CLASS ACTIVITY: February 26/27

1. In 2015 there was a breakthrough, scientists investigated CRISPR-Cas method, that solved all problems above. Four years later, in 2019, was conducted first experiment on people. This rapid development of science in field of humans gene engineering causes concerns and may be very dangerous for humanity.
2. There is less radical path, people will try consider both sides of coin.
3. David Baltimore in his speech “Gene Editing and Ethics” said, that he believes, that a majority of people suppose gene engineering in order to make their lives better.
4. However, this is a documented case and a breakthrough in genetic engineering. He shows that very soon we will be able to get rid of physical and mental illness even before birth.
5. It is been a while since the CRISPR-technology was first introduced to the public, however, the problem of the ethical side of modifying human germline remains unsolved.
6. In 2015 CRISPR technology appeared - it allows for fast and easy gene modification. The CRISPR found its applications almost immediately - from laboratory mice to livestock.
7. At present, biology, and especially genetics, is undergoing rapid development.
8. Being more precise and easy to implement than its’ precursors, CRISPR opens a wide range of applications that improve quality of life on Earth.
9. It would be better, if human genome experiments were open for society and for scientific comminity.

Essay 1

Wise Gene Editing

The great success of CRISPR technology in 2015 convinced many of us that science is almost almighty. Now people have potential to fight to any fatal disease and even turn people into perfect creatures. However, the majority of people are against human gene editing. They are frightened of possible errors in the technology, which can lead to unwanted alteration not only for a patient, but also for all his descendants. Acceptability of human gene editing is one of the hardest dilemmas which the humanity has to solve. However, the progress is unstoppable, and we should use gene editing at least in terms of disease treatment.

According to David Baltimore, there are several ethical problems concerning human gene editing. First, if you treat people as perfect creatures even with their illness, you don’t want to use this technology at all. Second, as mentioned above, alteration of person’s genes will affect not only him, but also his offspring. Is it acceptable to make decisions concerning not only you, but a lot of generations after you? Finally, gene editing can lead to raised class inequality and discrimination. Only wealthy people will afford gene editing (as any advanced medicine), so they will become healthier and more competitive compared to poor.

Most people agree that if scientists can do something to ease someone’s illness, they should do it, but we should severely restrict aims of gene editing - only for disease treatment. Indeed, decisions towards acceptance of gene editing are already made. Dartmouth ethics professor Ronald M. Green in his article in Washington post mentioned two British couples wanted to use in-vitro fertilization and preimplantation genetic diagnosis to choose only the healthy embryos to implantation. They wanted to get rid of breast cancer in their families. The Human Fertilisation and Embryology Authority approved the procedure to both families. Though it is not gene editing, this procedure is ideologically similar to it. Moreover, according to Stephen Buranyi, first two gene-edited twins already exist in China, but their personalities are unknown. So, the society is gradually moving towards acceptance of human gene editing, considering constantly rising precision and safety of the technology. However, we should to forbid commercial use of this technology to improve such characteristics as intelligence, beauty and physical strength. It will irreversibly lead to increased inequality and discrimination, because only rich people will afford it. In such society nazi moods can easily emerge.

The power and imperfection of gene editing technology cause a lot of ethical questions. The main of them: whether it is acceptable to use it on humans? Although it may lead to unwanted alterations in future generations and increased inequality in society, wise use of this technology will only free our descendants from a lot of diseases. We just need to use the technology only for treatment, not for improvement of human organisms.

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Essay 2

**Red line of human gene editing**

Gene editing technologies have already come into the society with the success of CRISPR-Cas9 in 2015 and first germline editing made by He Jiankui in 2018. However, they caused serious public discussion on ethical aspects of changing genes. Where is the border (so called “red line”) of such technologies applications, after which gene editing will become harmful and dangerous for the mankind instead of bringing benefit? Nowadays gene editing has some technical problems, its long-term effects aren’t well studied yet, and its unrestricted use might have negative social consequences, so it definitely should be controlled in some degree.

Actually, there are a lot of such possible degrees of control. The simplest and the most radical solution is, of course, just to prohibit all genetic modifications. According to David Baltimore, some people consider human beings as inviolable, given by high forces, and believe we mustn’t modify ourselves. Though, the majority of people accept gene editing in some way. So the second, compromise solution, is to restrict only negative applications and save possible benefit like genetic diseases elimination.

As stated in the Harvard review of perspectives on gene editing, rapid development of human genetics is being driven by CRISPR, which is a technology to correct errors in DNA with relative ease. There are two types of gene editing: somatic and germline. Somatic gene therapy affects only the patient being treated, and may be performed at any age. In contrast, germline editing alters the genome of a human embryo at its earliest stages, and affects not only on a single person, but also all its offspring. It has some risks like off-target effect, when the wrong gene is targeted, and mosaicism, when only some copies of the gene are altered and others are still defective. Scientists, directors and lawyers have various opinions on ethical aspects: some of them are cautious, like CRISPR pioneer Feng Zhang calling for a moratorium on implanting edited embryos in humans, some are positive, like Richard Hamermesh noticing a huge commercial potential of CRISPR.

The first way to deal with ethical problems is, as said, radical and uncompromising: simply forbid gene editing, especially the germline type. This solution satisfies the argument that people shouldn’t interfere evolution and natural selection. It might seem reasonable due to known possible negative effects of genetic modification: it’s not 100% effective yet and can affect wrong DNA fragment, which can cause even worse mutations than were tried to fix. However, it deprives people of the opportunity to get rid of terrible genetic illnesses – so, deprives of the benefit.

There is a compromise solution which saves that benefit. Genetic modifications should be available only if they are aimed at replacing defective fragments responsible for certain diseases, and it should be free for everyone. Any other modifications should be prohibited. Indeed, if gene editing is uncontrolled, people will use it to design perfect children, who will be smarter, healthier and stronger than children, whose parents can’t afford such modifications due to poverty. It, as Ronald Green tells, can increase social inequality and bring us to the world of “genetic overlords ruling a vast genetic underclass”. Such a compromise solution seems to solve this problem.

Now the society should find an invisible red line, a boundary between great benefit in form of longer lifespan and absence of genetic diseases, and disadvantages in form of negative social impact and harmful inefficiency. Scientists should be cautious about germline editing, especially about its usage for changing the essence and physical and mental parameters of the individual.

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