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**PREDICTION OF INTERDISCIPLINARY KNOWLEDGE ON THE
BASIS OF ACTUAL RESEARCH WITHIN GENOMIC
RELATIONS**

Vladislav V. Tishchenko (a)*

*Corresponding author

(a) Ural State Law University, Ekaterinburg, Russia

Abstract

The paper analyzes the current state of bioethical knowledge. The author forecasts the development of bioethics based on present-day knowledge. Within the framework of postnonclassical scientific rationality, an attempt is made to establish the ethical framework of genomic relations. Modern research is often interdisciplinary. Science develops with the interaction of scientists from different fields of knowledge that exchange the available scientific data. The interest in forecasting the development of genomic research is associated with the rapid development of bio-medical technologies and their implementation. The study of the human genome may entail not only the medical practice, which is undoubtedly important, but also affect other areas of public life. Recently discovered genome technologies require lawyers to develop new statutory concepts that are adequate for changing public relations. It is required to continue to improve the legal regulation of genomic relations, to determine the measure of possible change in the human genome.

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1. Introduction

In ancient times humanity was quite interested in various forecasts. These forecasts affect various aspects of our lives starting from the fate of the world to the weather forecast for tomorrow. Based on these forecasts, we are either preparing for the next end of the world, or once again we are surprised at the sudden frosts that we were not ready for.

The forecast depends on several factors. First, it is based on some information, and second, on the subject of the forecast. If we talk about information, then we need to talk about its quality – completeness, reliability, accessibility, etc. “The starting point of forecasting, like any study, is accurate knowledge of the subject, goals and problems of forecasting, as well as the necessary empirical and theoretical means for their implementation” (Ruzavin, 2012, p. 190). But we cannot ignore the subject of the forecast, which works with the available information, and has certain value-worldview attitudes.

2. Problem Statement

“In the late 19th-early 20th centuries, science is recognized as a productive force of society, which undoubtedly exerts a huge influence on almost all aspects of its life. The so-called “big science” is formed, which is characterized by an increase in financial costs for science, the number of scientists, the effectiveness of science and, accordingly, the share of applied research in it, the need to manage, plan, organize and forecast the development of science” (Gorokhov, 2012, p. 211).

Until the second half of the 20th century the basis and procedure for conducting research with genetic material did not become the object of critical reflection among lawyers. Until a certain moment, society positively perceived the activities of biologists and did not limit them to moral and legal regulations. The situation changed when scientists began to investigate human genetic material. Against the background of the positive results obtained by fundamental science on the diagnosis, treatment and prevention of hereditary diseases, risks for natural human development were simultaneously identified (Blinov, 2018). Genomic information is increasingly being used for a wide range of both medical and non-clinical purposes, such as solving crimes, establishing paternity, or studying the anthropogenesis. Genomic information is used in many areas, and above all – to improve the health and prevent diseases of the population as a whole (Berg & Golubtsov, 2020).

3. Research Questions

It is no exaggeration to say that genomic relations were initially doomed to interdisciplinarity. First, the human genome began to be studied only in the 20th century, and second, the specifics of this field of knowledge regarding the biological nature of man could not be the subject of natural sciences only. In the second half of the 20th century, bioethics naturally appeared – an interdisciplinary field of knowledge that combines the provisions of biology, medicine, chemistry, jurisprudence, philosophy and ethics. The question of humanity is also too important not to be interested in socio-humanitaristics.

Besides, the interdisciplinary knowledge itself, which has recently become possible, has its own characteristics. The interaction of various scientific spheres gives rise to high variability in the application of their tools to certain objects.

4. Purpose of the Study

To summarize the above, we aim to consider the qualitative changes in knowledge in the field of the genome based on the interests of society and the state.

Therefore, speaking about forecasting the development of interdisciplinary fields of knowledge within the framework of genomic relations, it is possible to talk about forecasting the development of bioethics as a discipline that combines knowledge from natural sciences and humanities and social studies. It is this relation that will be addressed in this work. It should be agreed that the understanding of bioethics and its subject matter changes dramatically over time. The subject of bioethics is an interdisciplinary study of social, ethical, legal, cultural problems caused by the development of biotechnologies of various kinds (Bondarenko & Vasenkin, 2019).

5. Research Methods

The modern philosophical dictionary defines development as a concept that characterizes the qualitative changes in objects, the emergence of new forms of being, and the existence of various systems associated with the transformation of their internal and external relations. In the sphere of philosophical and scientific usage, it determines the existence of the system as the unity of progress and regression, renewal and destruction, self-approval and self-destruction (Azarenko et al., 2015).

The current state of bioethical knowledge is characterized by the predominance of a conservative approach, according to which it is either unacceptable to interfere with the human genome, or possible with substantial limitations, since such intervention may entail irreversible changes in the genome of mankind as a whole, the consequences of which may lead to new, more dangerous diseases, social inequality and genetic discrimination, significant human change as a species and even its extinction. The proponents of a liberal approach speak of the need to use modern biotechnologies to treat numerous genetic diseases often referring to the ideas of transhumanism and selection of a “superhuman” (Berg et al., 2021, p. 67).

Postnonclassical scientific rationality is characterized by the correlation of the acquired knowledge about the object not only with the peculiarity of the means and operations of the activity, but also with value-target structures. Within the framework of postnonclassical scientific rationality, the connection of scientific goals themselves with extra-scientific, social values and goals is revealed (Stepin, 2006).

6. Findings

Postnonclassical science removes the opposition of the scientific search itself, the course of which, as it seems, is not evaluated ethically, and its results, which may be evaluated from an ethical point of view thus proving that the scientific search itself is guided by ethical orientations (Nikulina, 2012). Not only should the research process comply with certain rules, but also the direction of finding a new one, expected or anticipated results should also be evaluated from the legal and ethical perspective. Of course, it must be

borne in mind that the most unexpected results can be obtained. It is also worth noting that the potential harm of a scientific discovery is not always known in advance. But in a situation where the dangers are at least partly known, they cannot be negligently treated.

It is enough to recall the history of the creation of the atomic bomb. Imagine that now it is 1939 – public being is filled with problems and contradictions, and the world will soon plunge into a devastating Second World War. Albert Einstein is preparing an urgent letter to the US President Franklin Delano Roosevelt about the discovery of a new energy source, which can subsequently entail the creation of weapons of exceptional power that have no analogues in the past (Kuznetsov, 1972, pp. 271-273). Soon after, the Manhattan Project was launched culminating in the creation of nuclear weapons, which were used against militaristic Japan in almost exactly six years after the start of the project.

The Soviet Union also created nuclear weapons. In 1947, the University of Chicago launched the Doomsday Clock project, the arrow of which metaphorically shows, according to the creators, the approach of the end of humanity. Maybe in 1947 the time set on the clock was really chosen arbitrarily (TASS, 2021c), but the events of 1962 clearly showed everyone that the conflict using nuclear weapons between the United States and the USSR is more than real. At the international and national levels, regulations have been adopted restricting the activities involving nuclear weapons, but they have already been created and continue to threaten the integrity of the human community.

The world is still in a state of turbulence: a pandemic of a new type of coronavirus COVID-19 exposed serious problems in social, economic, and political spheres; international law is gradually losing its value; class contradictions again declare themselves; “new values” in western countries are aggressively introduced into the consciousness of the population, etc.

Humanity will either be able to subjugate new technologies, integrate them into social relations, get the most useful, or get the opposite effect caused by the threats of the new technologies. This fully applies to genetic technologies. Therefore, much in the development of bioethical knowledge will depend on how existing social institutions cope with modern challenges. The current reaction to them allows making some conservative forecasts.

One cannot ignore the growing economic crisis caused by the pandemic of a new type of coronavirus infection COVID-19. In 2016, the US was the leader in domestic research and development spending that amounted to \$511.1 billion representing 2.74% of its GDP (Ranking of the world’s leading countries by R&D spending, 2021). But in 2020-2021, the United States has high unemployment rates – due to the restrictions imposed by the pandemic, many people became unemployed. At the peak of the first wave of the pandemic in early May 2020, 24.9 million were officially unemployed. By November 2020, unemployment benefits are paid to 20.3 million Americans (Kommersant, Number of unemployed..., 2021). How the economic crisis will affect the financing of science will become clear in the near future.

The development of bioethical knowledge will depend on further funding for research. The fact that research will be funded is almost beyond doubt, but what will be the amount of such funding? This will largely depend on the state of both individual national economies and the economy in the global sense. It would seem that the described things are obvious. Science and scientists appeared at a time when society was able to afford to support them. Modern scientific discoveries largely depend on the size of funding,

although there are, of course, some exceptions. But if we talk about a certain system for the production of scientific knowledge, then its effectiveness is interconnected with the costs produced.

Man is a truly unique phenomenon – at a certain point in their development people began to compensate for their physiological limitations. The complexity of technology and forms of cooperation gradually led us to the current state of affairs, when we are not only trying to understand the nature of man, but also to change it, subjugate it and make it manageable. Governance is our natural trait. We strive to subjugate the world around us, stop being a simple user, but become a creator. In fact, a person has become such a creator long time ago. From the moment he began not only to create the simplest tools, but also to understand the purpose of their creation. Until a certain moment, a person was built into the chronotope, was not able to change it. But the development of society has reached the moment when man has become able to transform not only the world around him, but also himself. It should be accepted that the study of the human genome is the pinnacle in the history of knowledge of the essence and nature of man. Working with the genome can globally change the practice of medicine, the ways of conducting biomedical research, which is advantageous for the human population (Berg et al., 2021).

The world has already faced the ethical challenges of human genome intervention associated with improving humans as a biological creature. Such a “correction” is spoken, for example, by M.A. Gerasimov, who considers genetic correction of human characteristics (height, weight, physique, facial shape, etc.) (Gerasimov, 2019). If earlier changes in the human body occurred under the influence of objective factors (bipedal locomotion, increase in brain volume, etc.), now this may depend on the subjective will of an individual person. But this subjective will affect not only his own existence, but also his descendants. Given that the “concept of self-determination” dominates in western liberal democracies, in which a person independently “constructs” and “determines” himself, it is not surprising that soon a person may be allowed to correct his genes. In fact, more than three years have passed since the Federal Constitutional Court of the Federal Republic of Germany introduced a gender different from female and male one.

The fact that a certain group of people are optimistic about biotechnology is not in itself a factor that should cause widespread editing of the human genome.

Man ceased to be just an object of research, he established himself as a subject with rights and obligations. This also applies to medical intervention: a person has become a subject, but does he realize the possible consequences of his actions. Can he realize them if he does not have enough information? And this is not even about voluntary informed consent – the subject will be given all the available information, but can it be considered really complete?

We lack the understanding of the consequences associated with human genome intervention. The human genome has not been fully studied. The risk of making a mistake is too great, and given the possible negative consequences – it is not permissible to make mistakes. Moreover, we would not even understand that this mistake was made. At the same time, the legal regulation of these public relations is not at best complete, or maybe simply absent. The danger of various types of terrorist acts related to genetic engineering has also not disappeared. Not to mention a simple confidentiality of human genomic information, the threat of using it for self-interest, or to discriminate against a person. There are many cases

in which the holders of confidential information have failed to exercise due diligence to ensure that such information does not become the property of third parties.

In 1990, the Human Genome international research project was launched, thus setting quite ambitious goals. The nucleotide sequence of all human chromosomes was deciphered, and an open geneprint bank was created. There were some optimistic forecasts that by 2020, based on the study of the genome, it will be possible to create medicines for diabetes mellitus, hypertension, mental illness, cancer, etc. (Collins & McKusick, 2001). At the same time, it is rightly noted that the obtained large amount of data in the framework of the Human Genome project has yet to be processed and analyzed. But at the moment, the key to understanding the “mystery of life” has not been revealed (Moraes & Goes, 2016).

A few years ago, a scientist from China made changes to embryo genes, as a result of which the first genetically modified people immune to HIV infection were born in 2018 (TASS, 2021b). Two years later, the scientist was sentenced to criminal punishment for an illegal experiment with the birth of twins from genetically modified embryos (TASS, 2021a). At first glance, it may seem that there is nothing surprising in the fact of criminal prosecution: we are constantly talking about the inadmissibility of uncontrolled manipulations of the human genome, which means that state-legal systems should contain mechanisms to combat offenses.

The problem is that the Chinese legal system lacks special responsibility for human genome changes. And this is despite the fact that China is recognized as a leader in the field of biomedical technologies related to the human genome. This is an example of the unprepared legal system to respond to serious violations of the rules of medical and research ethics, even if the harm and danger of He Jiankui’s experiments are unproven (Kozachenko & Sergeev, 2021). But the state, as a regulatory system, should not function at the request of individuals who perceive a certain behavior unacceptable. The state and law are universal means of translating basic public ideas, but they are also subject to certain principles. The value of law as a regulator of public relations does not raise questions, and imperfections in certain legal systems are questions for legislators.

It is rightly noted that it is necessary to distinguish the areas of genomic relations, which should be given priority in legal regulation, and ensure legal protection. First, it is the genome itself. Second, the confidentiality of information related to the human genome, i.e. the secrecy of knowledge obtained both about the nature of the changes made, and about the data obtained during the study (intervention) on the origin of the individual, his ancestors, race, etc. Third, the whole society, as well as all its members individually, should be protected from the influence of ideas and views of an extremist orientation, the authors of which are able to speculate on these scientific studies in the field of genetics. Such speculation must be separated from science itself and scientific knowledge, which alone cannot lead to any extremism, but can be used for unseemly purposes. A society in which quasi-scientific ideas are freely disseminated is in undeniable danger and must take some measures. Thus, for the legal regulation of genomic research the scientific expertise in these three areas becomes necessary. In each case, such an examination turns out to be interdisciplinary, and often transdisciplinary. This is due to both the heterogeneity of human nature and the multidimensional effects of genomic intervention. We can say that all the instances involved in the decision on such an intervention face a dilemma that requires calculating the possibility of choosing between two fundamental human rights: the right to change and the right to preserve (Przhilensky, 2019).

However, the legal regulation of genomic research varies in volumes and approaches in national jurisdictions and systems. Many issues of social regulation remain outside the scope of legal regulation. Temporal lacunae between the pace of development of natural science knowledge and its legal assessment with necessity give rise to legal lacunae. In Russia (as in most countries of the world), genetic research is not brought to the constitutional level (Zakharova, 2019).

For example, the UK and Sweden allows a wide range of activities affecting human genetic material. The form of control over the behavior of subjects of this kind of scientific research is the licensing mechanism. So, in the UK, the issuance of a license for genetic research with human embryos is the prerogative of the Ministry of Health. Australia, Belgium, Germany, Georgia, Spain, Canada, France, Estonia have more bans on the interference with the genetic component of humans. For example, the Spanish Penal Code contains a whole section, the rules of which, under the threat of severe sanctions, oblige law enforcement officers to refrain from interfering in human genetics (section V “Genetic manipulation”). Spanish rulers classified acts aimed at changing the human genotype, use of genetic engineering to produce biological weapons or weapons of mass destruction, creation of identical human beings by cloning or other actions (etc.) as grave crimes (Blinov, 2018).

The Federal Law No. 86-FZ of 05.07.1996 (as amended on 03.07.2016) “On state regulation in the field of genetic engineering” establishes some definitions regarding genetic technologies. In accordance with the law, genetic engineering is a set of methods and technologies, including technologies for producing recombinant ribonucleic and deoxyribonucleic acids, for isolating genes from the body, manipulating genes and introducing them into other organisms; gene therapy – set of the genetically engineered (biotechnological) and medical methods directed to modify the genetic apparatus of somatic cells of a person for the treatment of diseases; genetic engineering activities – activities carried out using genetic engineering methods in order to create genetically engineered organisms (The Federal Law No. 86-FZ, 2016).

“It follows from the legal definition of gene therapy that the legislator allows exclusively unearthed genome modifications. However, modern achievements in the field of genomic research determine a debatable and ethically complex question about the admissibility of inherited modifications of the genome” (Ksenofontova, 2019, pp. 143-152).

In other words, it is possible to talk about the admissibility of only non-inherited changes in the human genome, when the modified genes will not be transferred to offspring. Or, when changing hereditary genes, to make their further transfer impossible. At least until scientists model positive and negative paths of development.

The United Nations has adopted several instruments dealing with bioethics. First, in 1997, the UN adopted the Universal Declaration on the Human Genome and Human Rights. Second, in 2003 – the International Declaration on Human Genetic Data. Third, in 2005 – the Universal Declaration on Bioethics and Human Rights. There are areas of human activity which principles must be unified. Research, treatment and diagnosis of the human genome should be carried out only after the associated potential hazards and benefits. These UN acts, in addition to the fact that they relate to bioethics issues, are adopted in the form of declarations and are not binding, but advisory in nature.

In 1997, the Council of Europe adopted the Convention for the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine: Convention on Human Rights and Biomedicine, which is binding on the signatory states. The Convention was not signed by all states-members of the Council of Europe, but even less in the additional protocols, and, most importantly, the Additional Protocol to the Convention on the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine concerning the prohibition of cloning of human beings in 1998. Despite the efforts and calls of the Parliamentary Assembly of the Council of Europe (PACE), the situation has not yet changed. This indicates that there is no pan-European consensus on the rules established by the Convention. Some member states have taken a more conservative stance on genome research and gene therapy opportunities, while others fear that the Convention could serve as a barrier to continuing important research (Kalinichenko & Kosilkin, 2019).

Chapter IV of this Convention is devoted to the human genome. It contains the following provisions: any form of discrimination against a person on grounds of his or her genetic heritage is prohibited (Article 11); tests which are predictive of genetic diseases or which serve either to identify the subject as a carrier of a gene responsible for a disease or to detect a genetic predisposition or susceptibility to a disease may be performed only for health purposes or for scientific research linked to health purposes, and subject to appropriate genetic counselling (Article 12); intervention seeking to modify the human genome may only be undertaken for preventive, diagnostic or therapeutic purposes and only if its aim is not to introduce any modification in the genome of any descendants (Article 13); use of techniques of medically assisted procreation shall not be allowed for the purpose of choosing a future child's sex, except where serious hereditary sex-related disease is to be avoided (Article 14).

The Convention establishes the following basic principle: the interests and good of the individual prevail over the interests of society or science. This rule raises the most difficult legal issues: what is a private interest and what is a public (general) interest? (*Publicum ius est quod ad statum rei romanae spectat, privatum quod ad singulorum utilitatem*). The problem of the ratio of private to public interest affects all areas of legal regulation. To what extent do the individual's interests dominate the interests of society? Is it possible to say unequivocally in genomic relations where the interests of an individual are, and where is the public interest? In particular, the famous pre-revolutionary Russian scientist I.A. Pokrovsky wrote about this problem in his immortal work *Main Problems of Civil Law*. Society as a whole has its own interests, which are completely and somewhat in conflict with the interests of certain individuals. There are various "antinomies between personality and society". Can society and the state put any interest above any individual interest, or among these latter there are those that, even for the state, should have absolute and irrefutable significance? Can it make any demands on the individual that he finds necessary in the interests of the "common good", or, on the contrary, are there such aspects of personal existence in which no external invasion is unacceptable? Is the "common good" in this sense the supreme ethical authority or, on the contrary, is it the subject to verification in terms of some other, even higher principle? (Pokrovsky, 2020, pp. 81-82).

Uncontrolled, ubiquitous activities related to the human genome should not be allowed. It seemed appropriate to establish a permissive type of legal regulation not only for the application of genetic technologies; collection, storage and use of genetic materials. Moreover, limitations are also required in

research activities. In fact, there are some, but is it enough? Therefore, it seems that a further “conservative” approach in terms of working with the human genome, which we mentioned a little earlier, will be reasonable.

The gene has become a source of national and social conflicts. Today, the development of technology has given rise to many problems related to the human gene and heredity, which are associated with the very nature of the genome. Some of these problems affect human social relations and pose a threat to the personality of an individual, for example, prognostic genetic tests; other problems threaten the future of our species (Pokrovsky, 2020).

7. Conclusion

It can only be expected what specific problems will humanity face, as well as the role of genetic technologies in solving these problems. Unless we have full objective, reliable and justified knowledge about the human genome, manipulations with it are dangerous. Conservatism in this matter is dictated by the concern about the potential negative consequences associated with genetic technologies. Besides, we need to recognize the positive aspects of genome research.

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