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Assessment of perceptions and practical use of biotechnology innovations by medical professionals.

Avaliação da percepção e uso prático das inovações em biotecnologia por profissionais médicos.

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RESUMO

O uso da biotecnologia no desenvolvimento de novos produtos pode trazer resultados positivos no tratamento de doenças, melhorando a qualidade de vida da população. Vendo esse cenário é possível relembrar os Objetivos de Desenvolvimento Sustentável da ONU. Pensando em formas de fortalecer e engajar novos produtos biotecnológicos e startups no mercado médico, esta pesquisa tem como objetivo estabelecer as percepções e o uso prático das inovações biotecnológicas. Em seguida, realizamos um estudo inicial exploratório qualitativo que visa construir hipóteses sobre o que está limitando o desenvolvimento da interface entre a biotecnologia e o campo médico, a partir de percepções sobre a biotecnologia e sua aplicação prática na perspectiva médica. Foi realizada uma entrevista semiestruturada em uma amostra foi intencional não probabilística, totalizando um N=6. As respostas foram registradas e analisadas pela plataforma Atlas.ti. Destacaram pontos do cotidiano atual como o desconhecimento do mercado biotecnológico nacional, enfatizando a produção internacional, bem como seu alto custo de produção e aquisição como se a inclusão dessas novas tecnologias estivesse longe da prática clínica.

Palavras-chave: Empreendedorismo, Biotecnologia, Área da Saúde

ABSTRACT

The use of biotechnology in the development of new products can bring positive results in the treatment of diseases, improving the population's quality of life. Seeing this scenario, it is possible to remember the UN Sustainable Development Goals. Thinking about ways to strengthen and engage new biotechnological products and startups in the medical market, this research aims to establish the perceptions and practical use of biotechnological innovations. Then, we carried out an initial qualitative exploratory study that aims to build hypotheses about what is limiting the development of the interface between biotechnology and the medical field, based on perceptions about biotechnology and its practical application from a medical perspective. A semi-structured interview was carried out in a non-probabilistic intentional sample, totaling an N=6. The responses were recorded and analyzed by the Atlas.ti platform. They highlighted points of current daily life such as the lack of knowledge of the national biotechnological market, emphasizing international production, as well as its high cost of production and acquisition as if the inclusion of these new technologies were far from clinical practice.

Keywords: Entrepreneur, biotechnology, health care sector

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INTRODUCTION

According to art. 2 of the Convention on Biological Diversity promoted by the UN in 1992, biotechnology is the development of new technologies from biological processes, organisms, tissues, cells, and even cellular parts. ("Convention on Biological Diversity - 1992", 1992). It was first described in 1919 by agronomist Károly (Karl) Ereky (FÁRI; KRALOVÁNSZKY, 2006), and encompasses several disciplines such as medicine, chemistry, engineering, pharmacy, agronomy, and many others, thus becoming a multi/interprofessional area. The development of new tools and products can bring positive outcomes in the treatment of diseases, improving the population's quality of life.

The most recent achievements in medicine are achieved by advances in biotechnology. For example, the production of liposomes and dendrimers that act in the transport of drugs and reduce toxicity, which may make the treatment more effective, as it is the first in cases of cancer. (FARJADIAN et al., 2019). In neuro-oncology, monoclonal antibodies are already applied for the remission of tumors (ABRAMS et al., 2020). In dermatology, they are present in almost all procedures and dermo-cosmetics. (MELLOU; VARVARESOU; PAPAGEORGIOU, 2019). and in orthopedics, there is already great use of 3D printed prostheses (ANDRÉS-CANO et al., 2021; CHANA RODRÍGUEZ et al., 2018). There is also the development of 3D bioprinting which intends to revolutionize surgeries, such as orthopedic or neurological surgery in which there is the use of personalized prostheses made specifically for each patient to reduce incompatibilities. (JOVIC et al., 2020)

In 2020 the size of the biotechnology market was valued at around $497 billion and it is projected to grow at a Compound Annual Growth Rate (CAGR) of over 9.4% between 2021 and 2027. largest pharmaceutical companies, almost all companies invest in biopharmaceuticals and biotechnology in general. (MOORKENS et al., 2017). Another important factor is the increase in the prevalence of chronic diseases, along with the increase in funds to support R&D and product development initiatives in the field of biotechnology, which will drive the growth of the industry in the coming years. Other reports show that the biotechnology market will exceed $775 billion in 2024.

Seeing this scenario as an opportunity for growth and development, it is possible to remember the UN Sustainable Development Goals. It is in the national interest to

mobilize domestic resources (SDG-17), to aim at improving Health, Welfare (SDG-3), and economic growth (SDG-8) through innovation and development of industry and infrastructure (SDG-9).

But for that, it is necessary to analyze how the Brazilian market is performing. A 2018 study by the Federal University of Goiás concluded that the insertion of biotechnology graduates into the job market is still a challenge, as companies and research institutions still do not know the profile of these professionals and their skills. (MARANGONI et al., 2018). Thinking about ways to strengthen and engage new biotechnology products and startups in the medical market, this research aims to establish the perceptions and practical use of biotechnology innovations by medical professionals.

We then carried out an initial qualitative exploratory study that aims to build hypotheses about what is limiting the development of the interface between biotechnology and the medical field, based on perceptions about biotechnology and its practical application from a medical perspective. The type of sampling was intentional non-probabilistic, totaling an N=6. Contact was made with physicians known or recommended so that they could answer the **semi-structured interview**. The responses were recorded and analyzed by the Atlas.ti platform, a tool for qualitative analysis.

Research characterization:

Among the 6 interviewees, 71.4% concluded the research, thus having a loss of 28.6% that were total (when the interviewee did not give feedback) or partial (when the interviewee abandoned the process of contributing to the research). As a profile, we obtained that 50% have 11 to 15 years of experience in the job market as a doctor, with the most experienced having more than 30 years of experience and the least experienced having less than 5 years. According to the Degree of Specialization, 67% have a master's degree, 17% have a doctorate and 17% are still in the process of completing their specialty in medical residency.

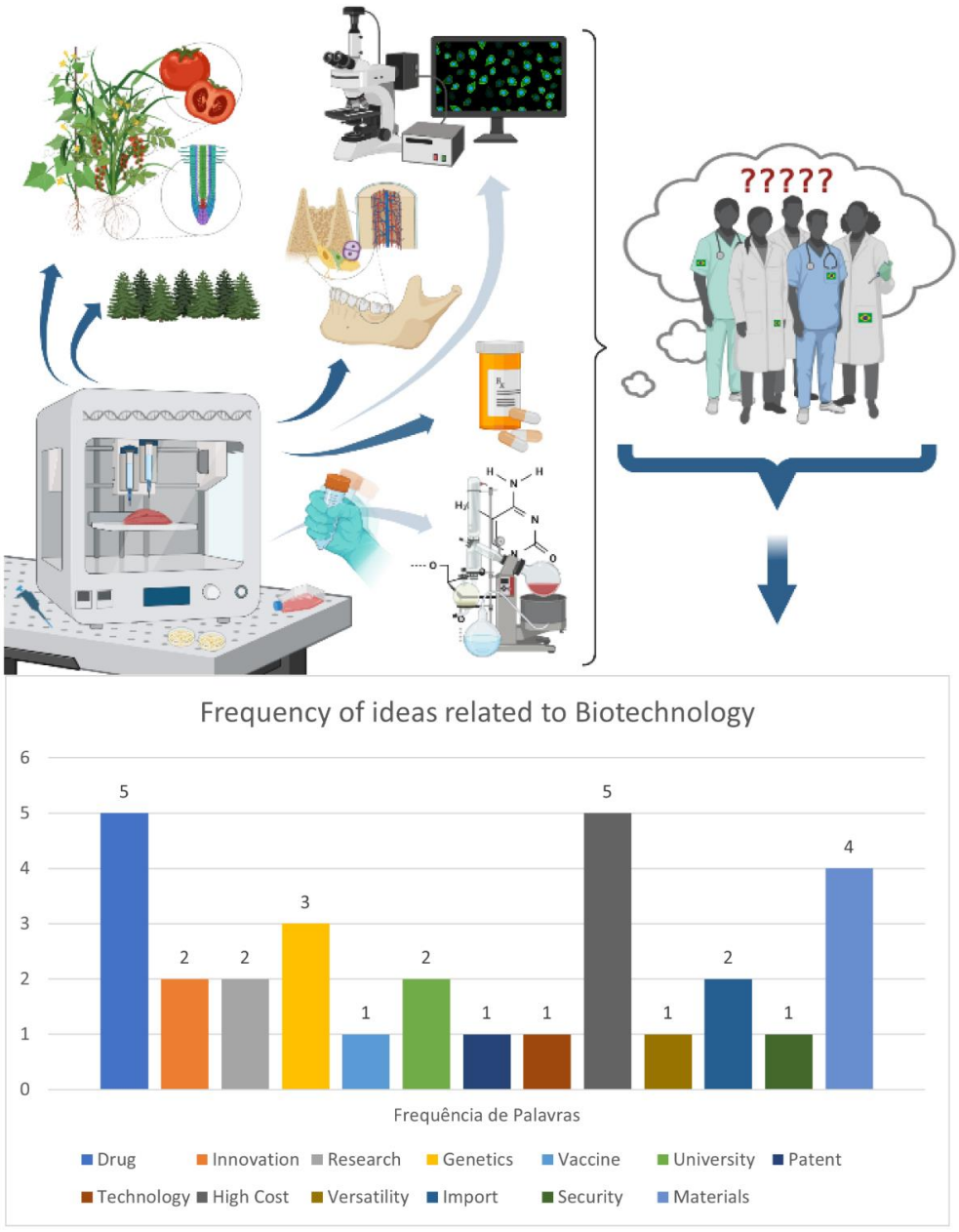
RESULTS AND DISCUSSIONS

Word Map:

It is well known that biotechnology has a multidisciplinary character and is inserted in the different areas of technology and applied by different professions. As a

result of the work, the words that most appeared when the interviewed physicians thought about Biotechnology were mapped and evaluated concerning the frequency of occurrence (Figure 1).

Figure 1: Biotechnology Multidisciplinary Panel and Frequency of Ideas "Created with BioRender.com."



Font: Cavicchioli, Ferreira and Barud (2022).

In this way, it is possible to verify in the small environment analyzed the words that appeared the most were related to "High Cost" as much as one thinks about the value

necessary for the production of research and technologies in the area of biotechnology, as well as the implementation of these products in daily life. from the clinic. Edelman says that, according to the Tufts Center for Drug Development, it costs an average of $897 million to develop a new drug and bring it to market. These costs encompass the entire process of formulation, testing, and failure. The author points out that failures exist and that they cost a lot. (EDELMAN, 2004)

At the same time, McKinsey & Company showed that biotechnology venture capital activity grew 45% in one year, bringing the 2020 global total to $36.6 billion.(CANCHERINI et al., 2021)

Subsequently, the presence of words such as “Medicine”, “Surgical Materials” and “Vaccine” demonstrate part of the knowledge of the applicability of biotechnology by physicians. But when questioned, they correlate with imported products. Where would the production of national biotechnological science and technological development be? Are there products missing? Or does it lack market positioning?

In this regard, one thinks about the low investment in national research and an important lack of knowledge of the existing national production.

A 2004 study by UNICAMP already showed that “Although Brazil ranks among the 10 largest drug markets in the world, investment in Research and Development (R&D) in the country in the pharmaceutical and drug industry is very small.” (MARIA et al., 2004)(MAGALHÃES et al., 2003)

Today, in 2022, the investment scenario in R&D is even smaller due to the numerous cuts that the Federal Government has made in this area. A 2021 study by economist Fernanda De Negri, from the Institute of Applied Economic Research (Ipea) showed that in 2009 the investment was R$19 billion and in 2020 the value was R$17.2 billion in values adjusted for inflation in the period. (NEGRI, 2021) And it is already common practice that cutting science funds harms the country's development (WESTIN, [s.d.])

However, the country's Innovation scenario is not only due to academic production, but a union and co-creation of sectors as established by Quintuple Helix.

Although “research, technology and innovation” are used as synonyms in common sense, according to the dictionary, research is the set of systematic processes for the investigation and attempt to solve problems related to society. Technology, on the other hand, is the development and practical application of new knowledge in new

products, services or processes that aim to facilitate or improve daily life. Even so, innovation has a strong relationship with what is new, a little more subjective, it is highly correlated with establishing new combinations that promote improvements and achieve better results. When analyzing more deeply, it is identified that there is a disconnection between the science projects developed in universities with technological research, which were investigated for innovations to the market (MINEIRO et al., 2019)

To better understand this reality, it is interesting to go back in history to the trajectory of the central actors responsible for Innovation. In 1968, the pioneers of the study of technological innovation in Latin America placed the State (Federal Government) as the main guide and precursor of the development of Innovation in a country in the so-called "Sabato-Botana Triangle".(SARAVIA, 2005) With such an impact, it ended up influencing most public policies in the 1970s. Over time, they realized that the University and Industry were also other influential points, thus giving rise to the Triple Helix Theory. (ERBER, 2012; MINEIRO et al., 2019; SILVA; SILVA; ABUD, 2021)

> "However, changes in the global scenario have expanded the form of relationship between these actors. The traditional triad formed by university-industry-government has been strengthened with new models of knowledge generation, including society (Quadruple Helix - HQ) and the environment (Quintuple Helix) with important helices in the dynamics of innovation." (MINEIRO et al., 2019)

Although they are not new theories, much of the thinking of the academic environment remains archaic, distancing itself from the active and integrative part in the development of innovations for the country.

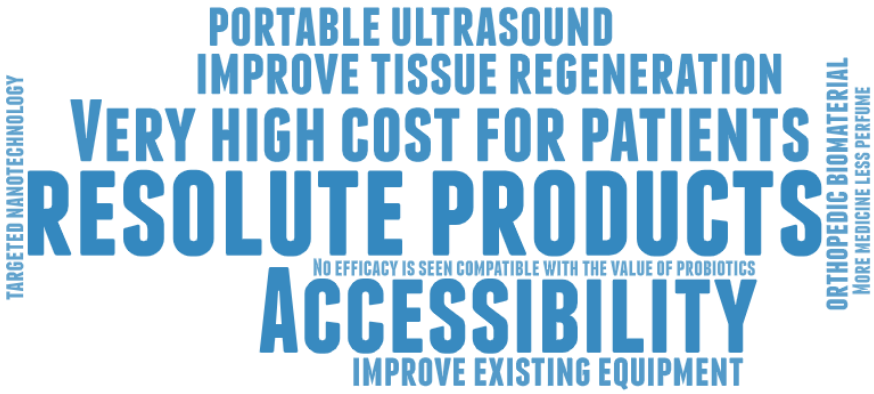
We asked respondents (Figure 2) which biotechnological products they use the most in their offices and created a word cloud to illustrate:

Figure 2: Word Cloud about products most used in the daily lives of respondents

Font: Cavicchioli, Ferreira and Barud (2022).

As we can see, biotechnology has a multidisciplinary character and is also present in the most diverse medical specialties, exemplified in the study by dermatologists, neurosurgeons, and orthopedists. And it is present in the most diverse moments and products of the medical day-to-day. From basic procedures to highly complex procedures, with greater emphasis on immunobiological, hemostatics, probiotics, dural substitute, implants, medicines, and catheters.

Figure 3: Word Cloud about missing products in the market



Font: Cavicchioli, Ferreira and Barud (2022).

And as a final search, we tried to map what is lacking in the market (Figure 3) according to the doctors interviewed to guide future research and present opportunities for new ventures. For specific products, such as portable ultrasound, orthopedic biomaterial, targeted nanotechnology, and products aimed at tissue Regeneration, there were

occasional criticisms that show current deficits, but that can result in a fertile scenario/field.

Among these points, the doctors raised an important agenda to consider making what already exists better and more resolute, instead of "trying to invent the wheel". That nothing more would be than investing in Incremental Innovation postulated by Joseph Schumpeter in 1939 (SCHUMPETER, 1939). Another concern is the high cost of these new products to patients. Would it be possible to make it cheaper for the population, making it more accessible even knowing these high production costs?

CONCLUSION

Semi-structured interviews correspond to a small universe of an intentional non-probabilistic sample. They highlighted current everyday points such as the lack of knowledge of the national biotechnological market, emphasizing international production as well as its high cost of production and acquisition as if the inclusion of these new technologies were far from clinical practice. Ages, contexts, and specialties vary and cannot establish a cause and effect parameter.

Investment in communication between doctors and biotechnology promoters, such as researchers, industries, and digital marketing itself, can strengthen this interface. As a result, greater prestige for national science and technology is possible, in addition to a likely lower cost of implementation in the clinical routine. For future studies, it is important that the research has a more significant sample size and preferably randomly included to avoid possible biases and have a better study.

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