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ADVANCES IN GENETIC ENGINEERING

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Genetic engineering emerged at the junction of many biological disciplines: molecular biology, genetics, enzymology, chemical engineering, cell biology, microbiology and others. Formally, 1972 should be considered as the date of birth of genetic engineering: the first recombinant DNA was obtained in the laboratory of P. Berg [24,25].

Keywords: molecular genetics, inheritance, recombinant DNA, biology, microbiology, transgenic higher organisms.

Genetic engineering is a branch of molecular genetics, which investigates the possibilities and methods of laboratory (in vitro) creation of genetic structures and hereditarily modified organisms, i.e. creation of artificial genetic programmes (recombinant DNA), with the help of which molecular genetic systems outside the organism are constructed in a directed manner with their subsequent introduction into a living organism. Recombinant DNA technology is an important part of biotechnology, so it is often referred to as molecular biotechnology [1,2,3,4].

As already mentioned, the goal of applied genetic engineering is to give organisms properties useful to humans by introducing specially designed recombinant DNA molecules into their genetic apparatus [5,6,7].

In this way, so-called 'biological reactors' were obtained - microorganisms, plants and animals producing, for example, substances pharmacologically significant for humans. Genetic engineering methods make it possible to create DNA vaccines, to conduct genetic passportisation of any organism, to diagnose genetic diseases in order to develop in the future methods of genotherapy for those types of diseases that are not amenable to traditional treatment [8,9,10].

Even a brief list of practical achievements of modern genetic engineering, given below, shows how important the results obtained are:

- in the last decade the direction of obtaining transgenic (genetically engineered) varieties of agricultural plants, which have already been introduced into commercial production in many countries, has been rapidly developing;
- the direction of obtaining transgenic breeds of animals with predetermined, valuable for human traits is gaining pace;
- gene banks, or clonothecae, which are collections of bacterial clones, have been created. Each of these clones contains DNA fragments of a certain organism (Drosophila, human and others), which can be used if necessary;
- industrial production of insulin, interferon, hormonal preparations is being carried out on the basis of transformed strains of viruses, bacteria and yeast. The production of proteins (e.g. to preserve blood clotting in haemophilia) and other drugs is at the testing stage;
- transgenic higher organisms (plants, some fish and mammals) have been created, in whose cells genes of organisms belonging to other taxonomic groups - carriers of the desired trait - successfully function. Genetically modified plants (GMPs) resistant to certain herbicides (glyphosate, for example) and Bt-modified plants resistant to pests are widely known;
- methods have been developed to clone strictly defined sections of DNA; for example, the polymerase chain reaction (PCR) method is used in almost all genetic engineering experiments. Genetic engineering refers to high-level technologies [11,12,13,14,15].

In contrast to low-level technologies, high biotechnology is characterised by high scientific intensity, i.e. the use of working systems derived from the most advanced methods of ecology, genetics, microbiology, cytology, and molecular biology [16,17].

Materials used in high-tech biotechnologies often need special pre-treatment, which requires special and often expensive reagents, and effective implementation of high-level technologies is possible only with the use of special technological equipment operated by qualified specialists. The expansion of high-tech production is in turn accompanied by its automation and computerization [18,19,20,21,22,23].

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