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ETHICAL CONSIDERATIONS IN THE USE OF GENETIC ENGINEERING TECHNOLOGY

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Abstract

Genetic engineering is a scientific field that involves the modification of genetic material in various organisms, including plants, animals, and human beings. This technology holds enormous potential for improving the quality of human life, but also raises significant ethical concerns due to its potential negative implications. This paper aims to provide a comprehensive overview of genetic engineering by discussing its nature, mechanisms, practical applications, scientific advantages, and ethical implications. The paper covers the potential benefits and drawbacks of genetic engineering, such as the unintended consequences of modifying an organism's DNA or the creation of new diseases. The paper also explores the complex ethical considerations involved in the use of this technology and evaluates the regulatory framework surrounding genetically modified organisms (GMOs) in Bulgaria. The paper highlights the importance of incorporating the precautionary principle in legislative and larger policy discourse to ensure the responsible use of genetic engineering. Overall, society's appropriate use of genetic engineering depends on carefully weighing its potential benefits against the potential risks and ethical concerns.

Introduction

Genetic engineering is the modification or manipulation of an organism’s genes using technology. Technology is used to change the genetic makeup of cells within the organism.

Humans have been engineering life for decades now. Through selective breeding, humans were able to administer useful traits in plants and animals. We became very skilled at this but never truly understood how it happens, until the discovery of the code of life, commonly known as DNA (Deoxyribonucleic Acid). DNA is a long double-helix shaped molecule which contains genetic instructions for the development, functioning, growth, and reproduction of all living organisms. The structure of the molecule carries genetic codes responsible for the genetic traits of the being. By changing this code, we can influence the traits possessed by the being, both, for the better and worse. DNA was first identified in the 1860s by a Swiss chemist called Johann Friedrich Miescher. A variety of methods are used in genetic engineering to purposefully change genetic material, typically deoxyribonucleic acid (DNA), to improve form or function. The use of bacteria (like Escherichia coli) or bacteriophages (viruses that infect

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bacteria, like the phage) or by direct microinjection are the two main methods for recombinant DNA technology, which was developed in the second half of the 20th century. In recent years, new methods have been added to these conventional tools to create and construct — or, more accurately, to engineer — unique living forms. This field is known as synthetic biology.

How is Genetic Engineering Performed

Recombinant DNA technology involves inserting foreign genes into plasmids of common laboratory strains of bacteria, which are capable of directing protein synthesis. Gene editing, based on CRISPR-Cas9, allows researchers to customize a living organism's genetic sequence by making specific changes to its DNA. It has potential applications in gene therapy for humans, where a normal gene is inserted into a mutant nucleus to repair a mutation that causes a genetic disease. Gene therapy is the introduction of a normal gene into an individual's genome to repair a mutation that causes a genetic disease. If the normal gene replaces the mutant allele, the transformed cells will proliferate and produce enough normal gene product for the entire body to be restored to the undiseased phenotype.

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Steps for genetic Engineering

- Choosing and separating the potential gene
- Gene transformation by plasmid selection and building
- DNA insertion into the genome of the host
- Verification of the insert

Application of Genetic Engineering 1). Genetic Engineering in Agriculture, Forensics and Environmental Science

There are several applications for genetic engineering in agriculture and food production. First, vaccine manufacturing and the use of technologies for transferring genes for economically significant qualities like as milk output, butter fat, and so on. An increase in the amount of lean meat is anticipated to help animal husbandry i.e Engineering in Agriculture, Forensics and Environmental Science. Second, genetic engineering is projected to significantly modify traditional ways to producing novel crop strains through breeding. The method enables the transfer of genes for nitrogen fixation, enhanced photosynthesis (and hence yield), resistance to pests, diseases, and herbicides, and tolerance to cold, drought, and increased salinity, as well as improved nutritional value and consumer acceptance.

2). Treatment of Diseases and Genetic Disorders

Genetic engineering may be used to cure illnesses or genetic problems in a variety of ways, including the creation of potential AIDS vaccines, cancer therapy, the synthesis of biopharmaceuticals for a range of metabolic, growth, and development ailments, and so on. Biosynthesis is a process in which a gene code for a certain product is extracted, cloned into another creature (usually bacteria), and then expressed in that organism (host). Large numbers of gene products can be gathered and purified by culturing host organisms. A few examples will demonstrate the beneficial properties of biosynthesis. Insulin is required for the treatment of insulin-dependent diabetes, which is the most severe kind of diabetes.

3). Prevention of Genetic Disorders

Currently, genetic disorders are typically prevented by identifying individuals in the population who are at risk of passing on a serious genetic disorder to their offspring, providing genetic counselling and prenatal screening, and then selectively aborting affected foetuses. Genetic counselling is the process of sharing knowledge gathered from traditional genetic studies and current research to individuals who are at risk or have a high possibility of transferring abnormalities to their kids. Generally, information about the disease itself - its severity and prognosis,

whether or not there are effective therapies, and the risks of recurrence - is presented during counselling. Counselling may also involve conversations about contraception techniques, adoption, and prenatal care for couples who feel the risks unacceptable.

Controversy and ethical considerations

The "new" microbes developed through recombinant DNA research were designated patentable in 1980, and the 1986 sale of the first living genetically changed organism—a virus used as a pseudorabies vaccine—was authorised by the U.S. Department of Agriculture. Since then, many hundred patents for genetically modified microorganisms and plants have been granted. However, patents on genetically modified and altered species, notably crops and other foods, were a problematic topic that persisted throughout the first decade of the twenty-first century.

Genetic engineering has drawn a lot of attention because of the possibility that it could introduce undesirable and perhaps dangerous features into microorganisms that were previously devoid of them, such as antibiotic resistance, the ability to produce poisons, or a propensity for disease. Indeed, there were many ways that genetic engineering could be misused. Particularly, there was a great deal of worry on the effects of genetically modified organisms, particularly transgenic crops, on both human and environmental health. For instance, genetic modification might change a crop's capacity to cause allergies. It was also uncertain whether some genetically modified crops, like golden rice, live up to the promise of better health advantages. Concerns were also expressed about the introduction of genetically altered mosquitoes and other species into the ecosystem.

The topic of the moral and societal ramifications of human genetic engineering has been ongoing for a long time, but in the twenty-first century, significant advancements in the creation of geneediting techniques gave the issue a new sense of urgency. The use of genome editing in humans has sparked serious ethical questions, especially in light of its potential to change qualities like intelligence and beauty. Practically speaking, some researchers attempted to use gene editing to change genes in human sperm, allowing the edited genes to be passed on to succeeding generations. Other researchers attempted to change genes that increase the risk of certain types of cancer in an effort to lower the risk of cancer in offspring. However, the effects of gene editing on human genetics were unknown, and there were few rules to govern its application.

Exploration Of Ethics and Considerations

A number of important ethical questions are raised by genetic engineering in its entirety. Ethicists have drawn attention to the possible health risks linked with genetically modified crops and livestock in agriculture. Ethicists have drawn attention to the risks to human health posed by genetically modified crops and livestock, as well as to normative worries about how animals are treated and the environmental effects of genetic engineering. The supposed difference between treatments intended to restore function and those intended to increase function beyond and beyond species-typical standards has generated major ethical debate in the field of medicine. As opposed to somatic genetic engineering, the possible hazards to human health connected with germ-line genetic engineering have also received attention from ethicists. The screening and alteration of embryos to remove or add different medical and/or aesthetic features creates ethical concerns, according to ethicists, in the context of reproduction.

CASE STUDY ON GENETICALLY MODIFIED ORGANISMS

In order to research and show the importance of the precautionary principle and its incorporation within legislative and larger policy discourse, this case study examines the development of the regulatory framework surrounding GMOs in Bulgaria. Debates around the nation. The passage of the Law on Genetically Modified Organisms (LGMO) and significant revisions made between 2003 and 2017 are discussed in detail.

It makes an attempt to explain how scientific and precautionary reasons might impact or not influence legislative choices, and how frequently these arguments are contested by a high level of ambiguity and socially constructed risk perception.

The case begins by outlining some broad elements of GMOs that are not country-specific and identifies the key difficulties that make this a divisive topic. The authors' goal is to increase interest in the case study among a larger audience while exploiting the uniqueness of the Bulgarian experience to advance global awareness of the GMO issue.

In Bulgaria, the Law on Genetically Modified Organisms (LGMO) serves as the primary legal basis for GMO regulation. It was presented to the Parliament in July 2003, and after being approved by the legislature in March 2005, it went into force on June 1 of that same year. The first plenary discussion on February 12th, 2004, was the culmination of a year's worth of effective legislative debates on this initial draught.

Conclusion

From a scientific standpoint, genetic engineering has many potential benefits. It can help us develop new therapies for diseases, create crops that are more resistant to pests and disease, and even create new species with desirable traits. However, there are also potential risks associated with genetic engineering, such as unintended consequences of modifying an organism's DNA or the possibility of creating new diseases.

From an ethical standpoint, genetic engineering raises many complex issues. Some people view genetic engineering as playing God, and believe that it is morally wrong to manipulate the genetic material of organisms. Others argue that it is our responsibility to use science to improve the world around us, and that genetic engineering can be a powerful tool for doing so.

Overall, genetic engineering is a complex field with many potential benefits and risks. It is up to society as a whole to determine the appropriate use of this technology, weighing the potential benefits against the potential risks and ethical concerns.

Political	*Science/risk assessment*	*Public debate*

Year	Event	Relevance to case study
1973	Scientists Herbert Boyer and Stanley Cohen develop a method to transfer a gene from one strain of bacteria into another	This achievement is considered the first example of a GMOs and spurs the development of the field
1987	First time genetic modification is used in crops for food	This opens up the discussions on risks to human health and gives rise to controversies within society
1992	The UN adopts the Rio Declaration of Environment and Development	The declaration provides the classic definition of a precautionary approach that later gives shape to the legal Precautionary Principle used by the European Commission
2000	The Bulgarian Parliament ratifies the Cartagena Protocol on Biosafety to the Convention of Biological Diversity	The protocol is a key international agreement which aims to ensure the safe handling, transport and use of living modified organisms resulting from modern biotechnology (including GMOs) that may have adverse effects on biological diversity, taking also into account risks to human health. The Cartagena Protocol recognises that biological diversity can be faced with risks from GMOs. It embodies the Precautionary Principle to allow signatory states to take protective measures against possible threats and damages from GM foods and crops.
2003	The Cartagena Protocol on Biosafety enters into force The draft of the first Bulgarian Law on Genetically Modified Organisms is submitted to the Parliament	The LGMO is the principle legislative document regulating GMOs, specifically contained use, deliberate release, release to the market, risk assessment and control procedures. It refers to the Precautionary Principle.
2005	The Bulgarian LGMO enters into force.	Bulgaria has a dedicated law regulating contained use, deliberate release to the environment and release to the market of GMOs, which embodies the precautionary principle and provides measures to ensure safety, risk assessment and management, as well as administrative sanctions.
2010	Public protests and heightened media attention to GMOs, in response to proposed amendments to the LGMO Most significant amendments adopted to the LGMO	The beginning of 2010 saw the most significant changes to the LGMO, but due to public pressure, the Law remained restrictive, effectively banning experiments in the field, deliberate release and release to the market of GMOs.

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