

Gattaca movie review and film summary

[Literature](#), [Russian Literature](#)



From science fiction movies like Gattaca to the reality of genetically modified food, the concept of designing bacteria, animals and even human genes has fascinated our imagination and culture for decades. This obsession is not surprising considering the significant impact of gene editing technologies on our society. It has long been debated whether humanity should continue to expand the application scope of the gene editing technologies, especially in public health services. Within the argument there are two perspectives present: Yes, scientists ought to introduce this technology to the public health service due to its extremely high medical value; and no, governments should stop relevant experiments because of the high uncertainty and risks involved in this kind of technology.

Let us start with a simple introduction of gene editing technologies. From a scientific point of view, gene editing is a method that allows scientists to design the DNA of many organisms, including bacteria, plants, and animals. In fact, editing DNA can lead to many changes in our physical features, like eye colors, intelligence quotient and even the disease risks. Figuratively speaking, this technology just acts in the same way with a pair of scissors, cutting the DNA at a certain location.

Then scientists are able to cut, add, and change the DNA where it was cut. In the very beginning, the first gene editing tool was invented in the 1900s. More recently, a new gene editing method called CRISPR, discovered in 2009, has made it much easier to edit DNA. CRISPR is a method which is easier, quicker, cheaper, and more accurate than others. ('Genome Editing', 2017). Therefore, many scientists prefer to use CRISPR to perform gene

editing. However, the improvement of the editing technology does not mean that risks and dangers are completely eliminated.

Let us go back to the title of the article again. According to Merriam-Webster, ‘expand access’ means to expand the permission. To be more specific, expanding gene editing technologies to areas that are not allowed to be studied or applied now. In other words, we need to apply embryo editing in clinical trials, which is strictly restricted by the existing laws and regulations. For example, in the United States, authorities currently are not allowed to consider proposals for this kind of research due to an ongoing prohibition on the U. S. Food and Drug Administration’s use of federal funds to review ‘research in which a human embryo is intentionally created or modified to include a heritable genetic modification.’ Besides, in a number of other countries, genome-editing trials are also prohibited entirely. (The National Academies Press (2017)).

This is mainly because gene therapies which are non-inheritable are considered as slightly acceptable; however, permanent edits or inheritable changes are considered extremely dangerous and unethical. In short, scientists do not know what will be the possible outcomes if inheritable changes are passed on to the next generations. A mistake in gene editing process could mean that all coming generations of that person are going to have that specific defect in their genes. The danger seems to be extremely severe, while we are not supposed to neglect the medical advancement brought by the genome-editing as well. Therefore, what we really need to

discuss is whether the medical value of human embryo editing is worth expanding the application scope, even if we take such a tremendous risk.

First of all, let us talk about the benefits of gene editing in germ cells.

According to Chris Gyngell, a Genetics specialist at Cambridge University, 'Gene editing techniques hold the promise of curing genetic defects such as cystic fibrosis, thalassemia, Huntington Disease, and some forms of Alzheimer's disease.' It indicates the importance of the gene editing technologies. Currently, the only feasible and available method to prevent genetic disorders involves using IVF (in vitro fertilization) and PGD (preimplantation genetic diagnosis).

Nevertheless, these kinds of techniques do not provide a therapeutic effect, it only prevents individuals who would have had a genetic disease from coming into existence. In contrast, gene editing technologies could provide permanent benefits to future generations by curing them of their genetic disease. More importantly, 'There is no medical treatment for hereditary diseases with genetic defects.' Qian Cheng, the director of the biological treatment center at southwest hospital of the third military medical university, said 'the most fundamental way to treat genetic diseases is to correct the mutated genes.' Therefore, gene editing is the only effective and promising way to cure genetic diseases now.

In fact, there have been successful cases of gene editing for incurable diseases. Among the common genetic diseases, for example, thalassemia, a disease commonly seen in Asia and Africa, is dragging down countless families mentally and economically. According to World Health Organization,

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there are more than 10% human carriers of thalassemia gene mutation in these areas. In 2016, China released relevant data showing that there are about 300, 000 people with severe and intermediate thalassemia in China, and about 30 million people with “Thalassaemia” genes.(Mingya, W.(2018)) These patients usually need to lose red blood cells every month, but this will lead to the deposition of iron in the organs. Another alternative cure is heterologous hematopoiesis, which is related to stem cells.

However, stem cells have very high requirements for matching, so the success rate of matching is very low. Most patients can only consume a short life while waiting for a suitable match. There is no effective way to cure this disease now. However, using gene editing technology will make it possible to provide more efficient, safe, and precise treatment options for Thalassemia. Besides, in 2015, scientists successfully used gene therapy in the United Kingdom to help a girl named Layla fight leukemia, a type of cancer.

Actually, doctors had given up all hope of saving Layla Richards, after she failed to respond to chemotherapy and a bone marrow transplant. But when desperate parents begged to try anything to cure their daughter, specialists agreed to attempt something entirely unique—the gene editing technology. Within a month, those genetically edited immune cells killed all the cancer cells in her bone marrow. She is recovering well and there is no sign of the cancer returning now.(The Guardian (November 05, 2015))

While such applications might at first glance be appealing and beneficial to those who are directly affected, the potential dangers are likely to be substantial. For instance, there are scientific concerns that CRISPR could

inadvertently target other genes in the genome and such unexpected genetic manipulations could change biological functions. These are genetic changes that would actually be permanent and the fear is that there could be unanticipated side effects. Couple that with the ethical concerns of people misusing this technology to intentionally modify the genome to make “designer babies” with enhanced characteristics.

Since the uncontrollability and unknown nature of gene editing technology have been clarified, if we force this technology to expand the scope of application, accidents and failures are inevitable. Just imagine when we use this technique for patients, and it goes wrong and misses the target, how do we deal with the situation and those patients? Can we reproductively segregate a person who misses a target? If so, it will be a violation of human rights, and the editor was deprived of the right to have children.

If not, it is inconsistent with human responsibility. After all, the edited failed genes will be passed on to the next generation, affecting more people and polluting the gene pool. In addition, genome-editing might disable a tumor-suppressor gene or activates a cancer-causing one. Two studies, one from the Karolinska Institute in Sweden and the other from the biomedical research in Cambridge, independently found that double-strand DNA breakage caused by CRISPR actually activates the p53 protein pathway.

In other words, cells that successfully edit genes are likely to be potential cancer cells, and using CRISPR for clinical treatment inadvertently increases the risk of cancer. (The Nature commentary (2018)) Besides, the number of abnormal genetic mutations increases. A team of US based researchers from

Stanford University, Columbia University and the University of Iowa sequenced the whole genome of mice that had previously undergone CRISPR gene editing.

The researchers surprisingly found that mice treated with CRISPR technology had undergone 1500 unintended single nucleotide mutations, as well as more than 100 large deletions and insertions of genetic material.(Howden J. (May, 2017)) However, mutations beyond normal level are the cause of certain diseases. [Science News 2013]explains how many other diseases, such as cancer, diabetes and asthma, are linked to genetic mutations. (Menamos J. (October, 2017))Such considerations undoubtedly contribute to the proposed suspension of clinical trials using gene editing techniques. (PMC(August, 2015))

In fact, scientists had made such an attempt. On November 26, 2018, He Jiankui, a scientist from China, announced that under his leadership, two girls whose genes had been edited and were able to immunize against AIDS had recently been born in China. However, 122 Chinese scientists immediately issued a joint statement expressing their firm opposition and strong condemnation to any attempt to edit a genetically inheritable human embryo. Although this objection is directed at this immature and premature experiment rather than the gene technologies, it still indicates that scientists are extremely cautious about putting the technology into clinical practice.

Generally speaking, the reason why the public opposes the use of gene editing technology in germ cell editing is predominantly focused on moral issues. It seems that gene editing directly in human embryos using currently

available technologies might have unpredictable side effects on future generations. This makes it dangerous and ethically unacceptable. However, many technologies have unpredictable influence on future generations, while this does not mean that they are either morally unacceptable or dangerous.

Who can ever predict the influence of the information technologies like the smart phones or internet on future generations? Opponents of gene editing might object that such technologies do not operate at the genetic level, like CRISPR, and are not passed heritably down to the next generation.

Nevertheless, this is a deep misconception – environmental interventions, like modified social interaction, have tremendous effects, modifying brain development and can be inherited as well.

In conclusion, although there are still many risks and uncertainty involved in embryo editing, the tremendous medical advances it brings are still worth taking. After all, there is still no alternative treatment for terminally ill patients. In the face of desperate patients, rather than doing nothing, we are at least trying. In the long run, with the development of science and technology, the possibility of this risk will continue to decrease, and ethical issues and off-target issues will gradually become less important. All in all, putting the only solution into public health services can save countless lives.