

Discussion on Human Gene Editing Technology from the Perspective of Ethics and Law

Hechun Wang

University of Washington, Washington 98105, USA
hechunw0423@gmail.com

Abstract: In recent years, there are more and more achievements in gene editing technology, and more and more private individuals begin to study gene editing technology. Gene editing technology is a hot topic both in medical circles and in legal circles. Different from traditional genetic engineering technology, gene editing technology has powerful functions and accuracy, which can effectively cure various human genetic diseases and prolong human life expectancy. However, while enjoying the great benefits brought by gene editing technology to mankind, we must also realize that a series of moral and ethical problems caused by gene editing technology have also promoted the improvement of China's legislative model in the field of gene editing. From the perspective of ethics and law, this paper studies the relevant laws and regulations of gene editing technology from many aspects, and effectively points out the application scope of the technology and the consensus that the current society should reach on the application of the technology.

Keywords: Human gene editing technology; Genetic engineering; Ethics; Law

1. Introduction

At present, with the development of economic globalization, the economic development level of all countries has been greatly improved. In this era of rapid economic development, the medical level of all countries has also been significantly improved. However, even under the background of the current advanced medical level, there are still many diseases that human beings have not been cured for the time being. With the emergence and application of gene editing technology, gene editing technology can replace pathogenic genetic genes with normal genes, which can greatly reduce various incurable diseases caused by genetic genes. This is the significance of gene editing technology applied to human genome modification.

2. Human Gene Editing Technology

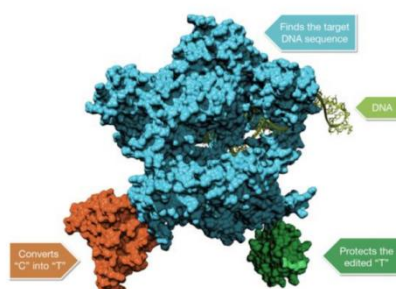


Fig. 1 Application process of gene editing technology

Gene editing technology, in essence, is to modify human genes with "molecular scissors" from the perspective of gene inheritance, so as to replace pathogenic genes with conventional genes, so as to help human beings completely cure all kinds of genetic diseases [1]. Different from the early genetic engineering technology, gene editing technology is an advanced technology further developed on the basis of genetic engineering technology [2]. This technology can accurately locate the target gene to be modified, which also enables human beings to ensure the modification of target gene without affecting

other genes. However, since the emergence of gene editing baby incident, all sectors of society have different views on the application of this technology [3]. At the same time, the application of human gene editing technology, especially the modification of human germ cells, has caused a series of moral and ethical problems. Fig. 1 demonstrates the application process of gene editing technology in detail.

3. Development Status of Human Gene Editing Technology

The editing and modification of gene editing technology in the human genome makes it possible for private individuals to modify specific DNA fragments. Fig. 2 shows the relationship between DNA fragments and genes in detail.

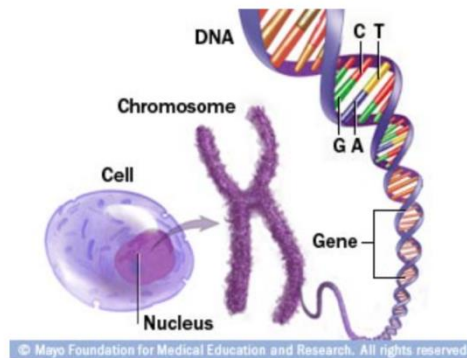


Fig. 2 Relationship between DNA fragments and genes

Through gene editing technology, private individuals can not only change the genetic genes of plants and animals, but also change their own genetic genes. In this respect, the application of gene editing technology will have a revolutionary impact on human life, and whether this impact is positive or negative has become one of the most controversial topics in society [4]. On the one hand, gene editing technology can replace pathogenic genes with conventional genes, so that private individuals can regain health, and even some incurable genetic diseases will disappear in human offspring. Fig. 3 shows that the research team of West China Medical College used CRISPR gene editing technology to knock out PD-1 protein gene, so as to increase the resistance of human immune system to tumor [5].

BIOTECHNOLOGY

CRISPR gene editing tested in a person

Trial could spark biomedical duel between China and US.

Fig. 3 Practice of gene editing technology in tumor treatment

On the other hand, gene editing technology can enable private individuals to obtain higher muscle mass, height, intelligence and so on. Therefore, through gene editing technology, human beings are likely to obtain higher intelligence and healthier body, but this also leads to a series of moral and ethical problems [6]. Fig. 4 shows that Jennifer Doudna and Emmanuelle Charpentier, two female scientists, first discovered the role of endonuclease mediated by Cas protein in bacterial adaptive immune system in 2012. Therefore, they won the 2015 life science breakthrough award. Since then, a new generation of gene editing technology has been really applied to all fields of life science. More and more experts and researchers begin to realize that gene editing technology has broad development prospects in the field of life science.

A Programmable Dual-RNA-Guided DNA Endonuclease in Adaptive Bacterial Immunity

Martin Jinek,^{1,2,*} Krzysztof Chylinski,^{3,4,*} Ines Fonfara,⁴ Michael Hauer,^{2,†}
Jennifer A. Doudna,^{1,2,5,6,‡} Emmanuelle Charpentier^{4,‡}



Fig. 4 Jennifer Doudna (left) and Emmanuelle Charpentier

4. Discuss Human Gene Editing Technology from the Perspective of Ethics

4.1 Inter-generational Gene Modification

When gene editing technology acts on the human genome, especially on human germ cells, it is equivalent to modifying inter-generational life genes. Therefore, inter-generational gene modification has triggered a series of ethical problems. From a popular point of view, when gene editing technology acts on human germ cells, it is equivalent to a huge deviation in the process of children inheriting their parents' genes. Moreover, this genetic deviation will have a great probability to destroy the natural ethical relationship between parents and children due to blood and heredity. Even at the current legal and ethical levels, it is difficult to determine the kinship between gene editing infants and their parents and other relatives.

Moreover, from the legal level, the issue of "whether gene editing babies can belong to natural persons" is still controversial.

4.2 Customization of Human Genes

When the baby event of gene editing appeared, all sectors of society began to pay attention to the application and development of gene editing technology. For human beings, gene editing technology can modify human genes, which means that human beings are likely to prolong their life expectancy, and can make incurable genetic diseases disappear in the world, so that private individuals can get the body of King Kong. At the same time, we should also realize that while human beings modify their own machines, this technology is likely to be applied to the customization of the next generation of genes. Obviously, if this technology is successfully studied, more and more private individuals will spend money to customize the genes of the next generation, so as to make the next generation have better appearance, higher intelligence and so on [7]. However, if this technology is mastered by a small number of private individuals, it will lead to further class solidification and more unfair phenomena in society.

4.3 Gene Editing Infants

When gene editing babies are born, they have lost their genetic autonomy. From the perspective of ethics, the loss of individual skill autonomy will directly affect individual dignity.

At the same time, there is a great controversy about the practice of gene editing infants in the current society. It only directly affects the individual survival and later development of gene editing infants. It can even be said that under the current social background, the survival and development of gene editing

infants are facing great challenges, which are mainly reflected in two aspects. On the one hand, because the application of gene editing technology is still in the exploratory stage, gene editing infants are likely to be difficult to adapt to the physical function after gene editing, leading to other diseases and even irreversible damage. On the other hand, private individuals from all walks of life are likely to look at gene editing babies with colored glasses, so that gene editing babies are placed in an unequal position from the beginning.

5. Discuss human Gene Editing Technology from the Perspective of Law

5.1 Advancement of the Coordination between Right Protection and Technological Development

From the perspective of law, there must be sound relevant laws to support the application of gene editing technology. In other words, we must strengthen the implementation and introduction of laws and regulations related to gene editing technology, and make the of laws and regulations related to gene editing technology consistent with the development status of the technology.

On the one hand, in the legislative process, relevant personnel must fully consider the development, future trend and potential risks of gene editing technology, and then formulate scientific and reasonable laws and regulations. This paper holds that when formulating laws and regulations related to gene editing technology, legislators must widely listen to different opinions, and invite experts and scholars in relevant fields to participate in the legislative process.

On the other hand, the established laws and regulations related to gene editing technology should also be adjusted in time according to the current development trends and new problems of the technology. In recent years, gene editing technology is in the stage of rapid development, but the relevant laws and regulations do not fully match it, and the content of relevant laws and regulations even lags behind [8]. Obviously, with the rapid development of gene editing technology, invariable laws and regulations have been difficult to meet its development needs, let alone solve the new problems in the development process of this technology. However, at the same time, it is worth noting that while adjusting the contents of relevant laws and regulations, staff must work with caution.

5.2 Amelioration of the Construction of the Legal System of Rights Protection

While carrying out the relevant legislative work of gene editing technology, China should also actively build and improve the relevant legal system of gene editing technology, so as to ensure that the legitimate rights of stakeholders can be guaranteed.

On the one hand, at present, China has formulated and launched relevant laws and regulations on gene editing, but these laws and regulations have low effectiveness and have not formed a sound legal system, which also makes these laws and regulations difficult to achieve the expected good results. Moreover, most of the existing laws and regulations related to gene editing in China only elaborate the use norms and principles of gene editing technology, mostly the provisions on the behavior of relevant scientific researchers, but there is a lack of elaboration and provisions on the details of gene editing procedures and legal responsibilities of gene editing.

On the other hand, China's laws and regulations should also fully consider the rights of gene editing infants after birth, and formulate and launch a series of laws and regulations related to the rights of gene editing infants, so as to ensure that gene editing infants can have the same equal right to survival as other natural persons.

5.3 Enhancement of the Allocation of Legal Liability for Infringement of Rights

At present, the current laws and regulations of gene editing technology lack effective allocation of legal liability, which is also the main reason why it is difficult for relevant legislators to adjust the existing relevant laws and regulations according to the development status of gene editing technology.

At present, in gene editing, the subject of power and related content are very complex, which also makes the existing legal responsibility difficult to fully protect the subject of related rights. Combined with China's national conditions, this paper discusses the improvement of the allocation of legal responsibility of gene editing from three aspects.

Firstly, from the aspect of administrative law, this paper believes that the relevant legislators of gene

editing should refine the legal responsibilities of the laws and regulations related to gene editing. Secondly, from the perspective of civil law, this paper believes that it is necessary for relevant legislators to launch a set of detailed laws and regulations to serve such groups. Finally, from the perspective of criminal law, this paper believes that relevant legislators should supplement and improve relevant provisions to determine the nature of gene editing behavior and specific criminal responsibility.

6. Conclusion

To sum up, gene editing technology is an advanced science and technology rising in recent years, which provides more possibilities for the development of human society. However, this technology has also caused a series of moral and ethical problems, and from the legal level, the application and development of this technology also put forward higher requirements and standards for the legal system. This paper holds that whether from the perspective of ethics or law, we should try our best to ensure that gene editing technology holds the bottom line in the process of development and application, and let the technology serve human health and safety.

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