

# DISCIPLINE ANNOTATION: BIOTECHNOLOGY IN HEALTHCARE

**The goal of the Biotechnology in healthcare academic discipline** is to introduce relevant and debated issues of modern biotechnology, including modern biotechnology research, the legal framework and ethical principles of their application, biotechnology in various fields of social production and healthcare, strategic areas of regenerative medicine.

**Key objectives** of studying the Biotechnology in healthcare discipline: to provide students with basic knowledge about modern biotechnology used in society, production, and medicine. To be able to use the acquired knowledge to analyze and solve problematic situational problems (forecasting possible ways of choosing a certain product, treatment method, lifestyle, etc.). To introduce the main methods of implementing new biological ideas in practice.

**Upon completion of the course, students will be competent in the following issues:** biotechnology as a science – state and prospects, genetic engineering as a basic principle of biotechnology, genetically modified (transgenic) organisms, general aspects of the organization of industrial production of genetically modified products. Biotechnology and food industry, industry, human healthcare sector, antibiotics and their use in medicine, physiological aspects of stem cells and the history of their research, regenerative properties of stem cells and the possibilities of their use in medicine, biotechnology in organ donation and transplantation, basic strategies of bioengineering of human organs, human artificial insemination, live cloning systems, life expectancy and factors for its extension. Besides, they should be able to use methods of statistical processing of experimental data in practice, master methods of genetic engineering as a basic principle of biotechnology, creation of genetically modified organisms. Students should be able to use methods of working with cell material: cultivation, analysis. Students should learn biotechnology safety techniques.

## ***Content of the academic discipline:***

**CONTENT SECTION 1.** General aspects of the application of biotechnology in society. Biotechnology as a science – state and prospects. Biotechnology as a science and its relation to other biological sciences. Historical aspects of the creation and use of biotechnology by human beings. Biotechnological products

and services to the population. Advantages, potential disadvantages and theoretical risks of using biotechnology. Future trends in biotechnology. Genetic engineering as a basic principle of biotechnology. Genetically modified screening technology. Creation of recombinant DNA. Gene cloning. Application of genetic engineering: advantages and disadvantages. Ethical, social and economic consequences of the application of biotechnology in society. New methods of production in genomic science and its use. Genetically modified (transgenic) organisms. Concept of genetically modified (transgenic) organisms. Some facts about the use of genetically modified organisms. Production technology and methods of identification of genetically modified organisms.

**CONTENT SECTION 2.** Biotechnology in healthcare. Biotechnology in human healthcare. Creation of genetically modified proteins of the human body to treat a number of diseases. Biosensors for diagnostics and monitoring of diseases and human health. Application of biosensors in the food industry and other industries. Potential risks of using biosensors. Classification of antibiotics. Action of antibiotics. Antibiotic resistance. Basic principles of rational antibiotic therapy. Biomedical micro- and nanotechnology. Micro-technology. Introduction to biomedical nanotechnology. Scientific and applied research in nanotechnology. Nanodiagnostics: in-vitro research. Nanodiagnostics and visualization In Vivo. Nanotherapy. Nanoparticles as medicines. Passive nanoimplants and tissue engineering. Active nanoimplants. Disinfection (using silver nanoparticles). Identification, security and logistics.

**CONTENT SECTION 3.** Modern biotechnology of regenerative medicine. Physiological aspects of stem cells and the history of their research. Physiology of stem cells in the human body: origin, development, differentiation into mature cells. History of stem cell research. Unique properties of stem cells of the human body. Development of embryonic stem cells. Proliferation and differentiation of stem cells. Regenerative properties of stem cells and possibilities of their application in medicine. Use of stem cells in stroke therapy. Stem cells and the blood bank. The use of induced pluripotent stem cells: advantages and disadvantages. Cell therapy. Therapeutic cloning. Biotechnologies in organ donation and transplantation. Modern technologies of regenerative medicine. Cell therapy in stimulating regenerative processes in the body. Substitution of organ functions with the help of devices of non-biological origin. Use of donor organs. The main historical milestones in the development of organ donation and transplantation. Donors and recipients. Organization of the transplantation process.