial enzymes, identification of isolated pure culture. Antimicrobial chemotherapeutic drugs. Viruses and bacteriophages. The genetics of bacteria. Microbes and the environment. Sanitary microbiology. The role of microbes in the circulation of substances in nature. Microflora of the human body. Microbiological control of water, air, equipment, and staff hands. Microbiological control of biotechnological processes. Fundamentals of immunology and pharmaceutical products.

Fundamentals of Biochemistry and Molecular Biology

The main classes of biomolecules (proteins, nucleic acids, lipids, carbohydrates, low molecular weight bioregulators), their structure, spatial organization, and biological functions in the cell. Fundamentals of enzymatic catalysis, concepts of enzymes, antibodies, and structural proteins. Principles of bioenergetics; ways and mechanisms of energy conversion in living systems; aerobic and anaerobic redox. Metabolism

of carbohydrates, lipids, fatty acids, proteins, amino acids, nucleic acids and nucleotides. Matrix biosynthesis of proteins and nucleic acids. Molecular mechanisms of transmission of genetic information; study of gene structure and function, enzymes and bioengineering methods. Biochemical research methods for assessing the qualitative and quantitative composition of cellular components; studying the qualitative reactions of proteins, amino acids, enzymes, carbohydrates, lipids, nucleic acids, vitamins and their quantitative determination.

Fundamentals of biotechnology

Biotechnology as a science and industry. A brief history of biotechnology development. Obtaining medicinal, preventive and diagnostic drugs by biotechnological methods. Bio-objects as a means of production of medicinal, preventive and diagnostic drugs. Classification of bio-objects. Bio-objects of plant origin. Bio-objects are microorganisms. Eukaryotes, prokaryotes. Viruses. Bioobjects are macromolecules. Traditional breeding methods. Mutagenesis and breeding. Physical and chemical mutagens and their mechanism of action. Classification of mutations. The subject, tasks and methods of genetic engineering, applied importance for biotechnology. General principles and methods of genetic engineering. Recombinant DNA technology. Microorganisms of various systematic groups: yeasts, eubacteria, actinomycetes, etc. as hosts in the expression of foreign genes. Regulation of the expression of foreign genes in pro- and eukaryotic cells. Applied aspects of genetic engineering. Basic methods and tools of genetic engineering experiments. Immobilized (on insoluble media) biological objects and their reuse. Immobilized enzymes. The effect of enzyme immobilization on their substrate spectrum and kinetic characteristics. Increased stability. Adsorption of enzymes on inert carriers and ion exchangers. Immobilization of enzymes by incorporation into the gel structure. Microencapsulation of enzymes. The use of immobilized enzymes in the production of biologically active substances. The structure of biotechnological production. The scheme of sequentially implemented stages of the transformation of raw materials into a product. Preparatory operations: sterilization of equipment, sterilization of air, sterilization of nutrient media, preparation of seed material. Classification of biosynthesis by technological parameters (periodic, regulated, continuous, etc.). Criteria for the selection of fermenters. The main parameters of control and management of biotechnological processes. General requirements for methods and

controls. Isolation, concentration and purification of biotechnological products. Sedimentation. Centrifugation. Filtering. Methods of extraction of intracellular products. Destruction of the cell wall of biological objects and extraction of target products. Chromatographic methods. High-performance liquid chromatography in solving the problems of biotechnological production. GMP requirements for biotechnological production. Immunobiotechnology as one of the branches of biotechnology. Mechanisms of the immune response to a specific antigen. A variety of antigenic determinants. Heterogeneity (polyclonality) serums. Advantages of using monoclonal antibodies. Hybridomic technologies. Technology for the production of monoclonal antibodies. Areas of application of monoclonal antibodies. Monoclonal antibodies in medical diagnostics. Enzyme immunoassay. Radioimmune analysis. Monoclonal antibodies as specific sorbents in the isolation and purification of biotechnological products.

Basic literature:

1. Almagambetov K.H. Fundamentals of biotechnology. Astana, 2006. -224 p.
2. Klunova S.M., Egorova T.A., Zhivukhina E.A. Biotechnologiya, Moscow, Akademiya, 2010– 256 p.
3. Zagoskina N.V., Nazarenko L.V., Kalashnikova E.A., Zhivukhina E.A. Biotechnology:
 4. Theory and practice. Moscow, Onyx, 2009. 496 p.
 5. Sazykin Yu.O., Orekhov S.N., Chakaleva I.I. Biotechnology. Moscow, Akademiya, 2006.
 6. Bakai A.V., Kochish I.I., Skripnichenko G.G. Genetics. Moscow: Kolos, 2007. – P. 448.
 7. Konichev V.V. Molecular Biology. Moscow, 2008.
 8. Zhimulev S.G. General and molecular genetics. Novosibirsk. Publishing House of the Siberian Academy of Sciences, 2006, p.478.

Additional literature:

1. Kershanskaya O.V. Genetic engineering of plants. A practical approach. Almaty, 2007. 152 p.
2. Almagambetov K.H. Fundamentals of biotechnology. Astana, 2006
3. Shupshibaev K.K. Production based on immobilized biocatalysts. Educational and methodical manual. Almaty, Kazak University, 2004, -99c. 1998. –479c.