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The current state of the biotechnology market and its main development trends

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Abstract. In its simplest form, biotechnology is technology based on biology: biotechnology uses cellular and biomolecular processes to develop technologies and products that help improve our lives and the health of our planet. We have been using the biological processes of microorganisms for over 6,000 years to produce healthy foods such as bread and cheese and to preserve dairy products. The basis of biotechnology is the use of biological processes such as fermentation and biocatalysts such as microorganisms or microbial enzymes to produce valuable products. Biotechnology ensures the optimization of the stages of chemical production processes by 80% or more, and increases the efficiency of various production processes. When using biofuels, greenhouse gas emissions are reduced by 52% or more. Biotechnology helps reduce water consumption and waste generation and ensure sustainable use.

1 Introduction

The global community faces growing challenges in food production. By biotechnology, it is possible to improve the resistance of organic products and herbicides to insect attack, as well as obtain better results at low costs, reduce volume of agrochemical materials required for growing plant material and limit them release into the environment. In the world, the needs of people for primary health care are constantly increased [1]. During its own time, Biotechnology has helped to heal the world by: reducing epidemics of infectious disease, save more than 250 biotechnology products and vaccines. Most are intended for treat previously incurable conditions; individualizing treatment with different risk factors as well as creating more exact tools for detecting cancer. The level of development of countries is based on the indicator of biotechnology. It is an indicator of the level of development of countries [2]. Biotechnology serves as a gauge of a nation's advancement. Advanced nations enthusiastically promote and advance biotechnological sectors through contemporary research approaches like molecular biology and genetic engineering. Recent breakthroughs in biotechnology have proven effective in addressing contemporary societal challenges. In Russia, the progress of biotechnology encounters specific challenges, but these are progressively being surmounted through fresh investments and the establishment of diverse research hubs and technology complexes. The establishment of biotechnology

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clusters emerges as a forward-looking approach for fostering biotechnology development within various regions.

2 Research Methodology

The rapid advancement of modern biological technologies and research methods has led to a substantial diversification of biotechnology, both in terms of the products it generates and its application areas. Given the continuous expansion of biotechnological product types and the methods employed for their production, there arose a necessity to categorize the various realms of biotechnology.

The widely adopted and user-friendly international classification of biotechnology based on activity sectors employs a color-coded system. Red biotechnology encompasses medical and veterinary biotechnology, biopharmaceuticals, which are specialized in regenerative therapies, vaccines and antibiotic production, molecular diagnostics. The "Red" biotechnology is the basis of scientific research on novel drug development, regenerative therapies, regenerative therapies, vaccine and antibiotic production, molecular diagnostics, and genetic engineering techniques for disease treatment via genetic manipulation.

The "White" biotechnology includes industrial and bioengineering aspects, sometimes also encompassing industrial and bioengineering aspects, sometimes also encompassing the concept of molecular and cellular industrial biotechnology. According to the researchers, it is important to develop more energy-efficient and eco-friendly products and processes that often surpass traditional alternatives.

Green" biotechnology, linked with agrobiotechnology and agrobiotechnology, occasionally involving environmental biotechnology and bioenergy, concentrates on the enhancement of agriculturally important plant varieties. It is intended to improve the quality for agriculturally important plant varieties, biopesticides, as well as biofertilizers.

Yellow biotechnology focuses on applying biotechnology in food production, such as fermenting wine, cheese, and beer [3]. The Yellow biotechnology center is a laboratory dedicated to advancing biotechnology in food production, specifically through fermentation processes for items like wine, cheese, and beer.

Environmental biotechnology, categorized under "Gray" biotechnology, is linked to industrial and technical biotechnology, particularly fermentation processes. It encompasses the creation of bioproducts like lump protein and environmental applications related to conserving biodiversity and removing pollutants using microorganisms and plants to separate and eliminate various substances such as heavy metals and hydrocarbons.

Blue biotechnology, also known as aquabiotechnology, utilizes marine resources to develop products and applications across various sectors.

Golden biotechnology combines biology, nanobiotechnology, and biometric technology, often referred to as computational science. It aids in solving biological challenges through computer-based methods, enabling the rapid organization and analysis of data.

"Brown" biotechnology is centered on developing applications for deserts and arid regions.

"Purple biotechnology" explores the legal and philosophical aspects of biotechnology, including patents and ethical considerations.

"Black" or dark biotechnology pertains to bioterrorism and biological weapons, involving the use of microorganisms to cause harm in humans, domestic animals, and crops [4].

This classification is somewhat arbitrary since it doesn't always accurately capture the nuances of biotechnological fields in practice. Additionally, there are interdisciplinary biotechnological research areas that blend related domains. Different countries may have their own specific classification characteristics. For instance, some countries may classify only industrial biotechnology using recombinant organisms as "white" biotechnology, while traditional fermentation and other bioprocesses are classified as "gray" biotechnology. "Green" biotechnology in some cases includes environmental biotechnology, geomicrobiology, biofuel production, and biofertilizers. In the realm of agricultural biotechnology, "green" may encompass crop production, livestock farming, and veterinary medicine. The categorization is more of a formality since the activities within it can be highly diverse, requiring distinct knowledge, skills, and abilities. Despite potential overlaps in classification systems, this approach effectively represents the various domains of biotechnology.

3 Results and Discussions

Industrial biotechnology is the use of renewable resources in production and development of products. The process for producing final, intermediary and final products depends on renewable sources. Industrial biotechnology involves the utilization of biotechnology for industrial purposes, where the generation of final and intermediary products relies on renewable [5]. It is this strategy, intended for sustainable resource management and preservation that prioritizes the use of less than 90% of energy. This will result in reduced and clean energy usage as well as decreases adverse impact on the environment and reduced production expenditures. About 28 facets of industrial biotechnology employ techniques that use microorganisms and enzyme to produce products of industrial utilities.

In the beginning of industrial biotechnology, the roots of industrial biotechnology can be traced back to the 1800s when Louis Pasteur demonstrated that microbial activity was responsible for fermentation. In addition, Alexander Fleming uncovered antibacterial compounds in mold. This was followed by Florey and Chain who discovered antibacterial compounds in mold, which were further developed into the antibiotic penicillin in the early 1900s [6]. Among the realms of contemporary industrial biotechnology, there are many other biological sectors that are intricately linked with different biotechnological sectors. In this way, it is because bioproducts produced through industrial biotechnology and its techniques find applications in medicines of different kinds: food industry, the food industry, education, and other fields.

The classification of industrial biotechnology domains is customary to distinguish between two main categories. In the classification of industrial biotechnology domains, it is customary to distinguish between two primary categories. Both are closely tied to modern molecular and gene techniques (referred to as "white"), the other relies on classical cultivation methods (called "gray" or “technical”). In addition, "White" biotechnology also exhibits significant overlap with "gold" biotechnology due to the same subject and research concept [7]. This is due to its close relationship with "Gold" biotechnology due to similar subjects and research principles.

The most important domains in the evolution of contemporary biotechnology are molecular and cellular biotechnology. The growth of scientific disciplines such as systems and synthetic biology, high-throughput genome research methods, genomics, pharmacogenomics, transcriptomics, proteomics, and metabolomics (collectively is called "omics"). In modern molecular and protein engineering, the advancement and commercialization of biotechnology, at the core of modern molecular biology is DNA cloning – the process of creating genetically identical DNA molecules. This process consists of producing genetically identical DNA molecules by combining two different nucleic acids in one cell.

By molecular cloning, it has become possible to pinpoint, identify and characterize the genomes of humans, create gene map structure. It is also possible to construct geographical data on genomes in order to find out how to pinpoint or localize genes, build genetic maps, arrange complete genomes, develop correlations between genes and their associated traits, and decipher the underpinnings of trait expression. For example, the use of molecular cloning is extremely widespread. The applications of molecular cloning are incredibly extensive. Genetic engineering techniques have helped to create revolutionary changes in biotechnological procedures [9]. Revolutionary shifts in traditional biotechnological procedures have stemd from the use of genetic engineering techniques.

Recombinant DNA technology serves as the cornerstone of contemporary biotechnology. Creating recombinant DNA involves the merging (recombining) of two or more DNA fragments from diverse species. Genetic engineering has enabled the development and application of various socially significant technologies and processes, including:

- The production of novel drugs and safe vaccines.
- The treatment of specific genetic disorders.
- The creation of biocontrol agents for agricultural purposes.
- The enhancement of productivity and reduction of production costs.
- The mitigation of allergenicity in certain products.
- The enhancement of nutritional properties in products.
- The formulation of biodegradable plastics.
- The retardation of food spoilage rates.
- The management of viral diseases.

By employing genetic engineering methods, notably recombinant DNA technology, various entities have succeeded in producing biologically active proteins, such as insulin, interferon, and growth hormone (as depicted in Figure 1).

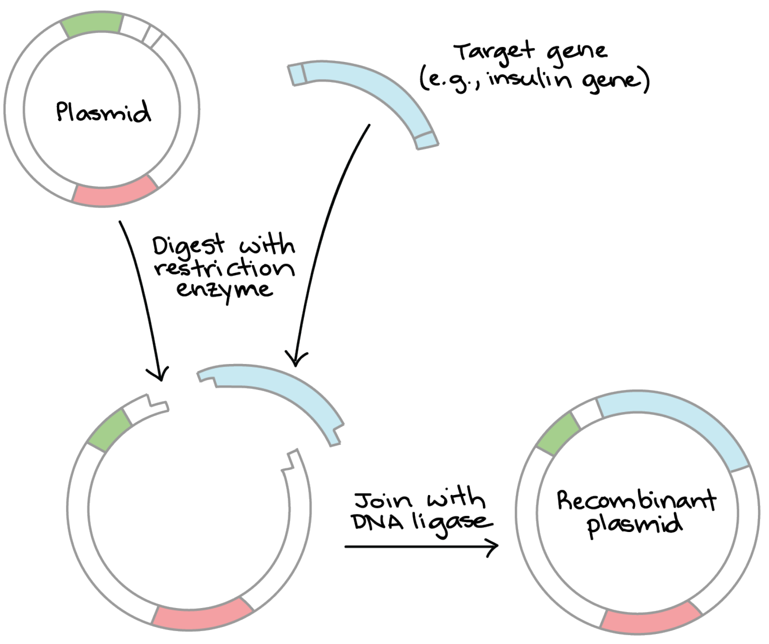

Fig. 1. Combine the fragments with DNA ligase, which links them to make a recombinant plasmid containing the gene

For example, in the realm of agriculture, it has been possible to cultivate plant resistant to salt and herbicides as well as frost. The development of models for studying human diseases, the aging process and malignant tumors can be studied by genetic engineering methods used to animal organisms. Furthermore, animal cloning techniques serve a dual purpose: they enable the creation of models for studying human diseases and facilitate genetic engineering methods in animals. This approach holds significant potential for advancing pharmaceuticals, implementing treatments like gene and cell therapy, and even preserving endangered species.

Manufacturing biotechnology, encompassing industrial fermentation and industrial biotechnology, applies technology for industrial objectives. It enhances efficiency and minimizes the environmental impact of industrial processes, such as paper production or pulp processing [10]. This field utilizes biocatalysts, including microorganisms and enzymes, to produce a wide range of goods across industries, from food and feed to textiles, biofuels, and biogas.

Additionally, industrial biotechnology plays a crucial role in reducing greenhouse gas emissions by using renewable raw materials to produce various substances and products. Enzymes, serving as biocatalysts, are employed in chemical synthesis by industrial biotechnology companies, which have developed methods to produce enzymes in commercial quantities. Enzymes, being proteins found in all organisms, are central to these processes. It is known that fermentation, the process of converting substances like sucrose into acids has been used as an intermediary in producing many different kinds of raw materials for multiple product lines [11]. Plants such as corn, which are used in the production of oil, can be used for substitution for oil in chemical production.

Microorganisms are more and more integrated into the production of materials in chemical industry, as well as to explore new sustainable energy sources like biofuels. Industrial biotechnology is a large-scale process of microbiological production, including unicellular organism proteins (e.g., single-cell protein), enzymes, alcohols (e.g., ethanol, butanol), amino acids, sugars, sweeteners, organic acids (e.g. acetic, lactic, citric succinic acids), antibiotics, vitamins and biopolymers, biological solutions for livestock production, and other applications. A green-chemistry is a term used for the production of substances, that were previously synthesized by an industry with biotechnological methods from renewable raw materials.

4 Conclusions

Biotechnology has become one of the most promising and profitable sectors in global countries, as well as providing an important indicator for assessing the country's current progress. It is also considered to be one of the most promising fields in many regions of the world, serving as key barometers for assessing a country's economic stability and progress. It is worth noting that Russia has strategically integrated biotechnological research into its long-term development plan, resulting in the rapidly advancing biotechnology market. The Russian Federation has consistently demonstrated strong economic performances, in line with the global trend. Across various segments, Russia has consistently demonstrated substantial growth rates, aligning itself with worldwide trends. For example, the government has enacted a number of programs to bolster biotechnology advancements in several sectors, and developmental institutions have begun to focus on this domain as part of investment plans.

In the industry, there are significant emphasis on Technological platforms such as "Medicine of the Future", “Biotech 2030”, and “Bioenergy” that intend to bridge the gap in business relations with science. At the moment, the pursuit of import substitution policies is gradually yielding fruit as domestic companies supporting the Ministry of Industry and

Trade create domestic counterparts to biological products from other countries. The result was that in Russia, small private firms, who are supported by the Ministry of Industry and Trade, create domestic counterparts to foreign biological products. The forecasted expiration of patent protection for many pharmaceuticals, Russia may emerge with a competitive biologics sector. However, establishing innovative drug production in the medium term is still an important challenge. A comprehensive development of the industrial infrastructure of domestic companies and government support for private sector investments in innovations are important components for success.

The possibility for import substitution in the production of industrial enzymes, biodegradable polymers and agrobiotechnologies encompassing vaccines-antibiotic products has been identified. Significant potential for import substitution still exists in the production of industrial enzymes, biodegradable polymers, and agrobiotechnologies encompassing vaccines, antibiotics and feed additives is present. This is facilitated by the growth of segments like bioinformatics and laboratory diagnostics, encompassing biomarkers, test systems, sensors, andbiochips. The shifting focus towards preventive medicine can be achieved through development of segments like bioinformatics and laboratory diagnostics, in addition to bioinformatics and laboratory diagnostics, that include biosensors for tests, biosensors for biochips. This is the strategic decision that has been made to actively nurture molecular and cellular biotechnological sectors. According to the scientific researchers, the most important prerequisite for effective advancement of biotechnological domains is the capability to transition scientific breakthroughs by Russian researchers into commercialization.

In addition to this, segments such as biodegradable polymers, bioenergy and environmentalbiotechnologies are promising for development if Russia aligns with modern standards of quality control, technology requirements in the field of biological plant protection products. They have great potential for development if Russia aligns with contemporary standards, technical regulations, environmental incentives similar to those observed in the well-developed regions of the United States and Europe.

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