

BIOETHICAL ASPECTS OF STEM CELL APPLICATION IN MEDICINE

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Анотация

Владислав Сищенко. Биоетични аспекти на използването на стволовите клетки в медицината. Това изследване анализира основните биоетични аспекти на използването на стволовите клетки в съвременната биомедицинска област. Проследено е историческото развитие на клетъчните технологии, характеризирани са ембрионалните, индуцираните плурипотентни и мезенхимните стволови клетки, както и техният терапевтичен потенциал и особеностите на приложението им от биоетична гледна точка. Основно внимание е отделено на морално-правните проблеми, свързани с получаването на ембрионални стволови клетки, безопасността на клиничното им приложение, въпросите за зачитане на човешкото достойнство, рисковете от комерсиализацията на клетъчните технологии, защитата на личните медицински данни и осигуряването на справедлив достъп до иновативни методи на лечение. Разглеждат се предимствата на индуцираните плурипотентни и мезенхимните стволови клетки като етично по-приемливи алтернативи, същевременно се подчертава необходимостта от по-нататъшни изследвания върху тяхната ефективност и безопасност. В заключението се посочва, че развитието на клетъчната терапия изисква комплексна нормативно-правна уредба, спазване на принципите на биоетиката и намиране на баланс между научния прогрес, защитата на правата на човека и обществените интереси.

Ключови думи: биоетика, стволови клетки, ембрионални стволови клетки, индуцирани плурипотентни стволови клетки, мезенхимни стволови клетки, клетъчна терапия, медицинско право, биомедицински технологии

Анотація

Сищенко Б. Г. Біоетичні аспекти використання стовбурових клітин в медицині. У даній розвідці проаналізовано основні біоетичні аспекти використання стовбурових клітин у сучасній біомедицинській галузі. Висвітлено історичний розвиток клітинних технологій, охарактеризовано ембріональні, індуковані плурипотентні та мезенхімальні стовбурові клітини, а також їхній терапевтичний потенціал і особливості застосування з біоетичного погляду. Основну увагу приділено морально-правовим проблемам, пов'язаним з отриманням ембріональних стовбурових клітин, безпечності їхнього клінічного використання, питанням поваги до людської гідності, ризикам комерціалізації клітинних технологій, захисту персональних медичних даних і забезпеченню справедливого доступу до інноваційних методів лікування. Розглянуто

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переваги індукованих плюрипотентних та мезенхімальних стовбурових клітин як етично прийнятніших альтернатив, водночас, наголошено на необхідності подальших досліджень щодо їхньої ефективності та безпечності. У висновку встановлено, що розвиток клітинної терапії потребує комплексного нормативно-правового регулювання, дотримання принципів біоетики та пошуку балансу між науковим прогресом, захистом прав людини й суспільними інтересами.

Ключові слова: біоетика, стовбурові клітини, ембріональні стовбурові клітини, індуковані плюрипотентні стовбурові клітини, мезенхімальні стовбурові клітини, клітинна терапія, медичне право, біомедичні технології

Abstract

Boleslav Syshchenko. Bioethical aspects of stem cell application in medicine. This research analyzes key bioethical aspects of stem cell application in the modern biomedical field. The historical development of cell technologies is highlighted, embryonic, induced pluripotent and mesenchymal stem cells are characterized, as well as their therapeutic potential and specifics of their application from a bioethical point of view. The main attention is paid to moral and legal problems related to the production of embryonic stem cells, safety of their clinical use, respect for human dignity, risks of commercialization of stem cell technologies, protection of personal medical data and ensuring fair access to innovative methods of treatment. The advantages of induced pluripotent and mesenchymal stem cells as more ethically acceptable alternatives are considered, while emphasizing the need for further research regarding their efficacy and safety. In conclusion it is established that the development of cell therapy requires comprehensive legal regulation, adherence to the principles of bioethics and the search for a balance between scientific progress, protection of human rights and public interests.

Keywords: bioethics, stem cells, embryonic stem cells, induced pluripotent stem cells, mesenchymal stem cells, cell therapy, medical law, biomedical technologies.

The concept of stem cells is fundamental to modern understanding of biology and is the direct key to the development of modern therapeutic methods. Their ability to renew damaged tissues and organs makes them especially promising in therapeutic applications: healing physical trauma, heart defects, and neurologic disorders, as well as the development of new treatment methods.

The use of stem cells in medicine poses a number of important ethical questions for science and society.

Stem cell application in medicine puts a set of important ethical questions for science and society, which require detailed discussion and further establishment of legal and moral boundaries. Since research in the area of stem cell technologies opens up new possibilities in treating otherwise incurable diseases, such questions of their use become more relevant, including questions in the context of bioethical aspects regarding their collection and use (Sprinsyan, 2021; Hyun, 2010).

The history of stem cell application in medicine finds its roots in the middle of the 20th century when researchers first began considering them as a potential source of novel discoveries in the area of therapeutics. As early as 1957, Donnel Thomas and the others have carried out the first allogenic blood marrow transplantation in humans. The concept of using stem cells for medical purposes has been positively received, despite the lethal outcomes of 6 patients in the span of 100 days since respective operations were carried out (Lendahl, 2022; Pronyaev, Voloshyn, Melnyk et al., 2021). After then, numerous operations and discoveries in the area of stem cell research have been made, all of which have been marred in ethical discussions regarding the preservation of human dignity and rights (Charitos, I. A., Ballini, A., Cantore, S. et al., 2021).

The question of ethics in such cases is being posed especially acutely with the application of human embryonic stem cells, procuring which first requires the destruction of an embryo. This yields numerous points of disagreement between scientists, human rights advocates, and religious figures.

Stem cells can be classified using several parameters: their origin, their ability to differentiate, and their developmental stage. Having alternative ways of procuring stem cells means their difference in ethical, legal, and moral aspects of use within medical and general application areas (Hyun, 2010).

Embryonic stem cells (ESCs) are collected from embryos during their blastocyst stage. These cells are pluripotent, which means that they can potentially become any cellular form within the organism. Since obtaining such cells requires first destroying the embryo, their use is the subject of numerous ethical and moral controversies. Scientists, who support the use of ESCs, highlight their major potential in treating serious and / or incurable diseases within the reach of modern medical practice. Such arguments, however, raise profound questions regarding the legal status of an embryo (Bilko, Malysheva, Budash, et al., 2012).

Induced pluripotent stem cells (iPSCs) are obtained from adult somatic cells – most often being derm cells or hematopoietic cells of the blood. By genetically reprogramming them to a pluripotent state, they gain the ability to differentiate into any type of cell, akin to embryonic stem cells, yet their application is commonly deemed to be more ethical in comparison, since they do not require a human embryo (Brenes, Griesser, Sinclair, 2024).

Mesenchymal stem cells (MSCs) can be obtained from different tissues in the body: blood marrow, fat tissue, umbilical cord, etc. They are restricted to their respective germ lines and can differentiate only into the cells, which are the direct cellular descendants of the tissue cell lineage, from which they have been derived. They have great potential in treating physical trauma, osteoporosis, chondromalacia, and other diseases of a specific organ system (Samsonraj, Raghunath, Nurcombe, et al., 2017).

Despite enormous potential, the use of all types of stem cells in research or treatment calls for a set of ethical questions. Questions regarding the application of stem cells in medicine can be divided into several general categories: moral and legal status of human embryos and fetuses, patient confidentiality, availability of stem cell therapeutic methods, and the problem of medical data as a product (Hyun, 2010; Boyko, 2009).

Unquestionably, the most controversial problem is the moral status of a human embryo, since the destruction of human embryos and germs to obtain stem cells for the sake of consumable material is traditionally unacceptable in a number of cultures and religious beliefs (Hyun, 2010). Critics of ESC use believe that the destruction of an embryo is ultimately unacceptable, because an embryonal cell has an inherent right to live, and, in similar views, is equivalent to any living person. They state that human life begins from the moment of conception, thus, the embryo must have the same set of rights as a born, conscious person. The opponents of ESC use also statement that resources in stem cell research should be redirected into researching induced pluripotent stem cells, and highlight the general inexpediency of ESC application when more ethical alternatives available (Boyko, 2009).

In our view, the technology of collecting iPSCs and MSCs seems to be more ethical, since it do not require the destruction of a human embryo. However, in this case, questions also arise regarding the effectiveness and safety of using such cells, because induced genetic modification can lead to mutations and oncogenesis (formation of tumors). This is exactly why the therapeutic application of iPSCs and MSCs is much more limited compared to ESCs, and additionally requires thorough research and regulation to ensure the safety of their use (Sprinsyan, 2021; Charitos, Ballini, Cantore, et al., 2021; Brenes, Griesser, Sinclair, 2024). Today, such regulation is either

completely absent or lacking (Lendahl, 2022).

Much time must pass before an effective legislative system of regulation the use of human stem cells in research and therapeutic applications would be form. Legalizing the use of stem cells may lead to quick commercialization, and then medical practices (and later more uniform organizations or monopolies) will be able to use patients as a source of medical data and stem cell material (Hyun, 2010); much like what happened in communications technologies after an unsuccessful regulatory campaign in western countries (Sidorenko, Khisamova, 2022). Therefore, there must exist certain mechanisms to prevent the exploitation of vulnerable populations as well as maintaining proper informed consent, preserving patient data, etc.

Another ethical issue arises from the unequal access to novel therapeutic methods employing stem cells. In many countries such technologies are simply unavailable for the majority of the population. This raises the question of social equality and providing fair possibilities for all patients, regardless of their economic background.

Therapeutic application of stem cells can be associated with various risks, of which there are the possibility of developing malignancies, infectious complications, and rejection of transplanted cells by the host's immune system (Graft vs. Host Disease). These worries are especially important in light of growing "stem cell tourism" sector. Certain medical practices in countries with poor regulation offer clients from the First World hope for treating diseases non-surgically, with the use of the patient's own mesenchymal cells (Murray, Chahla, Frank, et al., 2020). Most often such interventions are accompanied by serious side effects, such as bacterial infections, bilateral vision loss, paraplegia, and even cancer (Horner, Tenenbaum, Sipp, et al., 2018).

In summary, stem cells open up major possibilities in medicine, allowing for breakthroughs in the treatment of many diseases previously being considered incurable. Nonetheless, their application commands thorough analysis from a bioethical point of view. Issues regarding the legal status of human embryos and the safety of stem cell use in medicine, as well as levels of access to innovative treatment methods, require attentive study and resolution.

Therefore, in our view, the objective of modern science and society in general is achieving a balance between innovation in medicine and moral boundaries, which are based first and foremost on humanistic principles and social justice. Improving the methods of stem cell procurement, reducing the risks in treatment, and ensuring access to novel therapeutic methods must be achieved by us all in the future.

References

- Bilko, D., Malysheva, S., Budash, G. et al. (2012), "Embryonic stem cells. Prospects and problems of their use" ["Embrionalni stovburovi klityny. Perspektyvy i problemy yikh vykorystannia"], *Problems of ecological biotechnology*, No. 1, viewed 10 March 2026, available at: <https://doi.org/10.18372/2306-6407.1.757>
- Boyko, I. (2009), "Moral and ethical aspects of the therapeutic use stem cells" ["Moralno-etychnyi aspekt terapevtychnoho vykorystannia stovburovykh klityn"], *Scientific Notes of UCU: Theology*, No. 1, pp. 193 – 204, viewed 10 March 2026, available at: <https://nz-theology.ucu.edu.ua/wp-content/uploads/2018/01/igor-bojko.pdf> [in Ukrainian]
- Brenes, A. J., Griesser, E., Sinclair, L. V. (2024), "Proteomic and functional comparison between human induced and embryonic stem cells", *eLife*, No. 13, viewed 10 March 2026, available at: <https://doi.org/10.7554/eLife.92025.3>
- Charitos, I. A., Ballini, A., Cantore, S. et al. (2021), "Stem Cells: A Historical Review about Biological, Religious, and Ethical issues", *Stem Cells International*, Volume 2021, Article ID 9978837, pp. 1 – 11, viewed 10 March 2026, available at: <https://doi.org/10.1155/2021/9978837>

- Horner, C., Tenenbaum, E., Sipp, D. et al. (2018), "Can civil lawsuits stem the tide of direct-to-consumer marketing of unproven stem cell interventions", *npj Regenerative Medicine*, Vol. 3, No. 5, viewed 10 March 2026, available at: <https://doi.org/10.1038/s41536-018-0043-6>
- Hyun, I. (2010), "The bioethics of stem cell research and therapy", *The Journal of Clinical Investigation*, Vol. 120, No. 1, pp. 71 – 75, viewed 10 March 2026, available at: <https://doi.org/10.1172/JCI40435>
- Lendahl, U. (2022), "100 plus years of stem cell research-20 years of ISSCR", *Stem Cell Reports*, Jun 14, Vol. 17, No. 6, pp. 1248 – 1267, viewed 10 March 2026, available at: <https://doi.org/10.1016/j.stemcr.2022.04.004>
- Murray, I. R., Chahla, J., Frank, R. M. et al. (2020), "Rogue stem cell clinics", *The Bone & Joint Journal*, Feb., Vol. 102, No. 2, pp.148-154, viewed 10 March 2026, available at: <https://doi.org/10.1302/0301-620X.102B2.BJJ-2019-1104.R1>
- Pronyaev, D. V., Voloshyn V. L., Melnyk V. V. et al. (2021), "Experience of applied application of stem cells" ["Dosvid prykladnoho zastosuvannya stovburovykh klityn"], *Bukovyna Medical Bulletin*, Vol. 25, No. 4 (100), pp. 123 – 132, viewed 10 March 2026, available at: <https://doi.org/10.24061/2413-0737.XXV.4.100.2021.21> [in Ukrainian]
- Samsonraj, R. M., Raghunath, M., Nurcombe, V. et al. (2017), "Multifaceted Characterization of Human Mesenchymal Stem Cells for Use in Regenerative Medicine", *Stem Cells Translational Medicine*, Volume 6, Issue 12, pp. 2173 – 2185, viewed 10 March 2026, available at: <https://doi.org/10.1002/sctm.17-0129>
- Sidorenko, E. L., Khisamova, Z. I. (2022), "Big Data Regulation: The Main Risks and Ways to Neutralize Them", Ashmarina, S. I., Mantulenko, V. V., Vochozka, M. (eds) *Proceedings of the International Scientific Conference "Smart Nations: Global Trends in The Digital Economy"*. Lecture Notes in Networks and Systems, vol 397, Springer, Cham., viewed 10 March 2026, available at: https://doi.org/10.1007/978-3-030-94873-3_29
- Sprinsyan, T. A. (2021), "Stem cells as a promising therapeutic direction for the treatment of serious diseases" ["Stovburovi klityny yak perspektyvnyi terapevtychnyi napriam likuvannia tiazhkykh zakhvoriuvan"], *Infusion & Chemotherapy*, No. 2, c. 5 – 10, viewed 10 March 2026, available at: <http://www.ifp.kiev.ua/doc/journals/ic/21/pdf21-2/5.pdf> [in Ukrainian]

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