RESEARCH PAPER

IJAMB
International Journal of Advances in Medical Biotechnology

The importance of the fourth dimensions of fundamental rights in biotechnology and its constitutional effectiveness

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Received: 10 January 2024; 20 february 2024.

Abstract: This article analyzes the classification of biotechnology as part of the fourth dimension of fundamental rights, focusing on its essential content and effectiveness as a constitutional norm. The study explores how biotechnology is incorporated into international treaties and how this recognition impacts the enforcement of fundamental rights. A bibliographic and literature review was conducted, drawing on studies, scientific articles, and doctrines from respected researchers and specialists in the fields of biotechnology and fundamental rights. Sources were selected based on their relevance and contemporaneity, focusing on materials from the last ten years. The research examined key international treaties, such as the Convention on Biological Diversity, to assess their role in shaping biotechnology as a fundamental right.The findings reveal significant gaps in Brazilian legislation concerning biotechnology, which hinder the effective implementation of related fundamental rights, particularly in terms of equitable access and sustainable development. While international efforts to regulate biotechnology are advancing, national implementation remains inadequate. The study highlights the need for a more comprehensive normative framework and the development of public policies that ensure the responsible and safe advancement of biotechnology. It concludes that clearer legal interpretation and stronger policy measures are required to fully integrate biotechnology into the fourth dimension of fundamental rights, thereby promoting scientific and technological progress that benefits society effectively and safely.

Keywords: Biotechnology. Fundamental rights. Fourth dimension. Essential content. International treaties.

Introduction

Biotechnology, as a multidisciplinary science that encompasses various methodological techniques for the genetic manipulation of living organisms, has emerged as a powerful tool for developing products and services that benefit society across various aspects of contemporary life. The continuous evolution of this field has sparked debates regarding its classification as part of the fourth dimension of fundamental rights, representing a profound shift in current ethical, scientific, and legal discussions.

This scientific article aims to analyze the implications of classifying Biotechnology within the fourth dimension of fundamental rights, its essential content, and its effectiveness as a constitutional norm. To achieve this, the historical development of Biotechnology was examined to assess its impact on the effectiveness of fundamental rights. The relevance of this topic lies in the need to understand the challenges Biotechnology poses to contemporary society, especially in terms of its scope and implications for human rights. The classification of Biotechnology as a fundamental right, anchored in international treaties and agreements, holds the potential to ensure its applicability within national legislations, protecting its essential content and preventing restrictions that could hinder its safe and responsible development.

The primary objective of this article is to analyze Biotechnology as part of the fourth dimension of fundamental rights, its inclusion in international treaties, the recognition of its essential content, and the influence this classification has on the effectiveness of fundamental rights. The methodology utilized was based on bibliographic research and a comprehensive literature review, exploring the studies and doctrines of renowned researchers and experts in the field.

The following sections present the key findings and conclusions drawn from this analysis, as well as the ethical, scientific, legal, and social implications of classifying Biotechnology within the fourth dimension of fundamental rights. Finally, this article highlights the importance of appropriate regulation and the application of international treaties to ensure the responsible development of Biotechnology and its positive contributions to society.

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https://doi.org/10.52466/ijamb.v6i1.123

The importance of the dimensions of the fundamental rights

From the outset, it is important to note that, according to Lenza[1], the dimensions of fundamental rights represent a classification distinct from the older «generations» approach. This shift in perspective aims to avoid the notion of succession or replacement between dimensions, which could mislead the understanding of rights. There is no linear transition but rather a continuous addition of fundamental rights. In this research, we have therefore opted to use the term "dimensions" instead of "generations" when referring to this concept.

Sarlet[2] asserts that when analyzing fundamental rights, one must necessarily consider the historical evolution that stems from humanity's own transformations and progressions. These changes affect the content, ownership, effectiveness, and implementation of fundamental rights, resulting in what can be seen as a genuine mutation.

The importance of classifying fundamental rights lies in their connection to history and, consequently, the evolution of both rights and society. As Tavares[3] points out, human society's needs are infinite and inexhaustible, constantly being redefined and recreated, thus generating a cycle of new needs and advancements.

Therefore, discussing the various dimensions of human rights protections supports the argument that there is no eternal and immutable list of rights inherent to human beings. Instead, there is a continuous and persistent reconsideration of rights.[3]

According to Moraes[4],the Brazilian Supreme Federal Court, in its jurisprudence, has recognized only the triad of dimensions or stages, which will be discussed in the following section.

First dimension

The first dimension comprises what are known as rights of resistance, defense, and negative rights. Agra[5] notes that the origin of these rights coincides with that of the democratic rule of law, as they serve to limit the actions of an oppressive State—a legacy of absolutism—through the establishment of laws. At the same time, they guarantee civil and political rights, as well as freedom and private autonomy, without any state interference.

Thus, they are termed the first dimension, according to Wolkmer[6], because of their significance in the tradition of the political-legal institutions of Western modernity, which emerged during the 18th and 19th centuries. These rights reflect a historical context shaped by the ideologies of secularized natural law, Enlightenment rationalism, social contract theory, individualistic liberalism, and competitive capitalism.

Mendes[7] emphasizes that these rights began to be enshrined in national constitutions following the advances of the American and French revolutions. These revolutions prompted a shift towards the non-interference of rulers in citizens' lives, marking these rights as universal.

According to Moraes[4], the first generation represents a duty of omission, «in that rights to freedom are fulfilled through non-interference, respecting the individual's personal sphere and restraining the actions of the Liberal State.» Furthermore, «this generation includes individual rights that define the sphere of protection for individuals against State power, as well as political rights, which express the rights to nationality and political participation, synthesized in the right to vote and be elected[8]

By way of example, these rights include «freedom of expression, press, assembly, association, property, formal equality before the law, political participation, due process of law, habeas corpus, and the right to petition[5]. In summary, this is the first dimension.

Second dimension

The second dimension of rights emerged alongside the advancements of industrialization, which led to significant social and economic problems. At that time, socialist doctrine recognized that merely guaranteeing first-dimension rights was insufficient to ensure the effective enjoyment of those rights. Therefore, it advocated for a more active role from the State to ensure social justice through committed action.[2]

Barroso[8] further argues that the second dimension of rights is characterized by the consolidation of the social State, which arose in response to industrialization, struggles against inequality, and the spread of socialism. This dimension encompasses rights related to social freedoms.

According to Wolkmer, these rights correspond to «social, economic, and cultural rights» and are based on the principles of equality, with a positive scope. Instead of opposing the State, these rights require the State to guarantee and provide for the well-being of all individuals through public authorities.

This new dimension focuses not on protecting the individual from the State but on creating a list of claims that can be demanded from the State, which must act to satisfy these rights. Among the second-dimension rights are the right to work, protection against unemployment, a minimum wage, limits on

working hours, paid rest, and access to all levels of education.[3]

Moraes and Barroso[4],[8] classify these social rights as belonging to the second dimension, which requires the State to take action to ensure equality by addressing social, economic, and cultural needs. This aims to promote the full development of life in all its capacities, including labor rights and the provision of public services such as education, health, and social security, to enhance the general well-being of society.

In conclusion, the second generation of fundamental rights goes beyond simply ensuring provisions. What distinguishes this phase in the evolution of fundamental rights is its "positive" nature, implying that the State must assume the duty to act in order to meet social, economic, and cultural demands. This approach represents a significant advancement in the pursuit of equality and social well-being.

Third dimension

The fundamental rights of the third dimension are composed of rights of fraternity or solidarity, characterized by their transindividual, collective, and diffuse nature. This means that these rights are directed towards human beings as members of the human species, approached collectively. As a result, the responsibility for realizing these rights is also collective, not limited solely to the actions of the State but involving all members of society to ensure that these rights are upheld for everyone.[5]

Within this classification, according to Wolkmer[6], there are two doctrinal categories. The first offers a broad interpretation of solidarity or fraternity[9-12] and includes rights related to development, peace, self-determination of peoples, a healthy environment, quality of life, communication, and more.

The second provides a specific interpretation of transindividual rights. According to Oliveira Jr.[12], collective and diffuse rights fall into this category, gaining increasing significance in environmental law and consumer protection law.

In this realm, the third dimension includes the right to peace, development, environmental quality, and the preservation of historical and cultural heritage[7].

The third generation or dimension, still inspired by the motto of the French Revolution, centers on fraternity (or solidarity), encompassing rights that are not enjoyed individually but rather by society as a whole, directed towards the human race collectively. These rights have a global reach and require cooperation and collective responsibility for their realization.

The transindividual nature of these rights highlights their importance today, reflecting progress in the development and recognition of human rights. While first-dimension rights emphasize freedom and second-dimension rights highlight equality, third-dimension rights enshrine the principle of solidarity, establishing fundamental and enduring values within social formations. However, as can be observed, these generations of rights are cumulative and not mutually exclusive[8].

Fourth dimension

The fourth dimension, according to Wolkmer[6], arises from "new" rights, including biotechnology, bioethics, and the regulation of genetic engineering. These rights are directly connected to human life and encompass issues such as assisted human reproduction (artificial insemination), abortion, euthanasia, intrauterine surgeries, organ transplants, genetic engineering (cloning), contraception, and more[6]

This dimension will be explored in greater detail in the next section, where an in-depth analysis of biotechnology will be conducted.

Fifth dimension

Some scholars argue that the evolution of fundamental rights has reached a fifth generation, although opinions diverge on this matter. The most widely accepted classification refers to the rights of cybernetics and peace.

According to Oliveira Jr. and Wolkmer[6,12], this dimension addresses significant challenges arising from information technology, cyberspace, the internet, and virtual reality in general. As Wolkmer[6] emphasizes, the impact of developments in cybernetics, computer networks, electronic commerce, artificial intelligence, and the rapid dissemination of the internet has been extraordinary, both in the legal field and in global society at large.

Among dissenting voices, Sampaio[13] argues that this classification should instead focus on the duty of love and respect for all forms of life, advocating for the defense against all forms of prejudice.

Since the early 21st century, Bonavides[9] has supported the view that peace, as the opposite of war, must necessarily be recognized as a fundamental right and form a new dimension.

Peace, an aspiration held collectively over many centuries, is the culmination of all the reasons upon which human logic, under the guidance of law and justice, bases the act of governing society. It aims to punish terrorists, judge war criminals, imprison torturers, uphold the foundations of the social pact, and establish and maintain, as inviolable, the rules, principles, and clauses of the political community[9].

With this in mind, the concepts that doctrine

classifies as the fifth dimension are concluded, and the analysis moves toward the latest dimension.

Sixth dimension

The recent evolution of human rights in contemporary society has paved the way for the expansion of legal interests subject to judicial protection. Beyond material goods, the growing emphasis on ethical principles and new societal needs has brought additional concerns to the forefront, such as animal rights.

According to Agra[5], domestic animals were once considered mere objects, subordinated to property rights and governed by the provisions of the Civil Code. As a result of this conception, animals have not been recognized as holders of rights and, therefore, lack the legal standing to appear as parties within the legal system. Historically, they have been treated as property, tied to one of the parties involved in a dispute.

"To enable the legal recognition of non-human animals, it is necessary to attribute legal personality to them, detaching the concept of personhood from that of human beings—separating animals from the species Homo sapiens. In this regard, the 2002 Civil Code took a significant step by replacing the word 'man' with 'person' when addressing personality and capacity, highlighting that personhood and being human are independent concepts[5].

Thus, the discussion progresses toward a proposed sixth dimension of human rights, advocating for the recognition of the fundamental right to access potable water, which has gained prominence in international human rights law and comparative constitutional law. This right has become increasingly relevant due to its critical importance for life, health, and human development.[2]

In this context, Agra and Sarlet[5,2] argue that the evolution of human rights necessitates the consideration of new values and interests, encompassing the expansion of animal rights and the possible inclusion of the right to access potable water as a new dimension of fundamental rights.

The impacts of the biotechnology classification as fourth dimension

According to Diniz and Burillo,[14,15] biotechnology encompasses a set of methodological techniques that allow for the isolation of cells, animals, plants, or microorganisms to obtain products and catalyze chemical reactions that meet various human needs. This science of genetic engineering also enables the manipulation of living organisms, including the creation of transgenic or genetically modified organisms, with applications in the medicinal, scientific, industrial, agricultural, and environmental fields. As such, biotechnology represents a powerful tool for driving the production of goods and services that benefit society in multiple spheres of life. Furthermore, biotechnology, being multidisciplinary, is linked to a wide range of fields such as biology, microbiology, molecular biology, genetic engineering, cellular processes, organic and analytical chemistry, biochemistry, and biochemical engineering (bioprocesses).[16]

Biotechnology innovations have had a significant impact on the modern world, utilizing biological systems, living organisms, and their derivatives to manufacture or modify products and processes, thus driving development.[16]

Although the origins of biotechnology date back to the earliest stages of human history, its development, as cataloged by scholars, is more closely associated with recent history. In the 19th century, key figures such as Pasteur made advances in microbial fermentation processes. Between the 1940s and 1950s, efforts focused on antibiotic production, particularly the work of Chain and Florey in advancing Fleming's discovery of penicillin. In the 1950s, advances in biochemistry led to a better understanding of intermediary metabolism, while the 1960s saw significant progress in molecular genetics. The 1970s marked a turning point with the discovery of restriction enzymes by Arber, Smith, and Nathans, as well as ligases to join DNA fragments.[17]

The discovery of molecular DNA recombination sparked a revolution in biotechnology, with applications in various fields, generating numerous debates about its use in transgenic animals and plants, stem cell therapies, gene therapy, biological drugs, and vaccines. These innovations led to unprecedented impacts and, at the same time, raised ethical and moral questions about human rights.

Within this context, some scholars argue for the emergence of a fourth generation of rights to address challenges related to the increasingly complex effects of biological research, which allow for manipulation of an individual's genetic heritage. What are the limits of this potential (and increasingly likely) manipulation?[18]

Although there is no consensus on the subject, Ramos[19] notes that even critics acknowledge that the inexhaustibility of human rights transcends didactic classifications, requiring a broad understanding of these essential rights for a dignified human life.

As a result, great discussions and challenges of the new millennium arise, confronting the limits of science and the difficulties of legislating and regulating biotechnology on an international level. Sauwen[20] emphasizes that solutions to issues

such as procreation techniques, embryo and organ trafficking, the production of biochemical weapons, cloning, and other developments in genetic engineering must find their effectiveness in international agreements. For this reason, Mazzuoli and Bonavides[19] point out that this dimension reflects the globalization of fundamental rights, expanding beyond borders. In addition to biotechnology, this dimension includes participatory democracy, the right to truthful, non-manipulated information, and a universally dignified society.

The challenges continue to grow, as biotechnology's multidisciplinary nature confronts jurists, biologists, philosophers, theologians, psychologists, sociologists, and various humanists and health professionals, each with differing cultures and beliefs. This divergence makes it difficult for society to support biotechnology and to communicate effectively with the scientific community and the public.

Given these challenges, both biotechnology and bioengineering must consider scientific and ethical issues. Maluf[22] argues that the State must legislate, regulate, and ensure the dissemination of knowledge and safety standards, while also allowing for a broad ethical interpretation that extends beyond state competence and enters the delicate realm of individual rights.

This chapter is critical to this study's analysis, as it is directly connected to the essential content and, consequently, the effectiveness of fundamental rights, which will be explored further in the following sections.

The essential content of biotechnology and the effectiveness of the fundamental right

The importance of recognizing biotechnology as a fourth-generation right, for us, is not limited to mere didactic classification; it involves an evolution of human rights, which, being established in international treaties and agreements, ensure their applicability in domestic law. Being established in international treaties and agreements, ensure their applicability in domestic law. As a consequence, this right can be considered a fundamental right which, according to Agra,[5] is divided into two parts: the first being its core essence, and the second, its peripheral zone.

The core essence or essential content is configured as the limit that must be respected by the Supreme Federal Court when determining the density of a right, which, in no way, can be disregarded by judicial decisions, prohibiting its emptying or transformation into an exception. This core essence is defined as the very essence of the right, which must be realized regardless of factual circumstances.[5]

Silva,[23] in analysis from a strictly objective dimension, found that the essential content must be interpreted and applied as a fundamental right in the entirety of social life. Consequently, this right also means prohibiting restrictions to the point of making it inapplicable to all individuals or part of them.

According to Agra[5] understanding, only the peripheral zone will depend on factual circumstances but with applicability aimed at the principle of maximum effectiveness of fundamental rights.

The recognition of the fourth dimension of fundamental rights and the necessity of including their essential content to be protected is essential; otherwise, the application of balancing and proportionality in the interpretation of the norm will necessarily imply the possibility of restriction to the point of compromising the evolution of biotechnology in the country.

The current domestic legislations in our country are insufficient to regulate the issue, as they are limited to only a few laws,[24,25,26] which are absolutely insufficient to regulate the matter in our country.

Precisely because of this deficient domestic legislation, we understand that it is imperative to apply the international treaties and agreements that already have advanced precedents on the subject, justifying their applicability.

Piovesan's doctrine[27] argues that, for a large portion of contemporary internationalists, international law supersedes the State and highlights its supremacy over domestic law because it derives from a principle that is above to the will of the States. It is not to say that the power of the State is a delegation of international law; but it seems indisputable that international law constitutes a legal limit to said power.[27]

In this context, it is evident that there are already major international treaties and agreements, as observed in Table 1.

Given the existing gap in our legal system regarding biotechnology, it is imperative to apply the Federal Constitution of 1988, which explicitly enshrines, in its article 5, paragraph 2, an open clause for the inclusion of new fundamental rights. This provision states that the rights and guarantees expressed in the Constitution do not exclude others arising from the regime and principles it adopts or from international treaties to which the Federative Republic of Brazil is a party.[28]

Thus, when analyzing article 5, paragraph 2, of the Federal Constitution of the Republic of Brazil, it is noted that these rights are organized into distinct groups: one is the rights expressly stated in the Constitution (for example, the rights listed in subsections I to LXXIX of article 5 and in other

provisions scattered throughout the text of the Magna Carta); another is the rights expressed in international treaties to which Brazil is a party; and finally, a third group is the implicit rights (those implied in the guarantee rules, as well as those arising from the regime and principles adopted by the Constitution)[27].

Thus, there is support not only for the recognition of biotechnology as a right provided for in international treaties, but also, considering the premises of this right in our legal system, it is possible to recognize the fourth dimension of fundamental rights and, as a result, the essential content of biotechnology. This comes along with new principles already admitted internationally, which will allow an analysis without implying restrictions on development.

Table 1 – Main international treaties related to biotechnology, biolaw and genetic engineering.

International treaty/convention	Synthesised description
Convention on Biological Diversity (CBD)	Seeks to conserve biological diversity, use its components in a sustainable manner, and ensure the fair and equitable sharing of the benefits arising from the use of genetic resources.
Cartagena's Protocol on Biosecurity	Addresses the safety in handling, transporting, using, and transferring genetically modified organisms (GMOs) to protect biodiversity and human health.
Internacional Convention for the Protection of Plants Varities	Establishes international standards for the protection of intellectual property rights related to plant varieties developed through biotechnology.
Plants Varieties (UPOV)	Promotes the protection of intellectual property rights of breeders of new plant varieties, encouraging innovation in agriculture and the development of cultivars with beneficial traits.
Convention on the elimination of all forms of Discrimination against Women	Aims to eliminate discrimination against women, including health and reproduction issues that may have implications in biotechnology and biolaw.
Convention on People with Disabilites	Seeks to guarantee the rights of people with disabilities, including access to health services and technologies that may involve genetic engineering and other biotechnological applications.
Paris Agreement	Sets goals and actions to limit global warming to 1.5°C above pre-industrial levels, with impacts on bioenergy technologies and genetic engineering.

Source: produced by the authors (2023).

For the judge, instead of seeking to analyze the matter solely with constitutional principles, it will be possible to interpret it with the recognition of the essential content of biotechnology, avoiding restrictions on legal knowledge.

Therefore, the incidence of systematic and teleological interpretation is guaranteed with constitutional principles and with the applicability of the principle of maximum effectiveness of fundamental rights, emphasizing the dignity of the human person, based on a balance with human rights parameters, analyzing constitutionality.

The recognition of the fourth generation of fundamental rights and the inclusion of biotechnology as essential content, stemming from international treaties, give new contours to the effectiveness of fundamental rights, thus ensuring the absence of restrictions on technological advances that may be compromising the nation's development.[27]

Final considerations

This article is based on the premise of the importance of classifying biotechnology as a fourth-generation right, exploring its essential content and effectiveness as a fundamental right. Through a literature review and analysis of international treaties and agreements, the study aimed to understand the relevance of this multidisciplinary field, which encompasses various areas and methodological techniques for innovating processes and products to meet the demands of contemporary society.

After examining the dimensions of fundamental rights, the study aligns with the doctrine that advocates recognizing biotechnology as part of the fourth dimension of fundamental rights, addressing various societal concerns. To this end, a historical analysis of biotechnology from the 19th to the 20th century was conducted, highlighting significant mi-

lestones that enabled advances in the field. The major turning point came with the discovery of DNA molecular recombination, one of the key events that paved the way for previously unimaginable technological developments, such as transgenic organisms and stem cell-based therapies.

Having reached this stage, attention is directed to the essential content of biotechnology and its effectiveness as a fundamental right. Once its essential content is identified, this right must be respected and implemented regardless of factual circumstances. Additionally, the importance of protecting and regulating biotechnology was emphasized, with a focus on the need to use international treaties as references, given the insufficiency of domestic legislation.

In light of legislative deficiencies and significant gaps in the legal system, the relevance of the 1988 Federal Constitution is underscored as a source of support for recognizing biotechnology as a fundamental right. Article 5, paragraph 2 of the Constitution allows for the inclusion of new rights arising from international treaties, thereby strengthening the legal framework surrounding this complex issue.

The final considerations reaffirm the importance of biotechnology as a powerful tool for societal advancement, while emphasizing the need for a careful approach that accounts for ethical and moral issues as well as implications for human rights. Technological development in this field must be accompanied by appropriate legislation and regulation to ensure the safe dissemination of knowledge and the responsible use of advancements.

In this context, a systematic and teleological analysis, combined with the principle of maximum effectiveness of fundamental rights, allows for a coherent interpretation of the subject without undue restrictions from the subjectivity of judges or legislators. Recognizing the fourth dimension of fundamental rights and including biotechnology as essential content is crucial to ensuring the evolution of this field while respecting human dignity and advancing national goals of economic and social development.

Finally, the study highlights the importance of future research to deepen understanding of biotechnology, addressing its limitations and expanding knowledge. Science, law, and society must work together, drawing appropriate support from the scientific community and broader society, and developing clear and transparent communication about the challenges and possibilities of biotechnology.

In conclusion, the analysis of the implications of classifying biotechnology as part of the fourth dimension and recognizing its essential content as a fundamental right underscores the significance of this field in today's world. This study contributes to the advancement of scientific knowledge and ensures dignified coexistence by respecting the ethical, moral, and legal dimensions that encompass biotechnology in its various applications.

References

[1]. Lenza P. Constitutional Law schematized v. 3. São Paulo: Saraiva; 2021.

[2]. Sarlet IW, Marinoni LG, Mitidiero D. Course in Constitutional Law 10. São Paulo: Saraiva; 2021.

[3]. Tavares AR. Course in Constitutional Law. 21. São Paulo: Saraiva; 2023.

[4]. Moraes GP. Course in Constitutional Law. São Paulo: Atlas; 2018.

[5]. Agra WM. Course in Constitutional Law. 9. Belo Horizonte: Fórum; 2018.

[6]. Wolkmer AC. Introduction to the fundamentals of a general theory on "new" rights. Rev Juríd [Internet]. 2013 Ago [mentioned in 15 jul. 2023];2(31):121-148. Available at: http://revista.unicuritiba.edu.br/index.php/RevJur/article/view/593/454

[7]. Mendes GF, Branco PG. Course on Constitutional Law. 15. São Paulo: Saraiva; 2020.

[8]. Barroso LR. Course on Contemporary Constitutional: the fundamental concepts and the construction of a new model. 9. São Paulo: Saraiva Education; 2020.

[9]. Bonavides P. Course on Constitutional Law. São Paulo: Malheiros; 2011.

[10]. Lafter C. The reconstruction of Human Rights. São Paulo: Companhia das Letras; 1998.

[11]. Bedin GA. The rights of man and neoliberalism. 2. Publlisher Ijuí: Unijuí; 1998.

[12]. Oliveira Jr JA. Juridical Theory and new rights. Rio de Janeiro: Lumen Juris; 2000.

[13]. Sampaio JAL. Fundamental Rights: rethoric and historicity. Belo Horizonte: Del Rey; 2004.

[14]. Diniz MH. The present state of biolaw. São Paulo: Saraiva; 2001.

[15]. Burillo IZ. In: Casabona CMR, org. Biotechnology, law and bioethics: prospects in comparative law. Genetic Biotechnology in agriculture and livestock. Belo Horizonte: Del Rey and PUC Minas; 2002.

[16]. Alves AE, Bonotto RA, Claudino MC. Vesting' s contract at biostartups: risks, challenges and considerations. Rev Bras Direito Empres [Internet].

2022 [quoted in 22 jul. 2023];8(2):25-46. Available at: https://www.indexlaw.org/index.php/direitoempresarial/article/view/9237/pdf.

[17]. Grisolía S. In: Casabona CMR, org. Biotechnology in the third millenium. Biotechnology, law and bioethics. Belo Horizonte: Del Rey; 2002.

[18]. Bobbio N. The age of rights. Rio de Janeiro: Elsevier; 2004.

[19]. Ramos AC. Course on human rights. 7. São Paulo: Saraiva; 2020.

[20]. Sauwen RF, Hryniewicz S. "In vitro" law: from bioethics to biolaw. Rio de Janeiro: Lumen Juris; 1997.

[21]. Mazzuoli VO. Course on human rights. 6. Publisher São Paulo: Método; 2019.

[22]. Maluf E. Genetic manipulation and criminal law. São Paulo: Juarez de Oliveira; 2002.

[23]. Silva VA. Fundamental laws: essential content, restrictions and effectiveness. 2. Publisher São Paulo: Malheiros; 2009.

[24]. Brasil. Decree n. 6.041, February 7th, 2007. Instituted the Biotechnology Development Policy, the National Biotechnology Committee is created and offered other measures. [Internet]. Brasília, DF: Republic Residency; 2007 [quoted in 24th July 2023]. Available at: https://www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/decreto/d6041.htm

[25]. Brazil. Law n. 10.332, December 19th, 2001. Instituted financing mechanism to the Science and Technology for Agriculture Business Program, to the Promotion of Health Research Program, to the Biotechnology and Genetic Resources Program – Genoma, to the Science and Technology Program for the Aviation Sector and to the Competitiveness Innovation Program, and offered other measures. [Internet]. Brasília, DF: Republic Presidency; 2001 [quoted in 24th July, 2023]. Available at: https://www.planalto.gov.br/ccivil_03/leis/leis_2001/l10332.htm

[26]. Brazil. Law n. 11.105, March 24th, 2005. Regulates the Subsections II, IV, and V of § 1 of art. 225 of the Federal Constitution establish safety standards and oversight mechanisms for activities involving genetically modified organisms (GMOs) and their derivatives, create the National Biosafety Council (CNBS), restructure the National Technical Biosafety Commission (CTNBio), provide for the National Biosafety Policy (PNB), revoke Law No. 8,974 of January 5, 1995, Provisional Measure No. 2,191-9 of August 23, 2001, and articles 5, 6, 7, 8, 9, 10, and 16 of Law No. 10,814 of December 15, 2003, and make other provisions. [Internet]. Brasília, DF: Republic Presidency; 2005 [quoted in 24th July, 2023]. Available at: https://www.planalto.gov.br/ccivil_03/_ato2004-2006/2005/lei/l11105.htm

[27]. Piovesan F. Human Righrs and the International Constitutional Law. 7. Publisher. São Paulo: Saraiva; 2006.

[28]. Brazil. [Constitution (1988)]. Constitution of the Federative Republic of Brazil [Internet]. Brasília, DF: Republic Presidency; 1988 [quoted in 24th July, 2023]. Available at: https://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm

[29]. Moreira E, Wanghon MO, Costa CR, Mileo BAP, Pereira PAR, Pinheiro VS. Biotechnological patents: an essay on the impacts of the biotechnology effects in the Brazilian Systems of Patents [Internet]. Belém, PA: CESUPA; [Unknown date] [quoted in 29th Jan 2024]. Available at: https://www.cesupa.br/saibamais/nupi/doc/PRODUCAONUPI/Patentes%20Biotecnol%C3%B3gicas.pdf.