

## **МЕДИКО-БИОЛОГИЧЕСКИЕ НАУКИ**

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**БИОТЕХНОЛОГИЧЕСКИЕ ДОСТИЖЕНИЯ В ВЫРАЩИВАНИИ  
ОРГАНОИДОВ**

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**BIOTECHNOLOGICAL ADVANCES IN ORGANIDS GROWING**

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**Аннотация:** В статье рассматриваются основные достижения в области биотехнологий, на основе современных публикаций проводится анализ главных отличий технологий выращивания органоидов от стандартной трансплантации, рассматриваются некоторые открытия, совершенные на данный момент, а также приводятся мнения ученых о перспективах от этого направления.

**Annotation.** The article deals with the subject of biotechnology, analyzes the reasons for this science popularity and importance, describes the differences from standard transplantation, studies the discoveries made at the moment and future prospects in this area.

**Ключевые слова:** биотехнология, выращивание органов, эволюция, трансплантология, эксперименты.

**Key words:** biotechnology, organ cultivation, evolution, transplantology, experiments.

### **Introduction**

The pace of human development, namely science and technology, is so high that even 100 years ago it was impossible to imagine the achievements that we can witness nowadays. The level of development of medicine in the XXI century allows to get rid of lots of disorders though many problems like cancer, AIDS and many other diseases are still not solved. Fortunately, in the near future we hope to find a solution to these problems, one of these solutions being the cultivation of human organs [2,3].

Organ cultivation is a promising bioengineering technology aimed at creating a number of fully viable biological organs for humans. Unfortunately, these are not yet

complete organs, but only organoids – rudiments, cells and tissues that can only be used as experimental samples. Their effectiveness and vital activity are tested on experimental animals, mainly on various rodents [3].

**The purpose of the study** is to analyze and assess the progress of a new direction of science, its roots and achievements and to evaluate the possible effect it can produce on the evolution in future.

#### **Materials and methods of research**

The analysis of publications (articles and books) about the future of biotechnologies and its current progress over a period of 2000 - 2021 was carried out. The analyses made allows the authors to come to some conclusions related to the achievements and the prospects of the above-mentioned science.

#### **Research results and discussion**

Articles from 2000 to 2021 were examined. All of them were aimed at the description of the development of bioengineering, namely, the disclosure and promotion of this direction. If you follow the statistics you can say for sure that every year this direction is developing and gaining momentum.

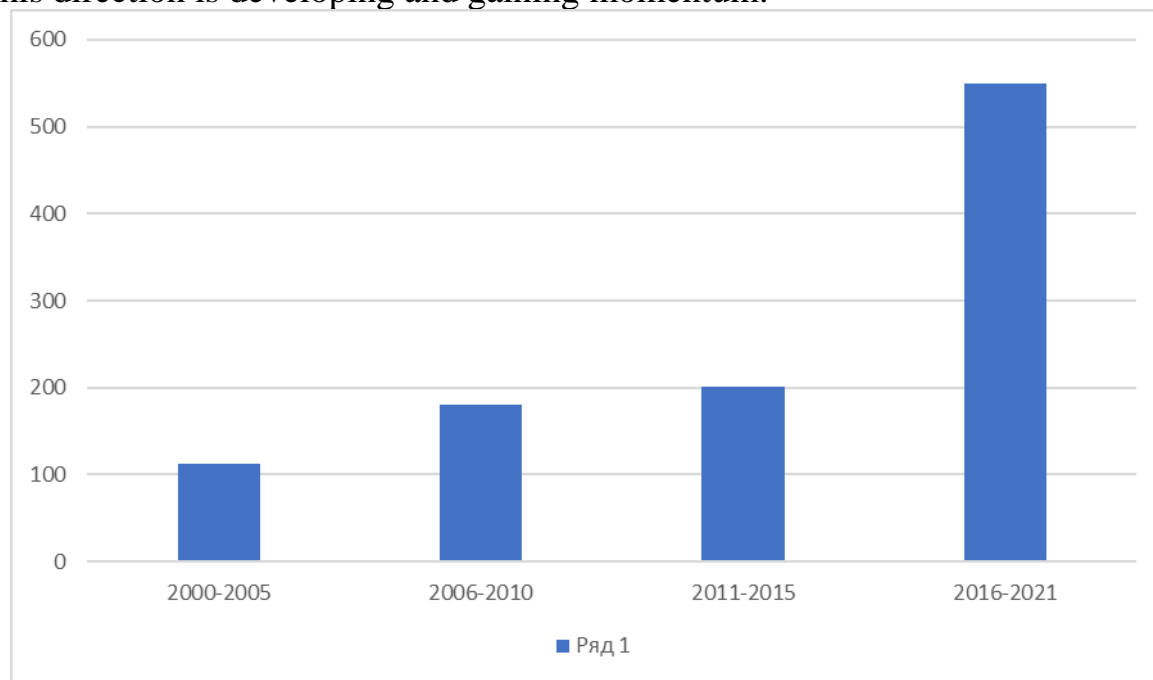


Fig. 1. Statistics of articles written in the period from 2000 to 2021

Currently, the principle of transplantation is the most successful way out if the patient is in mortal danger. The main problem is an acute shortage of donor organs. Patients can wait in line for years, and eventually of 15-30% cannot receive them [4]. In addition, there is a high risk that the transplanted donor organ will not be accepted in the recipient's body, since the patient's immune system treats it as a foreign object [4].

One of the most important competitive differences between growing organs and the way they are transplanted from a donor is that in the laboratory organs can be produced on the bases of the recipient's future tissues and cells. They mainly use stem

cells that have the ability to differentiate into cells of certain tissues [4]. Scientists are able to control this process from the outside, which significantly reduces the risk of future organ rejection by the human immune system. Moreover, the artificial cultivation of organs can produce an unlimited number of these organs thus satisfying the vital needs of millions of people. The principle of mass production significantly reduces the cost of organs, saving millions of lives, significantly increases the survival rate of a person and reduces the time of his biological death.

Scientists have managed to grow the foundations of future organs that have been tested for various diseases, viruses, and infections in order to monitor the infectious process and develop counteraction tactics [1]. The success of organoids is controlled by transplantation in the body of animals: rabbits, mice. It is worth mentioning that bioengineering has achieved some success in creating a full-fledged tissue and even in growing organs from stem cells which unfortunately cannot be transplanted to humans due to their inoperable condition [3]. However, now scientists have learned to create cartilage, blood vessels and other connective tissue elements.

Recently, scientists from Duke University in Michigan in 2015 grew in the laboratory a part of the muscle tissue, which, however, is twice as weak as the original [2]. Similarly, scientists in Ohio in 2006 created three-dimensional stomach tissues capable of producing all the enzymes needed for digestion. A Japanese scientist, Yoshiki Sasai and his team in 2011, on the other hand, did almost the impossible—they have grown a fully functioning human eye [5]. The problem with transplantation is that it is not yet possible to attach the optic nerve of the eye to the brain. In Texas, in 2014, they also grew artificial lungs in a bioreactor, but without blood vessels, which calls into question their performance [3]. A famous bioengineer Megdi Yakuba and his team in 2015 grew a part of the heart, using stem cells as a "building material" [3]. According to him, in a period of 15-20 years, scientists around the world will be able to use grown heart components in transplant operations.

There is a class of scientists who see the future and strive to improve it, but there are also those who deny and live by the old norms. For example, B. K. Gavriilyuk, a scientist in the field of biology, argues that "you cannot interfere with the nature of humanity and create foreign bodies" [1]. But this opinion is supported by a few, because scientists see progress and innovations in this direction.

### **Conclusion**

Based on our research, we can say that bioengineering as a science is aimed at the production of tissues and organs for further transplantation. The pace of progress is marked by significant results that will save millions of lives in the future. Growing from stem cells of bones and internal organs will negate the need for donor organs, the number of which is already in a state of shortage. Even now, scientists are working at innovations the results of which are not yet very productive, but possess huge potential.

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ОСОБЕННОСТИ ПРОЯВЛЕНИЯ САХАРНОГО ДИАБЕТА  
ВТОРОГО ТИПА В УСЛОВИЯХ КРАЙНЕГО СЕВЕРА В СРАВНЕНИИ С  
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