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The Biotechnologization of Law in the Context of Scientific and Technological Advancement

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Abstract. The article presents the authors' conceptual vision of a new stage in the development of law as a social regulator, a stage that is predetermined by the biotechnologization of human activity. The purpose of the study is to articulate the foundational vectors of potential transformations of law—both at the doctrinal level and within the sphere of legal implementation—under the influence of two constitutive factors of the contemporary context: biotechnology and artificial intelligence. Proceeding from the premise that the emerging reality substantively reshapes a number of elements traditionally regarded as axiomatic within legal theory, the authors outline possible trajectories for the further development of law under conditions of biotechnologization. Particular attention is paid to the methodological grounds of such transformation, which are determined, *inter alia*, by changes in the very nature of the human being, the modification of fundamental legal conceptual and categorical units, as well as shifts in the content of legal relations associated with the emergence of novel features of subject–object interactions. Each identified methodological ground necessitates the revision of existing doctrinal and regulatory

approaches, which allows biotechnologization to be conceptualized as a new point of legal development in the current socio-technological environment. This conclusion is supported by emerging trends in normative regulation, demonstrated through the authors' analysis of BRICS countries, namely the Russian Federation, the Federative Republic of Brazil, the People's Republic of China, and India.

Keywords: biotechnologization; biotechnology; artificial intelligence; legal system; legal regulation; BRICS; Russian Federation; Brazil; India; China.

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Introduction

Law, by its very nature, functions as a social regulator and is oriented toward the incorporation of objects of the material world into the legal domain. In this respect, the emergence of new objects associated with the evolutionary development of human activity predetermines the need for their conceptual comprehension and subsequent inclusion within the sphere of normative legal regulation. Scientific and technological development—whose current intensification represents one of the principal challenges facing contemporary legal systems—simultaneously

institutionalizes a new range of such objects, thereby necessitating their recognition within the legal sphere and constituting a further stage in the development of law.

It is indeed well known that the global digitization process affects and changes different spheres of social life. It is noteworthy that the legislation on digital technologies of the BRICS members forms the premise for regulation of such innovations as, among others, artificial intelligence, the Internet of Things, blockchain technologies, industrial robotics, cloud technologies and high-performance computing[1]. One of the most prominent manifestations of scientific and technological development is the biotechnologization of law, which unfolds along two interrelated dimensions: first, through the growing influence of biotechnologies on law; and second, through the integration of various artificial intelligence technologies. For this reason, contemporary legal scholarship faces a pressing task: to systematically reflecting on the impact of these factors on law, including projection of possible trajectories of legal development resulting from such influence.

1. Transformation of Law in Light of its Biotechnologization

The biotechnologization of law predetermines transformational changes that give rise to a qualitatively new stage in the development of law as a social regulator.

In the most general terms, biotechnologization may be understood as a set of organizational, technical, and other solutions whose emergence and application lead to changes in human activity and, accordingly, necessitate the development of adequate legal responses, particularly with regard to the establishment of permissive and prohibitive regimes governing their use.

While legal evolution has always responded to new and complex situations, it is nevertheless important to emphasize that biotechnologization entails profound transformations affecting elements that are fundamental to law itself. Scientific advances associated with the emergence of artificial intelligence, together with the accelerated development of the biotechnological field, are reshaping the core categories and institutions that are fundamental to contemporary legal systems.

1.1. Biotechnology as a New Focus of Legal Development

The intensification of biotechnological development, driven by a multitude of fundamental discoveries in this field, calls into question the applicability of existing approaches to legal regulation. It penetrates the very anthropological foundations of contemporary law, transforming fundamental conceptions of human nature as the primary subject of legal relations. Modern biotechnologies reshape human existence

[1] Cyman, D., Gromova, E., & Juchnevicius, E. (2021). Regulation of artificial intelligence in BRICS and the European Union. *BRICS Law Journal, 8*(1), 91.

by intervening in private aspects of individual life,[2] mediating interpersonal relations, and increasingly serving as instruments of social control.[3]

Biotechnological activity exerts a direct influence on prevailing understandings of human nature, altering elements that are essential for law and intrinsically connected with the human being, including its substantive and qualitative characteristics. In this context, these issues extend beyond changes in the functional parameters of the human organism, although such changes also present significant challenges for legal interpretation, particularly in light of the development of biotechnologies aimed at biomedical life support. This factor evidently affects fundamental criteria of life and death that have become entrenched in medical—and, consequently, legal–consensus.

Moreover, it is necessary to speak of a qualitatively different approach to conceptualizing human nature, which is transformed, *inter alia*, through the biotechnologization of the human body (organism). This transformation manifests both in interventions through genetic editing and in medical practices aimed at compensating for functional human deficiencies, including the implementation of anthropotechnologies designed to eliminate or minimize such deficiencies (for example, neural interfaces and bionic prostheses).

Such changes inevitably affect the conceptual and categorical apparatus traditionally employed in law to describe established and axiomatic phenomena. For instance, the very notion of the human being as one of the fundamental subjects of law requires reconsideration and refinement, taking into account both its juridified manifestations—legal capacity, active legal capacity, and delictual capacity—and the physical boundaries (limits) of the human body.

In turn, the substantive transformation of the human being as a legal category influences the existing structure of legal relations, in particular through the emergence of new subjects and objects, as well as through changes in subject–object interactions within the unfolding of biotechnological activity. In this respect, the biotechnologization of law itself calls into question the assumption that law is exclusively anthropocentric in character.

1.2. Transformation of Law under Conditions of Artificial Intelligence Technologies

The integration of artificial intelligence technologies into various forms of human activity exerts a profound influence on law, transforming its content both through changes in the human being as the principal subject of legal relations—

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[2] Yudin, B. G. (2006). The place of anthropological problems in bioethics. In *Bioethics Working Papers, Issue 1: Bioethics: Anthropological Problems* (pp. 3–10). Moscow University for the Humanities Press. (In Russian).

[3] van Est, R. (2014). *Intimate technology: The battle for our body and behavior*. Rathenau Instituut. https://www.rathenau.nl/sites/default/files/2018-04/Intimate_Technology_-_the_battle_for_our_body_and_behaviourpdf_01.pdf

viewed in terms of its legal characteristics—and through the introduction of new methodological foundations for the development of social relations. The use of AI technologies not only holds great promise for progressive development but also creates conditions for unlawful acts and offences, underscoring the urgent need for a regulatory framework and accountability mechanisms. The timeliness and appropriateness of the regulatory provisions will determine not only the effectiveness of AI integration into various spheres of social life but also ensure the fundamental rights and freedoms.[4]

First, this influence manifests in the institutionalization of the potential attribution of legal subjectivity to artificial intelligence technologies, a development driven by their increasingly complex functionality and by the conceptualization of the idea of "strong artificial intelligence." This situation is fundamentally novel for the legal domain, since contemporary legal regulation is grounded in the principle of anthropocentrism and in the legal protection of the human being as the highest value.[5] In this context, the potential emergence of a new form of subjectivity embodied in a functioning technology that claims a role analogous to that of humans in formal-legal terms necessitates a reconsideration of existing approaches to the very institution of the "subject of law."

Second, the emergence of new objects of legal regulation not only expands the scope of normative ordering but also necessitates its substantive transformation. In this regard, it is necessary to speak not merely of the new technology itself—understood as an algorithm operating with a certain degree of autonomy and independence—but also of substantive changes affecting objects that have traditionally been central to legal regulation. For example, personal data, as an area where multiple interests intersect, undergo significant transformation in the context of artificial intelligence, given its enhanced capacities for data processing, evaluation, and storage. Closely related to this is the issue of discrimination across various spheres in the context of artificial intelligence deployment and AI-based decision-making, which leads to a reconfiguration of non-discrimination principles within different types of legal relations.[6]

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[4] Khmelevskoi, I. R., & Kalashnikov, N. A. (2025). Responsibility in the field of artificial intelligence systems usage: Features of private and public law regulation. *BRICS Law Journal, 12*(4), 149.

[5] Tzimas, T. (2025). Legal anthropocentrism at crossroads: International legal principles ahead of transhumanism and post-anthropocentrism. *European Journal of Law and Technology, 16*(1). https://ejlt.org/index.php/ejlt/article/view/1087; Tzimas, T. (2015). Deconstructing Anthropos: A critical legal reflection on "anthropocentric" law and Anthropocene "humanity". *Law and Critique, 26*(3), 225–249.

[6] Aith, F. M. A., & Dourado, D. A. (2022). The regulation of artificial intelligence for health in Brazil begins with the General Personal Data Protection Law. *Revista de Saúde Pública, 56*, Article e2022056004461. (In Portuguese); Ashok, P. (2023). The curious case of automated decision-making in India. *International Cybersecurity Law Review, 4*, 235–248; Sihlahla, I., et al. (2025). Legal and ethical principles governing the use of artificial intelligence in radiology services in South Africa. *Developing World Bioethics, 25*(1), 35–45.

Third, the implementation of artificial intelligence technologies exerts a transformative impact on the conceptual and categorical apparatus of law. For instance, the potential attribution of legal subjectivity to strong artificial intelligence necessitates a reassessment of the formal-legal characteristics of the subject of law, including legal capacity, active legal capacity, and delictual capacity, as well as the possible emergence of new criteria for conferring subjectivity upon artificial intelligence (such as systemic integrity, autonomy, and cognitive independence, among others).[7]

No less significant, from the perspective of the conceptual and categorical framework, is the emerging need to revise the system of principles governing certain foundational legal institutions. In this context, it is appropriate, for example, to consider the transformation of the principles of legal liability in light of the distinct formal-legal characteristics of artificial intelligence technologies.[8]

It should be noted that the outlined directions of the transformation of law as a social regulator largely coincide with those discussed above in relation to biotechnologies, particularly with regard to the legal content of the category of subjectivity, changes in the conceptual and categorical apparatus, and the increasing complexity of the content and structure of legal relations.[9] This convergence, in our view, provides additional support for the argument that biotechnology and artificial intelligence should be regarded as two new points of development for law.

In light of the identified transformative changes in law resulting from the introduction and use of biotechnologies and artificial intelligence technologies, it appears justified to identify the following methodological foundations, which, in our opinion, necessitate the transformation of law as a social regulator and the modification of its content in several respects, including:

• the transformation of the very nature (understanding) of the human being from the perspective of legal protection and preservation of the human being as a fundamental legal value;

• the need to develop a new legal language, given the insufficiency of the traditional conceptual and categorical apparatus for the substantive description of the changes generated by biotechnological development;

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[7] Kurki, V. A. J. (2019). The legal personhood of artificial intelligences. In V. A. J. Kurki, *A theory of legal personhood*. Oxford University Press; Banteka, N. (2024). Legal personhood and AI. In E. Lim & P. Morgan (Eds.), *The Cambridge handbook of private law and artificial intelligence* (Chapter 28). Cambridge University Press; Kiškis, M. (2023). Legal framework for the coexistence of humans and conscious AI. *Frontiers in Artificial Intelligence, 6*, Article 1205465.

[8] Buiten, M., et al. (2023). The law and economics of AI liability. *Computer Law & Security Review, 49*, Article 105761; Soyer, B., & Tettenborn, A. (2022). Artificial intelligence and civil liability: Do we need a new regime? *International Journal of Law and Information Technology, 30*(4), 385–410; Llorca, D. F., Fernández, L., & Gómez, L. (2023). Liability regimes in the age of artificial intelligence: A use-case driven analysis. *Journal of Artificial Intelligence Research, 76*, 613–644.

[9] It should also be noted in passing that the directions outlined above do not claim to be exhaustive or exclusive; among other relevant vectors is the interplay and competition between soft regulation and traditional (hard) regulatory approaches.

• the reconsideration of the content of legal relations so as to ensure their adequacy to new subject–object configurations.

These methodological approaches will serve as the lens through which we can analyze the evolutionary changes.

2. Biotechnologization and the Legal Dimension of the Human Being

2.1. Transformation of Human Nature under Conditions of Biotechnological Application

One of the methodological foundations that make it possible to regard biotechnology as a driver of legal development lies in its impact on the legal dimension of the human being, which is undergoing transformation as a result of substantive changes in human nature itself. In this regard, several key issues should be highlighted:

1. The substantive transformation of legally significant criteria of life and death,[10] which having been incorporated into law from the medical domain in their current normative formulation, require reconsideration in light of advances in contemporary biomedicine. Developments in resuscitation science, transplantology, cryopreservation technologies, and artificial life-support systems call into question traditional binary constructs of "life–death," necessitating the elaboration of new legal definitions capable of reflecting current scientific realities.

2. Contemporary genome-editing technologies, in particular CRISPR-Cas9,[11] zinc finger nucleases,[12] and prime editing,[13] enable targeted modification of specific genetic sequences, thereby opening prospects for altering a range of biologically determined human characteristics that are legally relevant. The most readily achievable directions include: first, the correction of hereditary diseases caused by single-gene mutations; and second, the modification of relatively simple hereditary

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[10] Ministry of Health and Social Development of the Russian Federation. (2011). Order of December 27, 2011 No. 1687n "On medical criteria of birth, the form of the birth certificate, and the procedure for its issuance." *Rossiyskaya Gazeta*, 2012, No. 64. (In Russian); Russian Federation. (2011). Art. 53 of the Federal Law of November 21, 2011 No. 323-FZ "On the fundamentals of public health protection in the Russian Federation." *Collected Legislation of the Russian Federation*, No. 48, Art. 6724. (In Russian); Government of the Russian Federation. (2012). Resolution of September 20, 2012 No. 950 "On approval of the rules for determining the moment of death of a person, including the criteria and procedure for establishing death, the rules for termination of resuscitation measures, and the form of the protocol for establishing death." *Collected Legislation of the Russian Federation*, No. 39, Art. 5289. (In Russian).

[11] Trikoz, E. N., Mustafina-Bredikhina, D. M., & Gulyaeva, E. E. (2021). Legal regulation of gene editing procedures: The experience of the United States and EU countries. *RUDN Journal of Law, 25*(1), 67–86. (In Russian); Pestrikova, A. A. (2023). Legal regulation of genetic editing in clinical practice: Problems and prospects. *Medical Law, 2*, 18–23. (In Russian).

[12] Zhou, H., Edelman, B., & Skolnick, J. (2025). A mode-of-action protein-based approach that characterizes the relationships among most major diseases. *Scientific Reports, 15*, Article 9668.

[13] John, T., & Czechowicz, A. (2025). Clinical hematopoietic stem cell-based gene therapy. *Molecular Therapy, 33*(6), 2663–2678.

traits determined by a limited number of genes (for example, eye color or certain metabolic features); and third, the enhancement of specific physical parameters, such as increased muscle mass or resistance to HIV infection. This situation necessitates the development of clear legal frameworks defining the permissible limits of such interventions, with due regard to the protection of fundamental rights and freedoms of the individual and the prevention of potential abuses in this field.

3. The rapid development of anthropotechnologies associated with the implantation of functionally augmentative mechanisms—from neural interfaces to bionic prostheses—leads to the erosion of traditional boundaries of the human body and the emergence of new forms of corporeality.[14] This, in turn, requires the expansion of the scope of legal protection of the human being, including the development of special legal regimes for hybrid biotechnological systems, while preserving the priority of protecting human dignity as one of the foundational legal values.

In this sense, the need to conceptualize the impact of biotechnology on law is determined not only by transformations in the content of the object of legal relations but also by changes in the essential and substantive characteristics of the human being as a subject of legal relations, as well as by a qualitative transformation of the content of those relations themselves. Taken together, these processes mediate corresponding changes in the conceptual and categorical apparatus of law in this domain.

2.2. Human Transformation and Artificial Intelligence

The introduction and use of artificial intelligence technologies at the current stage of societal development also exert a tangible impact on the human being, comparable to that produced by biotechnological solutions. At the same time, the direction of this influence appears inherently contradictory. On the one hand, it is associated with the strengthening of the human role as a controlling subject in the implementation of technological solutions that entail the automation of various processes through the use of artificial intelligence. On the other hand, it is linked to the potential loss of the human being's exclusive status of legal subjectivity, which presupposes a departure from the established understanding of law as an anthropocentric construct.

With regard to the first dimension of the influence of artificial intelligence technologies on the human being within legal discourse, the requirements for human oversight in the use of such technologies serve as new criteria of legality and legitimacy, the presence of which enables their lawful implementation in practice. Such requirements are already reflected in existing normative legal regulation.

In particular, in Brazil (AI Act, Bill No. 2338/2023), there is a requirement for the joint participation of a human and an algorithm in decision-making processes that

[14] Filipova, I. A. (2021). Neurotechnologies: Development, practical application, and legal regulation. *Vestnik of Saint Petersburg University. Law, 12*(3), 502–521. (In Russian).

may entail legally significant consequences,[15] which in effect leads to a transformation of the human role within such legal relations. Human subjectivity in this context is supplemented not only by the algorithm itself and its decision-making outputs, but also by the duty to ensure appropriate oversight.

Similar requirements can be found in other legal systems that treat human control as a legally necessary factor. Provisions of this kind are present in the normative acts of BRICS countries in the context of personal data protection,[16] as well as in relation to decisions producing significant legal effects.[17] Comparable regulatory approaches are also established in European jurisdictions, which attest to the universal character of such normative prescriptions in the context of artificial intelligence deployment.[18]

Indirectly connected with these developments is the second factor, which points towards a departure from the exclusive anthropocentric orientation of law in general, and of legal regulation in particular, and gives rise to the possibility of new forms of subjectivity–namely, artificial intelligence technologies. In this regard, it should be noted that current regulatory frameworks in contemporary legal systems do not yet reflect such a possibility, a circumstance commonly justified by the absence of a functioning model of strong artificial intelligence, the emergence of which is directly associated with the attribution of legal subjectivity.[19]

At the same time, the significant acceleration in the development of the technologies under consideration increases the likelihood of the emergence of strong artificial intelligence, thereby presupposing the need for corresponding transformations within the legal domain. Moreover, the extremely high risks posed to human and civil rights and freedoms by the implementation of technological solutions—even where weak artificial intelligence is concerned—necessitate that this issue be addressed in a predictive rather than purely reactive manner, which further underscores both the importance and the complexity of the evolving situation.

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[15] Brazilian Artificial Intelligence Act. (2023). Artificial Intelligence Act. https://artificialintelligenceact.com/brazil-ai-act/

[16] People's Republic of China. (2021). Art. 24 of the Personal Information Protection Law of the People's Republic of China (adopted August 20, 2021, effective November 1, 2021). https://www.cac.gov.cn/2021-08/20/c_1631050028355286.htm. (In Chinese).

[17] Republic of South Africa. (2013). Protection of Personal Information Act 4 of 2013 (POPIA), Sec. 71 "Automated decision-making." https://www.gov.za/documents/protection-personal-information-act-4-2013

[18] European Union. (2016). Art. 2 of Regulation (EU) 2016/679 of the European Parliament and of the Council of April 27, 2016 (General Data Protection Regulation); European Union. (2024). Articles 14 and 26 of Regulation (EU) 2024/1689 of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act); United Kingdom. (2018). Art. 22 of the UK General Data Protection Regulation (UK GDPR), as retained in United Kingdom law following Brexit.

[19] Chesterman, S. (2020). Artificial intelligence and the limits of legal personality. *International and Comparative Law Quarterly, 69*(4), 819–844; Avila Negri, S. M. C. (2021). Robot as legal person: Electronic personhood in robotics and artificial intelligence. *Frontiers in Robotics and AI*, *8*, Article 789327.

Accordingly, the impact of artificial intelligence technologies on the human being in its legal dimension extends beyond questions of legal subjectivity alone, leading to changes in the human role within legal relations that are increasingly mediated and complicated by artificial intelligence technologies.

3. The Content of Legal Relations: The Specificity of Biotechnological and AI Subject–Object Interactions

3.1. New Objects of Legal Protection

Conceptualizing biotechnology as a new foundation for the development of law does not preclude the use of established approaches to structuring emerging legal formations. In this respect, the biotechnologization of law presupposes the identification of a number of new institutional formations, the emergence of which is determined by the recognition of new objects of legal protection.

It appears justified to distinguish at least three interrelated object-based clusters, which, when taken together, encompass the substance of social relations undergoing transformation as a result of biotechnological development:[20]

- unborn objects;
- living objects;
- dead objects.

In particular, the inclusion of the unborn within the sphere of biolaw regulation is driven by the development of assisted reproductive and other medical technologies, the object of whose intervention is the human embryo. Without denying the controversial nature of the legal status of the embryo, it is nevertheless necessary to acknowledge its inclusion within the sphere of legal regulation, which necessitates the formulation of appropriate legal relations. Moreover, certain approaches to normative regulation in this field are associated with attributing subjectivity (or quasi-subjectivity) to the embryo,[21] which in turn reflects transformations in legal relations arising in connection with unborn objects and, consequently, necessitates an adequate legal response.

Without engaging in a debate about whether "living" entities should be included within the scope of biolaw regulation or the delineation of the boundaries between

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[20] As a general remark, it should be noted that, within the framework of the present study, these object formations pertain to the human being and the human body as focal points of the transformation of law as a social regulator.

[21] Soares, E. (2017). *Brazil: New rules approved for assisted reproduction*. Library of Congress Global Legal Monitor. https://www.loc.gov/item/global-legal-monitor/2017-11-20/brazil-new-rules-approved-for-assisted-reproduction/; Machin, R., et al. (2020). Assisted reproductive technologies in Brazil: Characterization of centers and profiles of treated patients. *JBRA Assisted Reproduction, 24*(3), 235–240; Jamwal, V. D. S., & Yadav, A. K. (2023). The Assisted Reproductive Technology (Regulation) Act, 2021: A step in the right direction. *Indian Journal of Community Medicine, 48*(1), 4–6; The legal position of the in vitro embryo under South African law. (2020). *South African Journal of Bioethics and Law*, *13*(1). https://www.scielo.org.za/scielo.php?pid=S1727-37812020000100005&script=sci_arttext

the "living" and the "non-living," it is important to recognize the need to expand the subject matter of biolaw to include dead objects, such as the human corpse, within its normative legal framework.

It should be noted that this domain has previously fallen within the ambit of regulatory influence, primarily with respect to burial practices and funeral arrangements.[22] At the same time, there is an increasing accumulation of problematic issues in this area, relating both to the determination of criteria of human death–which are currently based on an established consensus within the medical community[23]—and to the emergence of new possibilities for the use of the dead body, such as post-mortem donation, including forms such as gestational body donation.[24] This development necessitates a legal conceptualization of the human body through the prism of subject–object perception, enabling a reassessment of doctrinal approaches that restrict the subject matter of biolaw exclusively to issues concerning living objects.[25]

From the perspective of the emergence of new objects of legal protection in the context of artificial intelligence deployment, it is also necessary to note the transformation brought about by the technologization of social relations. Artificial intelligence technology itself constitutes a new object of legal conceptualization, given its influence on numerous aspects of human functioning that are of formal legal significance, including information processing, the generation of new information and content, and the acceleration of a wide range of functional tasks that were previously performed exclusively by humans.

It is evident that artificial intelligence is increasingly being introduced into legal circulation as a new object–without excluding the possibility of its future recognition as a subject–thus necessitating its corresponding formal legal acknowledgement.

For example, the enhanced capabilities of algorithmic data processing are transforming traditional legal institutions, such as personal data, thereby requiring the development of new models of legal regulation in this area. The legislation of BRICS countries, as well as other legal systems, contains various approaches

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[22] Russian Federation. (1996). Federal Law of January 12, 1996 No. 8-FZ "On burial and funeral affairs." *Collected Legislation of the Russian Federation*, No. 4, Art. 41. (In Russian); People's Republic of China. (1997). Regulations on Funeral and Interment Control 《殡葬管理条例》 (promulgated by the State Council on July 11, 1997, as revised). https://www.lawinfochina.com/Display.aspx?lib=law&Cgid=18598 (In Chinese); Brazil. (1973). Law No. 6,015 of December 31, 1973 (Public Records Act). https://www.planalto.gov.br/ccivil_03/leis/l6015compilada.htm. (In Portuguese).

[23] Popova, O. V. (2021). *The body as a territory of technologies: From social engineering to the ethics of biotechnological construction* (pp. 161–178). Kakon Plus. (In Russian); Mokhov, S. V. (2020). *The history of death: How we fight and how we accept* (pp. 37–39). Individuum. (In Russian).

[24] Smajdor, A. (2023). Whole body gestational donation. *Theoretical Medicine and Bioethics*, *44*(2), 113–124.

[25] Vidalis, T. (2022). *The emergence of biolaw: The European experience and the evolutionary approach* (p. 3). Springer.

to addressing this issue, unified by a common objective: minimizing the risks of discriminatory and other adverse effects associated with the use and dissemination of personal data as a special category of information. At the same time, changes in the substantive content of personal data affect not only its legal regulation but also the legal status of the subjects involved in its use. As a result, qualified subjects endowed with additional rights and obligations emerge;[26] special regimes for the use of personal data in the context of artificial intelligence deployment are established in order to prevent discrimination;[27] and new criteria of legality for the use of such information are introduced, as previously discussed in relation to human participation in overseeing legally significant artificial intelligence decisions.

The institutional formations outlined above require appropriate normative consolidation. This necessity is driven by the heightened risks posed to human and civil rights and freedoms arising from increasingly complex social relations, as well as the need to maintain their stability.

It is also important to keep in mind that the proposed system of new and transformed objects does not purport to be exhaustive and does not exclude the emergence of other object formations that may also exert a transformative influence on law. Nevertheless, the very appearance of such objects compels all actors involved in the development of normative legal regulation to take their existence into account.

3.2. Subject–Object Interactions in the Context of the Biotechnologization of Law

Biotechnologies and artificial intelligence compel legal theory to adopt a revised model of subjectivity, which is influenced, among other things, by the complex and multidimensional nature of the changes they generate. The classical approach within contemporary legal systems is based on a binary model of subjectivity, according to which all participants in legal relations are classified into natural persons and legal persons.[28] The biotechnologization of human activity challenges this paradigm, giving rise to a fundamentally different system of subject-related characteristics,

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[26] India. (2023). *Digital Personal Data Protection Act, 2023: Data fiduciaries and enhanced obligations in the field of personal data protection*. (In Hindi).

[27] People's Republic of China. (2021). Personal Information Protection Law of the People's Republic of China (adopted August 20, 2021, effective November 1, 2021). https://www.cac.gov.cn/2021-08/20/c_1631050028355286.htm. (In Chinese); European Union. (2016). Art. 22 of Regulation (EU) 2016/679 of the European Parliament and of the Council of April 27, 2016 (General Data Protection Regulation).

[28] This classical approach is reflected, for example, in Federal Law of November 21, 2011 No. 323-FZ "On the Fundamentals of Public Health Protection in the Russian Federation," which delineates the key participants in the relevant legal relations—patients, medical professionals, and public authorities—in the context of safeguarding public health. The law conceptualizes health protection as the implementation of a system of political, economic, legal, social, scientific, and medical measures, including sanitary and epidemiological (preventive) measures, carried out by federal state authorities, state authorities of the constituent entities of the Russian Federation, and local self-government bodies.

determined by several structural distinctions inherent in the new socio-technological context.

First, a defining feature of subject–object relations under conditions of the biotechnologization of law is the dual role of the human being, as noted above, which reflects the complexity and multidimensionality of legal regulation in this field.

On the one hand, the human being functions as a subject of legal relations endowed with legal personality, that is, with the capacity to possess and exercise subjective rights and legal obligations. In this capacity, the individual acts as an active participant in legal relations, interacting and dealing with other subjects, including medical professionals, researchers, public authorities, and civil society organizations. Legal capacity and active legal capacity provide the ability to protect one's interests, make legally relevant decisions, and bear responsibility within the framework of biolaw.

On the other hand, the human body and its biological components become objects of legal relations, towards which the subjective rights and legal duties of participants in biolaw relations are focused.[29] This duality—human subjectivity alongside the objectification of the human body—gives rise to unique legal situations in which it becomes necessary to strike a balance between the protection of individual rights and the safeguarding of public interests associated with the use of biological materials and the advancement of biotechnologies. In this context, biolaw functions as a complex regulatory system ensuring interaction between subjects and objects of law, wherein the human being, as a subject, exercises rights, while the body and its biological components become objects of legal regulation requiring heightened sensitivity to ethical and social consequences.

Second, the established model for identifying legal subjects relies on a formal-legal criterion of legal personality, whereas in biolaw a functional-role-based approach acquires decisive significance. While civil law defines the status of a subject through the categories of legal capacity and active legal capacity,[30] biolaw subjectivity is constructed on the basis of the concrete role performed by an actor within biomedical processes (for example, donor, recipient, researcher, or member of a genetically unique group). This necessitates both theoretical elaboration and normative consolidation of special legal regimes for categories of participants that do not fit neatly within the traditional dichotomy of "natural person / legal person."

Similar observations regarding the transformation of subject–object interactions apply to the domain of artificial intelligence technologies. In particular, the

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[29] Trubina, V. A. (2020). *Human tissues and organs as objects of civil rights*. Infotropic Media. (In Russian).

[30] Russian Federation. (1994). Arts. 17 and 21 of the Civil Code of the Russian Federation (Part One), Federal Law of November 30, 1994 No. 51-FZ. *Collected Legislation of the Russian Federation*, No. 32, Art. 3301. (In Russian).

inapplicability of classical models of legal liability necessitates a search for alternative solutions, revealing the specific configuration of interactions among the various actors involved in the creation and functioning of artificial intelligence systems. Contemporary legal regulation already identifies multiple functional roles responsible for different aspects of algorithmic operation, which in turn presupposes a differentiated allocation of legal responsibility for potential violations. This makes it possible to speak of a transformation in the legal definition of the category "subject of law," associated with the introduction of a new requirement of systemic responsibility: the subject of certain violations related to the use of artificial intelligence technologies may consist of a chain of natural or legal persons, each responsible for specific elements of the system's design, development, or functioning.

For example, in the Russian Federation, the processes of anonymization of personal data and their subsequent use involve interaction among a data operator, an operator of state information infrastructure, and a competent public authority.[31] In India, a differentiated classification of actors—data fiduciaries and significant data fiduciaries—exists with respect to access to and use of personal data, implying varying degrees of legal obligations and liability in cases of non-compliance.[32] Comparable provisions are also present in Brazil, where the legal positions of controller and processor are distinguished, with differing legal consequences in the context of personal data processing and the ability to challenge automated decisions.[33] Overall, the concept of distributed responsibility may be regarded as one of the prospective directions for the development of the institution of legal liability in connection with the use of artificial intelligence technologies.[34]

Third, the heterogeneity of the subject matter and methods of biolaw is reflected in the specific nature of subject–object relations, creating a unique opportunity for the development of new legal constructs, such as quasi-subjects—special categories of participants in legal relations that do not possess full legal personality but, due to

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[31] Russian Federation. (2024). Federal Law of August 8, 2024 No. 233-FZ "On amendments to the Federal Law 'On Personal Data' and the Federal Law 'On conducting an experiment to establish special regulation aimed at creating the necessary conditions for the development and implementation of artificial intelligence technologies in the federal city of Moscow, and on amendments to Arts. 6 and 10 of the Federal Law 'On Personal Data.'" *Collected Legislation of the Russian Federation*, No. 31 (Part I), Art. 3451. (In Russian).

[32] Republic of India. (2023). Digital Personal Data Protection Act, 2023 (Act No. 22 of 2023), adopted on August 11, 2023. https://www.indiacode.nic.in

[33] Brazil. (2018). Lei Geral de Proteção de Dados Pessoais (LGPD), Law No. 13,709 of August 14, 2018 (as amended). Diário Oficial da União. https://www.planalto.gov.br (In Portuguese).

[34] Mocanu, D. M. (2022). Gradient legal personhood for AI systems: Painting continental legal shapes made to fit analytical molds. *Frontiers in Robotics and AI, 8*, Article 788179; Lima, G., et al. (2021). The conflict between people's urge to punish AI and legal systems. *Frontiers in Robotics and AI, 8*, Article 756242.

their distinctive characteristics, require a special legal regime.[35] The most illustrative example of a quasi-subject in biolaw is the human embryo, whose legal status varies across legal systems from treatment as a mere object of law to the recognition of certain rights analogous to those of a subject. The legal position of the embryo lies at the intersection of religious, ethical, scientific, and legal discourses, which explains the complexity of its normative determination.

Substantively, the category of quasi-subjectivity may also be applied to artificial intelligence technologies. This is attributable to the conservatism of legal theory, which currently does not allow for the assignment of full legal subjectivity to such algorithms, alongside the progressive complication of social relations in which artificial intelligence becomes an integral element of legal structuring and, therefore, requires corresponding normative recognition.[36] Thus, for example, in South Africa[37] in the context of patent litigation, artificial intelligence DABUS (Device for Autonomous Bootstrapping of Unified Sentience) was, for the first time, recognized as the inventor of a technical solution—a food container—thereby marking a significant shift in approaches to authorship and inventorship.

Further development of biomedical technologies, including genetic engineering, reproductive technologies, and neurobiological research, will contribute to the expansion of the range of subjects involved in biolaw relations and to the increasing complexity of interactions among different categories of participants. At the same time, the implementation of artificial intelligence technologies blurs the boundary between classical conceptions of legal subjects and objects and compels legal theory to reassess existing institutional formations in terms of their adequacy for the evolving social relations transformed by technologization.

Under these conditions, the development of adequate legal mechanisms aimed at ensuring a balance between scientific progress, economic interests, and the protection of fundamental human rights in the context of biomedical and technological innovation acquires particular urgency.

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[35] The concept of quasi-subjects of law is characterized by the following features: 1) recognition of a special socio-legal value (including bodily integrity and the right to dispose of one's body); 2) partial legal personality (the possession of certain rights in the absence of legal capacity to act); 3) legitimation through legislative acts and judicial practice; 4) a limited functional role (the status of a rights holder without corresponding legal obligations). Ponomareva, E. V. (2019). *Subjects and quasi-subjects of law: Theoretical and legal problems of delimitation* (Thesis). Yekaterinburg. (In Russian); Kurki, V. A. J. (2019). *A theory of legal personhood* (p. 240). Oxford University Press; Folková, Z. (2024). Beyond dualism(s): A new approach to legal personhood. *Iuridica, 70*(4), 43–54.

[36] Gordon, J. S. (2021). Artificial moral and legal personhood. *AI & Society, 36*, 457–471; Novelli, C., Bongiovanni, G., & Sartor, G. (2022). A conceptual framework for legal personality and its application to AI. *Jurisprudence, 13*(2), 194–219.

[37] Conlon, E. (July 29, 2021). *DABUS: South Africa issues first-ever patent with AI inventor*. Managing Intellectual Property. https://www.managingip.com/article/2a5bqo2drurt0bxl7ab1q/dabus-south-africa-issues-first-ever-patent-with-ai-inventor

Conclusion

The biotechnologization of law, as demonstrated in this study, should be understood not merely as a sectoral expansion of legal regulation in response to technological innovation, but as an indicator of a deeper paradigm shift affecting the very architecture of modern legal thinking. Bio- and AI-driven transformations expose the limitations of classical doctrinal constructs and reveal the growing inadequacy of anthropocentric legal models when confronted with hybrid forms of agency, corporeality, and decision-making.

From this perspective, law increasingly operates not as a closed normative system anchored in stable subject–object dichotomies, but as an adaptive regulatory framework embedded within a dynamically evolving techno-social environment. Biotechnologies and artificial intelligence do not simply generate new regulatory objects; they destabilize foundational legal assumptions concerning subjectivity, responsibility, bodily integrity, and the boundaries of legal protection. This destabilization necessitates a reconfiguration of legal ontology itself, rather than incremental doctrinal adjustments.

A key theoretical implication of this research lies in the recognition that contemporary law is entering a phase of structural pluralization, in which multiple forms of subjectivity coexist—human, hybrid, algorithmic, and quasi-subjective—each requiring differentiated legal regimes. The emergence of such pluralized subject configurations challenges the universality of traditional legal categories and calls for a functional, context-sensitive approach to legal status, rights allocation, and responsibility attribution.

Equally significant is the shift from reactive to anticipatory legal rationality. The risks associated with biotechnological and AI-driven interventions—particularly those affecting human dignity, equality, and autonomy—cannot be adequately addressed through ex post regulatory mechanisms. Instead, law must increasingly adopt a prognostic orientation, integrating ethical foresight, technological assessment, and precautionary principles into its normative design. In this sense, biotechnologization transforms law from a mechanism of stabilization into an instrument for the controlled management of uncertainty.

A comparative analysis of BRICS legal systems further indicates that, despite divergent legal traditions, there is a convergent recognition of the need to recalibrate legal safeguards in response to technological mediation of social relations. This convergence suggests the gradual formation of a transnational normative horizon within which bio- and AI-related risks are addressed through shared regulatory logics, even in the absence of fully harmonized legal frameworks.

Ultimately, the biotechnologization of law should be conceptualized as a constitutive moment in the evolution of legal systems under conditions of scientific and technological acceleration. It compels legal scholarship to move beyond the

preservation of established dogmatic boundaries and toward the development of a new methodological grammar capable of capturing the fluid interplay between technology, humanity, and normativity. Future research should therefore focus on elaborating integrative models of legal regulation that reconcile technological innovation with the enduring imperative of protecting the human dimension of law–without presuming its exclusivity.

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