

## SOCIO-PHILOSOPHICAL DIMENSION OF EPIGENETIC RESEARCH

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In the last 20 years, epigenetics has evolved into a relevant and rapidly growing area of science. Scientific achievements in this area stirred interest among representatives of numerous socio-humanitarian disciplines, creating discussions at the legal, philosophical, political, social, cultural, medical, commercial and other levels. Thus, epigenetics is an outstanding example of a modern trend towards interdisciplinary trials as it is becoming a 'borderline object' of different sciences. In this article, the author analyzes the unfolding discussions regarding assessment of ethical, social and legal effects of epigenetics. Representation of epigenetics in mass media and science has been considered. Particular attention has been given to the reasons for epigenetic antideterminism. The epistemic value of epigenetics offers a different perception of some fundamental concerns such as the nature-upbringing/nurture dichotomy, appropriate social politics, in particular, in the area of health, ethical contradictions when assessing harm and benefit, collective and individual responsibility (especially parental one), and the issue of non-identity. The author notes that in spite of the potential of epigenetics in personalized medicine, the exceptional phenomenon of epigenetics should be treated with caution due to early stages of the research and insufficiency of empirical data. Unreasonable extrapolation of epigenetic regulation to the sociocultural life can result in false reductionist conclusions. Nevertheless, the author is quite optimistic about the perspectives of epigenetic studies.

**Key words:** bioethics, epigenetics, ELSI, theory of justice, political theory, determinism, responsibility

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## СОЦИОФИЛОСОФСКОЕ ИЗМЕРЕНИЕ ЭПИГЕНЕТИЧЕСКИХ ИССЛЕДОВАНИЙ

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Эпигенетика в последние 20 лет превратилась в актуальную, активно развивающуюся отрасль научного знания. Научные достижения в данной области вызвали интерес представителей множества социогуманитарных дисциплин, сформировав дискуссии на нескольких соответствующих уровнях: правовом, философском, политическом, социальном, культурном, медицинском, коммерческом и пр. Таким образом, эпигенетика становится одним из ярких примеров современной тенденции к междисциплинарным исследованиям, став «пограничным объектом» разных наук. В данной статье автор анализирует разворачивающиеся дискуссии в оценке этических, социальных и правовых последствий эпигенетики. Рассматривается репрезентация эпигенетики в СМИ и науке, отдельное внимание уделено причинам формирования представления эпигенетики как «антидетерминистской». Эпистемическое значение эпигенетики позволяет по-новому обратиться к ряду фундаментальных проблем: дихотомии природа-воспитание, вопросам о справедливой социальной политике, в частности, в области здравоохранения, этическим противоречиям в оценке вреда и пользы, коллективной и индивидуальной ответственности (особенно родительской), «проблеме неидентичности». Автор отмечает, что несмотря на потенциал эпигенетики в персонализированной медицине, к феномену эпигенетики, как исключительному, следует относиться с осторожностью ввиду ранних этапов исследования и недостаточности эмпирических данных. Неоправданная же экстраполяция эпигенетического регулирования на социокультурную жизнь может приводить к ошибочным редукционистским выводам. Тем не менее он оптимистично смотрит на перспективы эпигенетических исследований.

**Ключевые слова:** биоэтика, эпигенетика, ELSI, теория справедливости, политическая теория, детерминизм, ответственность

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Academician Frolov IT wrote as follows: 'Biological cognition, just like any other cognition, is a deeply social subject and object interaction process, during which complex social and ethical research principles have been elaborated for centuries' [1].

The Human Genome Project launched in 1990 let us hope for a new paradigm of personalized medicine, use of genome-coded information to prognosticate occurrence of diseases, an individual approach, and analysis of susceptibility to some therapy. Though not all HGP expectations have become a reality, the research activity aimed at ethical, legal and social effects or aspects (ELSI and ELSA respectively) was a trend towards complexity, transformed approach to human examination, where philosophy accomplishes an integrative function. Such discipline as bioethics serves as an example.

All the enumerated above was true for a relatively new branch named epigenetics. In spite of being frequently opposed to its 'elder sister', it inherits many features of socio-humanitarian expertise.

In a wider sense, epigenetics examined the inherited changes in gene expression not associated with the changed DNA sequence. The mechanisms of epigenetics commonly mean DNA methylation, modified histones and microRNA with every enumerated process having a unique dynamic pattern and can alter the genome function under the exogenous effect [2]. It is worth noting that during the last 20 years, epigenetics hasn't lost the relevance and also formed a special field of research, which can be characterized both as very promising, and controversial.

The term 'epigenetics' was first used by Conrad H. Waddington in 1942 to determine 'the mechanisms used by genes to induce phenotypical signs' [3]. The images of epigenetics have been significantly modified since that time due to development of molecular biology. It was transformed into a multi-faceted field of various trials, including examination of interrelations between the internal effect and DNA methylation, histone modifications, dependance of diseases on epigenetic options, and specific intergenerational inheritance of epigenetic mechanisms.

Scientific achievements in this area have attracted attention of different scientists and stakeholders with discussions at the medical, philosophical, legal and commercial levels. Positions regarding epigenetics are commonly divided into optimistic, the ones that consider a bunch of possibilities and advantages, which can be provided to the human being by such a discipline, neutral and cautious, which discuss potential risks associated with development and implementation of epigenetic technologies and its explanatory capabilities into different spheres of life.

Meanwhile, epigenetics is one of the brightest modern examples of the implementing trend towards inter- and transdisciplinarity, and uniting philosophers, doctors, sociologists, lawyers, anthropologists, etc. into one group. Epigenetics is considered as a possibility to unite isolated disciplines because the research object includes both cultural and biological context. It becomes a borderline link, suggesting that different methodology trends can have innovative forms of cooperation.

#### REPRESENTATION OF EPIGENETICS IN MASS MEDIA AND SCIENCE

Perspectives and emotional content of epigenetics can be explained due to a breakthrough in the explanation of gene expression plasticity, comprehending how environmental factors can inheritably influence the phenotype, but not the genotype. Epigenetic trials undermine the 'gene-feature' and 'genotype-phenotype' rigid reductive structure, rejecting the gene causality with reference to such a feature of biological systems as emergence, i. e., ignoring the traits of separate portions or structural elements.

It is noteworthy that active development of this area for the last twenty years evoked a ready response and was widely covered in media [4]. Representation of the wide audience is built on the mentioned opposition to genetics. In the public discourse, the last is characterized as strictly determined, passive and not exposed to environmental effect, whereas epigenetics is represented as space for dynamics and even personal enhancement. The main feature that shaped such an opinion is reversibility of epigenetic changes and their dependence on the way of life and environment (with reference to the issue of determining the environment as it is). The two terms are defined in a vague and wide way, including 'everything around you', from ecological factors that influence the individual body to such behaviors as alcohol consumption, physical activity, smoking, nutrition, mental stress, sleep deprivation, constant stay in the sun, etc. [5]. The community is attracted by the biohacking potential of epigenetics described in mass media. Thus, it deprives us from the 'genetic destiny' and inheritance is no longer a prevailing factor of human life. In simplified forms, the methyl groups are expression ON/OFF switches, whereas histones are brightness ON/OFF switches. Mass media representation has a number of almost classical problems such as extremely concept

oversimplifying (both on the part of genetics, and epigenetics), formation of wrong expectations and conclusions that occur due to arbitrary interpretation of the researchers. However, the image is rather homogenous and is built on the opposition to genetic determinism and biological destiny, partially exposing controversial elements and extrapolations present in the scientific environment.

Researchers have different opinions. They, however, have high expectations, too. Epigenetics stimulates development of epistemic challenges. This is explained by a possible effect of science achievements in this area at several levels, integrating the positivistic, structural and social approaches in the research.

On the one hand, epigenetics can be considered as an argument against genocentric deterministic theories. On the other hand, it can serve as a counterargument to assertion that culture has primacy over nature. Thus, it can't solve the classic 'nature-nurture' dichotomy in favor of one party. It, however, provides for better comprehension of the uneasy or totally lacking difference between nature and upbringing, and makes the concepts of 'joint manufacture' (theory of gene-culture coevolution) more relevant.

It is true that epigenetics considers a genome as a biosocial construct during the 'post-genomic era' [6], and turns the gene used to be treated as stable or unchanged into a more plastic and flexible substance.

The particular value of epigenetics consists in taking an epistemic turn involving reestimation of social and biological links, better comprehension and emphasizing the importance of the first one, explaining the complex interrelations. The discipline states that external sociocultural and ecological factors are internalized into the body functioning by way of forming long-term biochemical changes.

These mechanisms can be conceptualized as a special human 'epigenetic history', embodiment of personal experience, surrounding reality, integrated at the molecular level. Being the new 'biologization' of sociocultural reality, it can be completely integrated into public discourses and practices. Knowing of epigenetic processes is a new focus on social and political space. Thus, epigenetic markers can be used as a proof of influencing social injustice in the past and subsequent life of a human being and descendants.

The position should, however, be taken with caution, as complex social processes reduced to biochemical processes can have a number of negative effects and support the deterministic thinking by means of epigenetics connection between epigenetic profiles and genotypes, their inheritance and, thus, influence on development of future generations.

#### EPIGENETICS AS A VECTOR OF PREVENTIVE HEALTHCARE AND SOCIAL POLICY DEVELOPMENT

Epigenetics also promotes better understanding the sources of diseases and health factors. This allows to use it as an additional argument in favor of subsequent development of preventive social practices, including the ones in the area of healthcare. Some researchers know that shedding light in close interrelation of the human body and environment, epigenetics makes it possible to expand the scope of bioethics coverage and include the environmental issues, public healthcare and social conditions [7].

Apart from that, epigenetics shows how an early life experience influences gene expression later in life, gradually providing access to understanding the necessary conditions of health improvement in children of the future. From the commercial point of view, epigenetics provides additional

proof of importance of social workers, enhancing the prestige and financing of these professions. Thorough examination of health social determinants can significantly improve preventive medicine by preventing a wide spectrum of diseases, including mental health disorders. Potential inheritance of epigenetic regulation increases the relevance of epigenetics even more, because if harm produced by social disasters and toxic effect influences future generations, implementation of preventive public strategies becomes urgently prioritized.

New biologization of social space implemented by epigenetics can modify the ideas of functioning of the society and political movements [8]. It has been mentioned that epigenetics is used as evidence of influence produced by social injustice and poor ecology on the biological inequality among people and even generations. This inevitably results in discussion of the discipline value for theories of justice. Thus, some researchers challenge the opposition of traditional approaches by J. Rawls concentrated on socially induced differences in vital possibilities and egalitarian theories, which include congenital or inherited biological inequality, which unjustly reduce and worsen vital possibilities by birth. Casting light on the mechanisms used to bring social injustice to life and for its transfer to children, epigenetics rejects the 'social lottery', eliminating the boundaries between the two mentioned concepts and synthesizing them. The role of countries in prevention of epigenetic factors is increased in this regard.

On the one hand, it can be an additional argument in favor of the social justice concept, demonstrating discrimination of poor people. Moreover, some researches show the influence of early life experience on gene expression at a later age; this can enhance development and lobbying the advanced political preventive practices to eliminate the biological inequality, which, first, reduces the living possibilities soon after the birth and, second, can be inherited by other generations. On the other hand, considering complex social issues from the biological point of view can result in undesirable effects. Problems can arise during an attempt to determine the 'ideal' epigenomes because of high contextuality of the discourse. In this regard, epigenetics follows its 'elder sister', genetics. Complex determination of ideal or 'normal' genomes is followed by an equivalent issue assessing reference epigenomes, as it is not always possible to differentiate between epigenetic options leading to a higher risk of certain diseases and options which constitute a favorable biological adaptation to specific context of development at this very stage [9]. Irregularity and reversibility of epigenetic changes in different cells found during different periods of time hinder the analysis.

Thus, environmental conditions can be favorable for the entire population, but detrimental for a certain group. This brings up the question of the borders between the possible political intervention and epigenetic control. If epigenetic programming improves the individual adaptation to own context, the universal politicians can induce unintentional harm. Injustice is associated with a group membership, but not with epigenetic signs, which turn into shortcomings under certain conditions.

Moreover, the model of racial differences in health (prevalence of premature labor and cardiovascular diseases among African Americans) proposed by some researchers, generates a separate ethically problematic field as related to biological comparisons among any social groups. Epigenetic researches can provide a new idea of long-term effects of discrimination views, discourses, practices and social structures on health and well-being of certain populations. However, there is a risk of occurrence of reductionistic and fatalistic views on expression of genes, which, in its turn, gives

birth to the view about the 'excessive' or critical epigenetic damage of some people. This makes related preventive social policies unsuccessful. The ideas can increase discrimination among groups of population, resulting in greater marginalization and stigmatization of certain groups. So, epigenetics can form a new basis for reproduction and consolidation of differences in the society and preserving biological inferiority of the poor or marginalized levels of the society.

In spite of what was mentioned above, it is worth noting that incorrect generalizations in the representation of epigenetics, especially within socio-humanistic disciplines, exaggerate the explanatory capacity of epigenetic mechanisms. The specific 'rhetoric of the future' displayed throughout the entire technocratic discourse and reliance upon prediction and control as the principal epistemic values promote instrumental conceptualization of epigenome and supply epigenetic factors with a unique discreteness, which can be misleading as well. The researchers should be careful about similar 'mythologization' of epigenetics.

#### EPIGENETIC RESPONSIBILITY

Epigenetic responsibility, which is opposed to collective and individual moral responsibility for epigenetic health, stands as a separate issue [10]. This leads to discussion regarding how and when people can estimate their own epigenetic risks and risks for their children. Moreover, a question about assessment of epigenetic harm inflicted in the result of voluntary and conscious actions (which is a separate concern) was posed directly.

The metaethical issue of 'non-identity', which raises a question about the ethical preference of any action aimed at the future generations, is singled out specifically. It concerns epigenetic preconditions of birth and its unique environment. Epigenetic and genetic trials [11] display a specific temporality of conception and birth, unpredictable situation with a certain individual. Epigenetic responsibility of parents consequentially results in the ethical responsibility of all parents to reproduce the best offspring, follow the principle of reproductive benefit and partial negation of reproductive freedom, stigmatizing and depreciating the life of sick people. Not every life, but only the life with a certain degree of well-being, is worth living then. As a result, assessment of benefit and harm of existence is difficult.

Characteristics of both anti-deterministic or non-deterministic epigenetics can be hasty and incorrect, as it is based on simplification of epigenetics and genetics it is opposed to. The opposition consists in determination of the research language for this discipline. Apart from that, epigenetic determinism can be considered in some cases, for instance, perinatal or pediatric effect can be called as predetermined as separate genes. In its turn, epigenetic determinism can result in discussion of confidential data about epigenome, similar to debates on the access to genetic data. Some epigenetic data can be of great concern, as they present information not just about the risks of current diseases, but also about the previous way of life. So, microRNA expression profiles found in the blood can be compared to a certain individual with a probability of 90% [12]. This can result in effects that will prevent researches and medical practice.

Use of epigenetics in law is of note as well. It can enable tracing the harm due to the effect of chemical substances. Here, 2 issues arise: first, qualitative assessment of the rate of epigenetic harm is difficult; second, the latent time until occurrence of exposure symptoms can exceed the period of limitations. Development of long-term neurological and mental

effects of epigenetic harm can still result in reinterpretation of criminal responsibility.

Certainly, epigenetics influences the reproductive sphere. Thus, the area of 'maternal effect' is being expanded; not just the reproductive period, but also lives of mothers prior to childbearing is analyzed, which is interpreted with some caution, as the maternal body considered as the 'epigenetic vector' can intensify control over women. The assisted reproductive technologies and surrogate maternity, which influence the epigenetic programming and health of future children, are considered as well. Thus, the ethical issue about the controversy between the reduced risk of congenital diseases, abnormalities and reproductive autonomy has been raised.

## CONCLUSION

In the future, epigenetic testing can open up new possibilities for personalized medicine, enabling to use epigenetic markers for more effective early detection, diagnostics and prognostication of diseases including cancer, cardiovascular, respiratory and neurodegenerative diseases, and individual selection of the most effective medications that involve epigenetic mechanisms (pharmacoeugenetics) [13].

Thus, the value of epigenetics for public well-being and health can't be overestimated, as the discipline is still in an embryonic stage. Unconditional proof of an epigenetic trial in humans is currently lacking. It is necessary to solve a

very important metaethical issue regarding prescriptive and standardized value of epigenetics empirical data.

Considering all the above, a number of basic issues of epigenetic trials for socio-humanitarian disciplines can be mentioned [14]:

1. Nature-nurture dichotomy.
2. Biologization of social space.
3. Public healthcare and preventive strategies.
4. Reproductive policy and parental responsibility.
5. Political theory (theory of justice in particular).
6. Stigmatization and neoeugenics.
7. Confidentiality protection.
8. Legal advice.

The exceptionality of epigenetics postulated by some researchers doesn't prove itself, as epigenetics discourse is rather an important extension of ideas that have already been spread in genetics. The area of research is a typical example of the growing trend towards the new synthesis of human interdisciplinary research and overcoming reduction in the process of comprehension, with an important role being played by philosophy and bioethics, in particular [15]. The author also sincerely hopes for subsequent development of these problematic fields, especially by the Russian researchers, as the socio-humanitarian concerns of epigenetics are poorly highlighted in Russian literature. Development of potential effects of epigenetic trials can add to and enhance ideas of ethical, social and legal theories.

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