были освобождены от омертвевших участков, сшиты и помещены в сосуд с быстро заживляющей жидкостью Б314, соответствовавшей соматическим особенностям организма. После этого Аф Нут приступил к самому трудному. Он извлек из подреберья почерневшую, проткнутую осколками ребер печень и, пока ее держали на весу ассистенты, с поразительной уверенностью отпрепарировал и вытянул тонкие ниточки автономных нервов симпатической и парасимпатической систем. Малейшее повреждение самой тонкой веточки могло повести к необратимым и тяжелым разрушениям. Молниеносным движением хирург перерезал воротную вену, подключив к обоим ее концам трубки искусственных сосудов. Сделав то же самое с артериями, Аф Нут поместил печень в отдельный сосуд с жидкостью Б3. После пятичасовой операции все поврежденные органы Рен Боза находились в отдельных сосудах. Искусственная кровь текла в сосудах его тела, подгоняемая собственным сердцем раненого и вспомогательным дубль-сердцем – автоматическим насосом. Теперь стало возможным выжидать заживления извлеченных органов. Аф Нут не мог просто заменить поврежденную печень на другую из хранившихся в хирургическом фонде планеты, так как для этого нужны были дополнительные исследования, а состояние больного не позволяло терять лишней минуты [5].

After the necessary period of the organs purification and restoration, the next surgery was necessary, during which all the cleaned and restored organs would be placed back into the body, until then kept in pharmacological coma. As the leading surgeon observes about his patient Ren Bos:

– Очнуться он не может. Разве мы столь тупы, чтобы не предусмотреть этого?

– Сколько надо ждать?

– Четыре-пять дней. Если биологические определения точны и расчеты правильны, тогда можно будет оперировать снова, поместив органы обратно. Потом – сознание...[5].

The present paper analyses the Histories of the Future *The Shape of Things to Come* by Herbert G. Wells and *The Andromeda Nebula* by Ivan Yefremov. These utopias represent important examples of some possible ways of scientifically informed long term development of the human species. Biological sciences and biotechnologies play an important role in both utopias. The research focuses on the abovementioned issues of bioethics, relative to genetic engineering and transplantation, as well as analyses some other bioethical problems raised in the science fiction texts under consideration.

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SOME ACUTE PROBLEMS OF BIOETHICS RAISED IN THE SOVIET SCIENCE FICTION LITERATURE

О НЕКОТОРЫХ АКТУАЛЬНЫХ ПРОБЛЕМАХ БИОМЕДИЦИНСКОЙ ЭТИКИ В СОВЕТСКОЙ НАУЧНОЙ ФАНТАСТИКЕ

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This research focuses on various issues of biomedical ethics raised in the science fiction novels *The heart of the Dog* by Michail Bulgakov and *The head of Professor Dowell* by Alexander Belyaev. The paper analyses such concepts of bioethics and biomedical ethics as the problem of equality in medicine, the understanding of fundamental concepts of life and death, patient's consensus for medical treatment, reanimation etc.

Статья посвящена некоторым наиболее актуальным вопросам биомедицинской этики в произведениях советской научной фантастики – на примере романов Михаила Булгакова *Собачье Сердце* и Александра Беляева *Голова профессора Доуэля*.

Keywords: science fiction, bioethics, medical ethics, cloning, transplantation, genetic engineering, Michail Bulgakov, Alexander Belyaev, *The Head of Professor Dowell*, The *Heart of a Dog.*

Ключевые слова: биомедицинская этика, биоэтика, клонирование, трансплантация, научная фантастика, Беляев, Булгаков, Собачье Сердце, Голова профессора Доуэля.

In the broadest sense, medical ethics is the study of moral values and judgments as they apply in the field of medicine. The four main moral principles and commitments used by medical ethics are: justice, respect for autonomy, beneficence and non maleficence. Using these main principles and thinking about what the physicians' specific concern is for their scope of practice can help physicians make moral decisions. Moreover, as a scholarly discipline, medical ethics embraces both the practical application in clinical settings and the research work on its history, philosophy, theology, and sociology.

Sometimes medical ethics and bioethics are used as interchangeable terms, while it is necessary to bear in mind that in the first place, medical ethics tends to be understood as an applied professional ethics. Bioethics, on the other hand, is used in a much broader sense. It deals also with the philosophy of science and various issues of biotechnology, such as cloning of various organisms and body organs, organ transplantation, etc.

As a matter of fact, medical ethics and bioethics very often do overlap, and the distinction is due more to a matter of style than professional consensus. It is important to keep in mind though, that medical ethics shares many principles with other branches of healthcare ethics, for example, it is related to nursing ethics. In general, a specialist in bioethics assists the health care and research community in examining a broad spectrum of moral issues involved in our understanding of life and death. He contributes to resolving various ethical dilemmas in medicine and science. For example, bioethicist can discuss and analyse various issues related to cloning, transplantation, as well as the topic of equality in medicine, the intersection of medical care and cultural practices.

As far as cultural practices are concerned, it is a common knowledge, that arts and literature often represent and manifest cultural values and practices of the society. Very often, arts and literature raise issues relative to medical ethics and bioethics. This is especially true in the case of science fiction literature, which is one of the few literary genres very closely concerned with the analysis and improvement of the human society. As a matter of fact, any significant work of science fiction can be viewed as a kind of a scientific research laboratory in which the important trends in the development of the society are studied, analysed and extrapolated to an imaginary world for further analysis. Science fiction has been always actively involved in the discussion of such acute issues of biomedical ethics as cloning, transplantation, equally in medicine, concept of life and death, artificial conception, artificial intelligence, longevity, immortality, personal experience and memory processing, correction, storage and uploading, and many other related issues.

For many millenniums, the humankind has been striving to discover the secrets of the eternal life, or at least tried to make human life less dependent on the limitations of the human physical body, like diseases and disabilities. However, this desire, besides raising many medical and scientific issues, has posed many ethical and philosophical problems as well. Literature, and especially science fiction literature, has been faithfully reflecting and documenting all these long-lasting debates. Suffice it to say, that the first issues, related to bioethics date back probably, to the times when the Bible was written and in particular, to the moment of creation of the first human being, as well as the subsequent creation of a female from a man's rib and many other biomedical issues. Also, *The Epic of Gilgamesh* contains some bioethical issues.

A great number of bioethical issues were raised in one of the first science fiction novels, *Frankenstein, or the Modern Prometheus* (1818) by Mary Shelley. This novel has influenced many important writers and has forever changed the emerging genre of science fiction. It is often considered to be one of the first science fiction novels, in which the genius of the impressively young eighteen year old female writer sketched the impressively great number of problems to be discussed in the coming centuries by the genre of science fiction. This great novel owes its everlasting significance to the thorough and profound treatment of many important issues, such as the mystery of life creation, the bioethics and biomedical ethics, etc. Due to Mary Shelley's genius, her daring moral and intellectual honesty in the treatment of many scientific and moral issues, the novel was far ahead of its epoch and was banned for some time, especially for the religious and bioethical problems raised in it. Among the most important philosophical, ethical, and moral issues treated are the moral and ethical responsibility of scientists, consequences of a scientific research and discovery in biomedical field. For a very long time, Mary Shelley has been accused of describing inhuman scientific experiments, contradicting the will of God. However, a careful analysis of the novel reveals that the main motivation for the creation of a new human body was to defeat death and to eliminate fatal deceases. The scientific motivations of Dr. Frankenstein were more than noble; he wanted to abolish pain and suffering due to death and the loss of the loved ones.

Mary Shelley faithfully presents the dialectics of complex internal conflicts and motives struggling with each other within Victor Frankenstein's soul while he was working on his Creature. The writer demonstrates that from the very beginning Dr. Frankenstein strived to obtain the powers of creation. He admits: "It was the secrets of heaven and earth that I desired to learn, […] my inquiries were directed to the metaphysical, or in its highest sense, the physical secrets of the world". He was eager to "pioneer a new way, explore unknown powers, and unfold to the world the deepest mysteries of creation". Dr. Frankenstein reveals to us: "Life and death appeared to me ideal bounds, which I should first break through, and pour a torrent of light into our dark world". Victor also became utterly interested in the elixir of life. He was thinking about the raising of ghosts or devils, which was a promise liberally accorded by his favourite authours like Agrippa or Paracelsus. However, Victor's motivation were also rather noble: he wanted to "banish disease from the human frame and render man invulnerable to any but a violent death!" Are these not the same noble ideas, which later motivated many genetic engineers and prominent doctors? In the times of Mary Shelley, these ideas were rather revolutionary; she was one of the first writers to introduce these issues from such point of view.

Exploring the deepest mysteries of creation, Dr. Frankenstein is guided in his activities by noble motives, according to his own point of view. "If I could banish decease from the human frame and render man invulnerable to any if violent death! […] A new species would bless me as its creator and source; many happy and excellent natures would owe their being to me".

With great artistic skills and psychologism, Mary Shelley genially describes Dr. Frankenstein's sufferings after the death of his mother and explains that it is exactly this trauma, which catalysed his scientific experiments with human cadavers and their reanimation. Who could understand these sufferings better than a young and fragile Mary Shelley, who already lost her mother and a baby; who could be more knowledgeable about this obsessive desire to bring a dead loved body back to life? With the same great artistic skills and impressive psychologism, Mary Shelley genially describes Frankenstein's Creature's sufferings, his blood chilling loneliness, his bitter realization of the cruelty and injustice of the human species, as well as his painful understanding of the futility of his life, since he did not ask anybody to create him and to forcefully place him into the cruel world of humans, and many other issues.

Alongside with the leading theme of the creation, *Frankenstein* treats many other important issues raised by the problem of creating a humanlike being. Among the most important philosophical, ethical, and moral issues are the moral and ethical responsibility of a scientist, consequences of a scientific research and discovery, physical and moral sufferings of the objects of irresponsible scientific experiments, terrifying loneliness of these creatures and their spiritual strivings. All these issues are even more important nowadays, than at the times when they have been raised for the first time two hundred years ago in *Frankenstein, or the Modern Prometheus* by Mary Shelley, as the analysis of the novels by A. Belyaev, M. Bulgakov clearly demonstrates.

This great novel celebrates nowadays its bicentennial anniversary, and in these two centuries, biomedical sciences and technologies have made a great progress. In the meantime, also the number of moral and ethical issues related to this progress, has been drastically increased and constantly discussed in the society, arts and literature.

Russian and Soviet science fiction writers also have made their great contribution to the debates on the issues of bioethics, continuing the traditions of Mary Shelley, H.G. Wells, and other great science fiction writers, who raised these issues in their science fiction novels. Many Russian and Soviet science fiction writers made their great contribution to the discussion on the equality in medicine, on cloning, transplantation, immortality and other important issues, actively discussed by the world community.

Let us start the analysis of the novels from *The Heart of a Dog* by Michail Bulgakov. The novel narrates the life of a street dog, transformed by Dr. Bormental and Professor Preobrazhensky into a human being Sharikov during a scientific experiment of a body rejuvenation and then back to a dog again. Hence, in the novel, Bulgakov creates an estranged, alternative world, namely, an imaginative framework, alternative to the author's empirical environment by introducing as *novum* to the 'zero world' the experimentally produced super-intelligent dog, which gradually turns into a man. The choice of the super-dog/human being as the *novum* is not incidental and serves different cognitive purposes in the novel. In this way, Michail Bulgakov raises a series of important bioethical issues relative to new biotechnologies, namely, the experiments concerning body rejuvenation, transformation of the species, etc.

Surgeons Professor Preobrazhensky and his disciple and assistant Dr. Bormental were making their living by making people look younger. One of their scientific innovations was the idea of the transplantation of a human hypofis gland, which is responsible for the production of various hormones. However, during one of the experiments, they achieved not only a desirable rejuvenation of the species, but a complete transformation of one species into another one, that is, a dog into a human being. This event becomes a key point in the story of Sharik/Sharikov. This surgery may be considered an artificial enhancement of the species, the theme which is so widely being discussed now by the scientific community and society in general. Since the general practice in medical and biotecnological sciences is to use animals for the experiments, and that Dr Bormental and Professor Preobrazhenski were working to rejuvenate people, we can easily suggest that the next step would be artificial enhancement of the human species. At the times of Bulgakov, such experiments were also closely related to eugenics, or to genetic engineering as it is defined today.

Obviously, at least as far as it follows from the events in *The Heart of the Dog*, Michail Bulgakov is rather careful about the use of eugenics. The results of the innovative surgery on the dog Sharik clearly demonstrate a very high potential of this field of knowledge for the human species, as seen by the eyes of the trained doctor (as we said, Bulgakov was a doctor by profession). However, constant criticism of the newly emerged human creature by his surgeons (Bormental and Preobrazhensky) may signify not only the social and political criticism of Bulgakov, but also his social and scientific concerns about the wide use of eugenics and responsibility for such scientific experiments.

The Heart of the Dog by Michail Bulgakov continues the great traditions of Mary Shelley and raises many important issues related to the field of biomedical sciences and bioethics. Moreover, the experiments of Dr Bormental and Professor Preobrazhenski foresaw some actively discussed issues on the genetical engineering and the improvement of human species that are only now being actively discussed and investigated by the scientific community. Their research belongs both to the fields of experiments on animals and human beings; they are still very important also nowadays. Even today, there are still ongoing debates in the society about the legitimacy and moral rights of experiments on animals in medicine, pharmaceutics, cosmetics industry, etc. It is important to emphasize, that Michail Bugakov raised all these problems almost a century ago. In the novel, Bulgakov also focused on such important problems of bioethics, as relations between different species and species mutations and transformations. The author meticulously describes the gradual transformation of the

dog into a new human being, as well as the role of genetics, eugenics, education and instruction in this process. Bulgakov also focuses on the legitimacy of such transformations, the responsibility of scientists during these experiments, the destiny of the creatures produced during such scientific experiments, their sufferings and confusion. Interestingly enough, that a similar state of such a mental, psychological and moral confusion of patients after organ transplantation were reported by various scholars not so long ago, well after the novel was written. It is important to emphasize, that a great deal of the novel is also dedicated to the description of the relations and conflict between real humans and a newly created Sharikov.

The novel *The Head of Professor Dowell* by Alexander Belyaev skilfully develops some major problems of bioethics, already sketched by Mary Shelley in *Frankenstein*, alongside with more recent ones. The novel is inspired by some research and attempts of various organs transplantation, which have been taking place since 1900. This brilliant novel raises not only medical issues relative to this type of transplantation but also focuses on a wide range of moral and ethical issues of head transplantation as being drastically different from any other type of transplantation from the point of view of medicine, morals and ethics. For example, death is usually associated with the irreversible brain damage caused by various reasons, like heart failure, lung failure, etc. However, the novel *The Head of Professor Dowell* demonstrates that this issue is not that clear and unequivocal and views it from several different viewpoints. Technically, Professor Dowell is alive, since his brain is still functional; however, he us not auto sufficient and can not make any decision on his own. So, is he really alive after all? Also, during head transplantations, who inherits the legal rights of the body: the owner of the head or the owner of the body? These are only few of the dozens of bioethical issues raised by Belyaev and polyphonically developed in the novel, outlining different directions of the research in the field of transplantation, life supporting systems, reanimation techniques, as well as moral and legal issues related to these problems.

Isolation, loneliness and alienation becomes one of the biggest problems for the creatures obtained during the scientific experiments described in the novels The Head of Professor Dowell by Alexander Belyaev, The Heart of the Dog by Michail Bulgakov, as well as in *Frankenstein, or the Modern Prometheus* by Mary Shelley.

The Creature, the demon of Dr. Frankenstein suffers from loneliness and asks Victor to create a female companion for him; he gets furious and desperate when the scientist refused to fulfil his request. Similarly, after the experimental surgery that leaves only his head alive, Professor Dowell feels lonely and isolated in the world of humans. He is kept prisoner by his cruel and fame thirsty colleague, who mercilessly exploits Dowell's scientific potential and his inability to move, since his head was connected to the life maintaining systems. Professor Dowell clearly perceives his loneliness and uniqueness in the human world more and more clearly: he definitely feels infinitively lonely and desperate, almost as lonely and desperate like the Creature of Frankenstein. The situation seems slightly better for Sharikov, since he seems to integrate into the society he was forced to live in. However, after a careful analysis it becomes clear that he is being used by some people due to his low intellectual level, which in its turn, is due to the way he was produced. Sharikov is strictly controlled by his creators, Dr Bormental and Professor Preobrazhensky, he is deprived of freedom to have a partner, friends, documents, etc. Finally, the most obvious demonstration that Sharikov was absolutely deprived of any freedom and any legal rights (moral rights and rights for self determination included) is the fact that he was finally destroyed as a person and turned into a dog again. It is important to emphasize that both of these surgeries took place without his conscious agreement and permission. The same absence of any conscious consent for the surgery we observe in the case of Professor Dowell and the Creature of Dr. Frankenstein. The novels also raise the problem of a conscious agreement of a patient to any surgery he/she has to undergo These and other facts as well, projected back to the zero world, may signify that scientists, in fact, must think very carefully about the consequences of their experiments in order not to cause unnecessary sufferings to created beings. This problem was acute not only in the times of Mary Shelley, but it is even more acute now, especially when one thinks of cloning, genetic experiments, artificial intellect, cyborgs, etc. All these topics are widely explored by the genre of science fiction but Mary Shelley was among the first pioneers in the field.

Alongside with the loneliness of newly created human-like beings, the above mentioned science fiction authors consider the problem of the relation between these creatures and the humankind in general. The authours emphasize that these relational problems are mainly due to the irresponsible behavior of the scientists who undertook their experiments without taking into the consideration all the possible negative consequences both for the creatures and for the humanity they had to interact with.

As a matter of fact, most of the big developments in organ transplantation have taken place within the past forty years. The first really successful human organ transplantation took place in 1954. Actually, it was performed by Joeseph E. Murray and his colleagues at Peter Bent Brigham Hospital in Boston, when the first truly successful kidney transplant from one twin to another was done. However, already almost thirty years before that date, both novels by Bulgakov and Belyaev were anticipating not only such possibilities from the point of view of medicine and science in general but were going even further in raising and discussing bioethical and moral issues relative to organ transplantation. While many doctors were working on the research and practical feasibility of these projects of transplantation, cloning, etc, other great minds of the planet were researching various moral and philosophical issues related to these scientific practices. Hence, by sketching such a wide range of bioethical issues in their novels, Bulgakov and Belyaev, as well as other prominent science fiction writers that focused on the issues of biomedical ethics, tried to attract the attention of the wide audience to the discussion and analysis of these very important issues and to sensibilize society to these problems. The milestone achievements of medical sciences in the fields of transplantation, cloning, artificial intelligence and their combination can be a very potent life-preserving and disability repair instrument. However, as any instrument, it can be also used for

evil purposes, motivated by the human aggression, greed and egoism. Thus, the task of everyone related to the fields of bioethics and medical ethics (writers, artists and philosophers included) is to create a set of concepts that allow the use of the transplantation, cloning, artificial intelligence and their combination only to the benefit of the human species, by provoking wide discussions, referendums, etc.

Thus, the latest advances in biotechnical sciences have inevitably raised various legal and ethical issues related to cloning, organ transplantation, stamina cells, as well as the topic of equality in medicine, the intersection of medical care and cultural practices, etc. The paper under consideration analyses the novels by Michail Bulgakov *The Heart of the Dog* and *The Head of Professor Dowell* by Alexander Belyaev through the prism of ethical, moral and philosophical issues related to biotecnological sciences. The research aims at demonstrating that already at the early stage of development of biomedical sciences, almost a century ago, these prominent science fiction writers posed moral and ethical questions related to the progress of biotecnologies, which are only now being widely discussed in the society. Suffice it to mention *The Altered Carbon* by Richard Morgan (2002), *Spares* by Michael Smith (1997), etc.

The importance of the novel by Belyaev, as well as *The Heart of a Dog* becomes even more obvious with reference to the resent practical research by Italian surgeon Dr. Sergio Canavero in the direction of alive human-to-human head transplantation. Dr Canavero's activities bring the daring Belyaev's concept of the head transplantation, one more step closer to the reality, as well as make the bioethical issues raised in the novel *The Head of Professor Dowell* very important even nowadays, though very soon this great novel celebrates its centenary.

It is worthwhile to emphasize, that the novel *The Head of Professor Dowell* can also acquire some new modern interpretation due to the recent advances in the creation of the artificial intelligence, as well as due to the new possibilities achieved in the personal experience and memory storage, processing, transfer, etc. Earlier, all these operations were usually associated only with the brain functions, and hence, considered possible only by means of head transplantation. Thus, also these scientific technologies and advances introduce new meaning to the already existing number of bioethical and biomedical issues relative to organ transplantation, discussed in the above-mentioned novels by Michail Bulgakov and Alexander Belyaev.

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БИОЭТИЧЕСКИЕ АСПЕКТЫ ВНЕДРЕНИЯ ИННОВАЦИОННЫХ НАНОТЕХНОЛОГИЙ В ГЕНЕТИКУ И МЕДИЦИНУ И ОХРАНА ЗДОРОВЬЯ НАСЕЛЕНИЯ

BIOETHICAL ASPECTS OF THE APLICATION OF NEWEST NANOTECHNOLOGIES IN GENETICS AND MEDICINE AND PUBLIC HEALTH PROTECTION

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Сегодня нанотехнологии широко распространены, и сфера их применения продолжает расширяться. В то же время непредсказуемость последствий применения многих новейших нанотехнологий, особенно в биомедицине, предполагает тщательную предварительную оценку рисков обратного, негативного их воздействия. Оно направлено на защиту экологии человека, охрану здоровья и жизни людей. Защита прав и достоинств человека в связи с применением современных достижений науки и техники в биологии и медицине, что особенно актуально сегодня, послужит делу защиты людей от негативных последствий современных технологий.

Today, nanotechnology is widespread and their scope continues to expand. The unpredictability of the consequences of using many of the newest nanotechnologies, especially in biomedicine, suggests a thorough