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# THE PROSPECTS FOR GROWING HUMAN REPLACEMENT ORGANS

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***The purpose of research*** is to study the prospects for growing human replacement organs, in particular, the achievements of genetic engineering when donor organs grow in a lab or the idea of xenotransplantation or implanting human stem cells into an early pig embryo.

***Objective:*** to study the prospects for growing human replacement organs.

The following tasks have been set:

1. to analyze the latest researches in growing human organs
2. to identify the stages of development of biotechnology in creating genetically engineered organs
3. to define the fields of application of genetic engineering, in particular the idea of xenotransplantation

***Object:*** genetic engineering as a solution to the shortage of donor organs

***Research methods.*** Literature reviews, quantitative techniques have been used to generate a dataset which was analyzed to give definitive conclusions. Theoretical analysis has been used: selection and discussion of theoretical material and descriptive material, in context, and detailed comparison of theories in terms of their applicability.

***Scientific novelty and practical significance of the results:*** 10 years ago the very idea that living flesh could be "constructed" by engineering principles and combining nonliving materials with cells or growing human organs in host animals sounded fantastical to many. Today, the organ shortage is an even bigger problem than it was in the past. Scientists are working with biotechnology to create genetically engineered organs, reducing the number of donors that are so urgently needed on a daily basis. The use of organs from animals has long been seen to be a solution to the shortage of donor organs as well.

David Cooper of the University of Pittsburgh in Pennsylvania and his colleagues supported the idea of xenotransplantation, or the transplantation of organs and tissues from animal species, such as the pig, to humans [2 , 17]. The advent of genetic engineering and cloning techniques offers the prospects of donor organs that are protected from destruction by human host. There is work in progress aimed at inducing the human recipient to accept an animal organ without the need for immunosuppressive drug therapy. The mix of human and animal DNA in modern medicine is known as chimera. The name is inspired by a monstrous creature from Greek mythology that is depicted as part lion, part goat and part snake. [ 1 ] This idea of chimera organs isn't a new concept. In 2010, Japanese scientist Hiromitsu Nakauchi, who is now a stem cell biologist at Stanford University, was able to grow a rat pancreas inside a mouse. This was a huge breakthrough in chimera research because rats and mice are different species.

Scientists are essentially asking themselves what happens if human stem cells somehow start to create a human brain inside an animal. It's a major bioethical question. Although the risk of an animal acquiring human consciousness is slim, anything is possible. Moreover, the potential risk have to be considered as pig viruses may be transferred from the transplanted organ into the human patient, and then spread on other members of community.

Joseph Vacanti, a surgeon-scientist in the field of Pediatric Surgery and Transplantation Surgery, realized that the major problem in transplantation was insufficient donor organs [ 5 ]. Vacanti finally realized that the cells in the interior of each layer were not getting enough oxygen and nutrients and could not get rid of their metabolic waste. He therefore came up with the idea of using polymer materials with a branching porous structure instead of solid polymers, which was a milestone in tissue engineering. His work triggered much enthusiasm about tissue engineering in the 1990s.

The ultimate goal with the technology is to be able to "regenerate an organ that will not be rejected (and can be) grown on demand and transplanted surgically, similar to a donor organ." By using the blood or stem cells of either the actual patients receiving the transplants or people who are close matches, scientists hope to replicate real organs by triggering a type of conduit in which the required cells are drawn to the transplanted cells, ultimately replacing them and regenerating on their own. Genetically-engineered organs and organ tissue in a laboratory may prove to cause more harm than good in the long run, as the long-term side effects of splicing man-made tissues and other foreign materials into people's bodies are still largely unknown. But the practice is already taking place. Numerous patients around the world have already had synthetic blood vessels, windpipes, bladders, and other so-called "minor" organs and tissues, for instance, implanted into their bodies using a technology that involves affixing real human cells onto synthetic scaffolds. [ 3 ]

***Research results***

The controversial idea of growing human organs in host animals has gotten a reality check. Despite recent successes at growing mouse organs in rats, using the same trick to grow human organs in larger animals such as pigs is a long way off, new research shows. The resulting human-animal chimeras don’t grow well, and few human cells survive.

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***Conclusion.*** Faced with the common problem, Vacanti and Cooper have championed very different solutions. Cooper thinks that the best hope of providing more organs lies in xenotransplantation—the act of replacing a human organ with an animal one. Vacanti, now at Massachusetts General Hospital, has instead been developing technology to create genetically tailored organs out of a patient’s own cells, abolishing compatibility issues.[ 4]

***Key words:*** xenotransplantation, genetic engineering, transplanted cells, chimera, a stem cell

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