УДК 811.111

MODERN PERSPECTIVES AND PROBLEMS IN BIOTECHNOLOGY (СУЧАСНІ ПЕРСПЕКТИВИ ТА ПРОБЛЕМИ БІОТЕХНОЛОГІЇ)

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У статті йдеться про проблеми, які вирішує наука біотехнологія, пріоритетні завдання, перспективи у різних галузях життєдіяльності людини.

Ключові слова: *біотехнологія, перспективи, генна інженерія, рослини.*

The article deals with the problems solved by the science of biotechnology, priority tasks, prospects in various spheres of human life.

Key words: *biotechnology, perspectives, genetic engineering, plants.*

Biotechnology is the science of methods and technologies for the production of various valuable substances and products using natural biological objects (microorganisms, plant and animal cells), cell parts (cell membranes, ribosomes, mitochondria, chloroplasts) and processes.

The roots of biotechnology go back to the distant past and are associated with baking, winemaking and other ways of cooking, known to man since ancient times. For example, a biotechnological process such as fermentation involving microorganisms was known and widely used in ancient Babylon, as evidenced by the description of brewing that has come down to us as an inscription on a tablet discovered in 1981 during excavations in Babylon [2].

Biotechnology became a science thanks to the research and work of the French scientist, founder of modern microbiology and immunology Louis Pasteur (1822-1895).

In the twentieth century there was a rapid development of molecular biology and genetics with the application of advances in chemistry and physics. The most important area of research is the development of methods for culturing plant and animal cells. And if only recently only bacteria and fungi were grown for industrial goals, now it is possible not only to grow any cells for biomass production, but also to control their development, especially in plants. Thus, new scientific and technological approaches have been embodied in the development of biotechnological methods that can directly manipulate genes, create new products, organisms and change the properties of existing ones. The main purpose of these methods is to make fuller use of the potential of living organisms in the interests of human economic activity. In the 1970s, the most important branches of

biotechnology, such as genetic and cellular engineering, emerged and actively developed, initiating "new" biotechnology as opposed to "old" biotechnology based on traditional microbiological processes. Yes, the usual production of alcohol during fermentation is "old" biotechnology, but the use of yeast in this process, improved by genetic engineering to increase alcohol yield – "new" biotechnology [1].

Genetic and cellular engineering are the most important methods (tools) that underlie modern biotechnology. Cell engineering methods are aimed at designing a new type of cells. They can be used to reproduce a viable cell from individual fragments of different cells, to combine whole cells belonging to different species to form a cell carrying the genetic material of both stem cells, and other operations.

Genetic engineering methods are aimed at constructing new, non-existent in nature combinations of genes. As a result of the use of genetic engineering methods, it is possible to obtain recombinant (modified) RNA and DNA molecules, for which the isolation of individual genes (encoding the desired product) is carried out from the cells of any organism. After certain manipulations with these genes, they are introduced into other organisms (bacteria, yeast and mammals), which, having received a new gene (genes), will be able to synthesize end products with altered, in the right direction, properties. In other words, genetic engineering allows to obtain the specified (desired) qualities of changing or genetically modified organisms or so-called "transgenic" plants and animals.

Genetic engineering has found the greatest application in agriculture and medicine.

People have always thought about how to learn to manage nature, and looked for ways to get, for example, plants with improved qualities: with high yields, larger and tastier fruits or with increased cold resistance. From ancient times the main method used for this purpose was selection. It is widely used to date and aims to create new and improve existing varieties of cultivated plants, breeds of domestic animals and strains of microorganisms with valuable human traits and properties [3].

Selection is based on the selection of plants (animals) with pronounced favorable traits and further crossing of such organisms, while genetic engineering allows you to directly intervene in the genetic apparatus of the cell. It is important to note that in the course of traditional selection to obtain hybrids with the desired combination of useful traits is very difficult, because the offspring are passed on very large fragments of each parent's genomes, while genetic engineering methods often work with one or more genes. their modifications do not affect the work of other genes. As a result, without losing other useful properties of the plant, you can add one or more useful features, which is very valuable for creating new varieties and new plant forms. It has become possible to change plants, for example, resistance to climate and stress, or their susceptibility to insects or

diseases common in certain regions, to drought, etc. Scientists hope to even get species of trees that would be resistant to fire. Extensive research is being conducted to improve the nutritional value of various crops, such as corn, soybeans, potatoes, tomatoes, peas, etc [4].

With the deepening of knowledge about plant genetics, people began to carry out purposeful crossbreeding (crossbreeding) with desirable characteristics or no undesirable traits of plant varieties and interspecific hybridization to obtain new varieties that retain the best qualities of both parent lines. Currently, virtually any crop is the result of crossbreeding, hybridization, or both. Unfortunately, these methods are often expensive, time consuming, inefficient, and have significant practical limitations. For example, it would take more than a decade to create a variety of corn that is resistant to certain insects with the help of traditional crossbreeding, and without a guaranteed result [2].

Modern breeders-biotechnologists set themselves the same tasks as in traditional crossbreeding and other methods of genome modification: increase yields; resistance to pathogenic bacteria, fungi and viruses; ability to survive in adverse environmental conditions (frost and drought); resistance to pests such as insects, weeds and roundworms (nematodes).

Biotechnology also offers great potential for new biopesticides, such as microorganic proteins and fatty acids, which are toxic to certain agricultural pests but harmless to humans, animals, fish, birds and beneficial insects. The uniqueness of the mechanisms of action of biopesticides provides protection against pests resistant to traditional remedies [3].

Productivity of agricultural crops depends on the presence in the habitat of weeds that enter with the main crop to compete for nutrients and moisture. To destroy unwanted plants, agricultural plantations are usually sprayed with herbicides that are more or less toxic not only to weeds.

In addition to the biological factors described above that hinder the growth and development of plants, there are a number of abiotic stressors that are regularly provided by nature to crops – it's drought, cold, heat, high acidity or salinity. With the help of crossbreeding, breeders have managed to create a sufficient number of plant varieties that are resistant to biological environmental factors, but in terms of resistance to abiotic stresses is not so simple. The main limiting point in this case is the lack of many species of cultivated plants of wild relatives that are resistant to one or another environmental factor [4].

The central problem of biotechnology is the intensification of bioprocesses both by increasing the potential of biological agents and their systems, and by improving equipment, the use of biocatalysts (immobilized enzymes and cells) in industry, analytical chemistry, medicine.

The basis for the industrial use of advances in biology is the technique of creating recombinant DNA molecules. Designing the right genes allows you to manage the heredity and activity of animals, plants and microorganisms and create organisms with new properties. In

particular, it is possible to control the process of fixing atmospheric nitrogen and the transfer of relevant genes from the cells of microorganisms in the genome of a plant cell.

Biotechnology is a typical product of our turbulent, dynamic XXI century. It opens new horizons for the mind. The problems of biotechnology are extremely complex, ranging from purely technical (for example, reducing the catalytic activity of enzymes during their immobilization) and ending with subtle intellectual problems associated with the impoverishment of basic science due to the dominance of purely problem-based applications.

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