Synthetic Biology Market Assessment, By Tools [Oligonucleotides, Enzymes, Cloning Kits, Synthetic Cells, Chassis Organisms, Xeno Nucleic Acid], By Technology [Genome Engineering, PCR Technology, Bioprocessing Technology, NGS Technology, Bioinformatics, Nanotechnology and Others], By Application [Healthcare, Non-Healthcare], By End-user [Pharmaceutical and Biopharmaceutical Companies, Academic and Research Institutes, Others], By Region, Opportunities and Forecast, 2017-2031F

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Report description:

Global synthetic biology market is projected to witness a CAGR of 20.29% during the forecast period 2024-2031, growing from USD 15.21 billion in 2023 to USD 66.68 billion in 2031.
The scientific field of synthetic biology is related to the biological application of engineering concepts. Biomaterials, biotechnology, systems biology, chemical and biological engineering, electrical and computer engineering, and evolutionary biology are just a few of the specialisations that are a part of this interdisciplinary field. In synthetic biology, microorganisms are redesigned for practical uses. Expanding the repertoire of naturally occurring proteins for novel processes and recognizing and cataloging standardized genetic components for the construction of innovative biological systems are among the main objectives of synthetic biology. Increased investments in cutting-edge procedures and techniques, the growing need for synthetic genes and cells, and the expanding applications of synthetic biology are the main drivers of market expansion. Synthetic biology has a wide range of applications in sectors including healthcare, agriculture, and energy that open new avenues for solving difficult problems and propelling market expansion.

In addition, rising R&D expenditures support the creation of novel methods and procedures in the field of synthetic biology, which promotes creativity and competitiveness in the marketplace. Additionally, the market is expanding due to the rising demand for synthetic genes and cells, which highlights the significance of these biological building blocks in a variety of biotechnological applications. These interconnected factors work together to define the market's trajectory, providing businesses with the possibility to profit from the rising demand for synthetic biology services and products while advancing scientific and industrial advancements. For instance, in May 2023, a diverse group of key opinion leaders (KOLs) and their strategic partner called Allozymes helped GenScript Biotech Corporation, which is the sponsor of the SynBioBeta Conference in Oakland, California, present the newest tools and approaches in synthetic biology.

Advancements in Molecular Biology Led to Market Expansion

Advancements in molecular biology have significantly propelled the growth of the synthetic biology market, a field dedicated to redesigning organisms for useful purposes by engineering them to have new abilities. Molecular biology techniques, such as Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR-Cas9) gene editing, next-generation sequencing, and advanced bioinformatics tools, have streamlined the process of DNA manipulation and analysis, making genetic engineering more precise, efficient, and cost-effective. CRISPR-Cas9, for instance, allows for targeted and highly specific genetic modifications, enabling scientists to edit genes with unprecedented accuracy. This precision is crucial for developing synthetic organisms with desired traits, such as microbes capable of producing biofuels, pharmaceuticals, or other valuable chemicals. Next-generation sequencing technologies provide comprehensive genomic data, facilitating the design of synthetic pathways and circuits by identifying and characterizing genetic components. Furthermore, advancements in bioinformatics have enabled the integration of vast amounts of biological data, aiding in the modeling and simulation of synthetic biological systems. This integration helps predict the behavior of engineered organisms, thus reducing trial-and-error experimentation and accelerating development timelines.

The ability to design and construct synthetic organisms more efficiently has opened new commercial avenues in various sectors, including healthcare, agriculture, and environmental management. For example, engineered microbes are used to produce insulin, biodegradable plastics, and crop-enhancing biofertilizers. These innovations address critical global challenges such as sustainable production and disease management, thereby driving market demand. In summary, the synergy between molecular biology and synthetic biology is creating a robust foundation for innovation, expanding the capabilities and applications of synthetic biology, and consequently driving market growth. For instance, the goal of the multi-stage collaboration between Octarine Bio, a synthetic biology company that develops new sustainable bio-based ingredients, and Ginkgo Bioworks, Inc. is to focus on compounds in the tryptophan pathway and engineer a strain that can produce violacein and its derivatives, a naturally occurring bis-indole pigment with potent bioactive properties like anti-microbial, antioxidant, and UV protection. This partnership was announced in May 2023.

Rising Demand for Precision Medicine Promotes Market Growth

The rising demand for precision medicine is significantly driving the expansion of the synthetic biology market. Precision medicine, which tailors medical treatment to the individual characteristics of each patient, relies heavily on the ability to understand and manipulate genetic information. Synthetic biology plays a crucial role in enabling these personalized medical approaches with its capacity to engineer biological systems. Firstly, synthetic biology facilitates the development of custom therapeutics, such as gene therapies and personalized drugs. By designing and constructing new genetic sequences, scientists can create treatments that specifically target the genetic mutations underlying a patient's disease. This precision in targeting improves the efficacy and safety of treatments, making synthetic biology indispensable in precision medicine. Moreover, synthetic biology contributes to the advancement of diagnostic tools. Engineered biosensors and diagnostic platforms can detect biomarkers at unprecedented levels of sensitivity and specificity. These innovations enable early detection and accurate monitoring of diseases, which are critical components of precision medicine strategies.

The growing adoption of precision medicine also spurs investment in synthetic biology research and development. Biotech companies and research institutions are increasingly focusing on synthetic biology to meet the rising demand for personalized medical solutions. This influx of funding accelerates the innovation cycle, leading to more advanced and commercially viable synthetic biology applications. In addition, regulatory support for precision medicine, along with public and private sector

collaborations, further propels the synthetic biology market. Governments and organizations recognize the potential of precision medicine to transform healthcare, thus driving policies and partnerships that favor the development and integration of synthetic biology technologies. Overall, the synergy between precision medicine and synthetic biology not only enhances patient outcomes but also significantly expands the synthetic biology market, fostering a new era of personalized healthcare solutions.

For example, Bit.bio, a startup that codes human cells for cutting-edge treatments, and Ginkgo Bioworks, Inc., a business creating the industry's best platform for cell programming and biosecurity, announced Bit.bio as the Ginkgo Technology Network's first partner on February 28, 2024. The Network is an innovative group of state-of-the-art technology partners committed to working with Ginkgo Bioworks, Inc. to provide new, integrated capabilities that make customer R&D projects successful.

Increasing Dominance of Healthcare Segment Leading to Market Growth

The healthcare sector is now opting for a variety of therapeutic treatments utilizing modified phages, artificial cells, and live bacteria due to the rapid growth of synthetic biology. It has made it possible for life technologies to quickly develop and produce antigens and their variations with high expression, capacity, and speed. Applications for synthetic biology range from manufacturing and diagnostic tests to the development of drugs and vaccines. Governmental and non-governmental activities are anticipated to have a favorable impact on this market area. For example, in July 2022, SynBioVen, Limited awarded a grant of USD 6.6 million (GBP 5.5 million) to SynbiCITE, the National Centre for the Industrial Translation of Synthetic Biology in the United Kingdom. With this funding, the imperial-hosted center would be able to further assist small and medium-sized businesses and startups in the field of synthetic biology, bolster the United Kingdom's developing economy, and unleash the potential benefits of synthetic biology for society as a whole. In a ground-breaking development that eliminates the need for eggs or sperm, researchers demonstrated the generation of synthetic human embryos using stem cells in June 2023 at the annual meeting of the International Society for Stem Cell Research. These model embryos, which mimic the earliest stages of human development, are thought to offer a vital window into the effects of genetic diseases and the biological causes of recurrent miscarriages, according to scientists.

Thus, advancements in synthetic biology-related healthcare are anticipated to accelerate market expansion. Therefore, due to the above-mentioned factors, including ongoing research and advances in synthetic biology for healthcare areas, the healthcare segment is anticipated to experience significant growth during the projection period.

North America to Dominate the Synthetic Biology Market

The market for synthetic biology is predicted to grow significantly in North America because of the region's growing demand for bio-based goods, growing investments in synthetic biology startups, and rising financing for synthetic biology research and development. The region's synthetic biology market is growing because of the United States' significant contributions to research in drug discovery, genomics, and proteomics structure prediction, in general. Governmental bodies like the National Institutes of Health (NIH) and private organizations like the Gates and Melinda Foundation have funded several universities and research institutes to develop bioinformatics, DNA sequencing, biological components, and integrated systems devices that have a wide range of applications in healthcare and other fields. The Canadian government invested more than USD 4.13 million (CAD 5.6 million) in October 2022 to help early-stage genomics companies launch new products. This would facilitate the application of artificial intelligence (AI), automation, miniaturization, and computers to molecular biosciences related to synthetic biology or genetic engineering. Similarly, the products developed by the Twist Bioscience Corporation's manufacturing plant, called the Factory of the Future in Oregon, U.S., were shipped in January 2023. Twist Bioscience Corporation helps its customers thrive by offering high-quality synthetic DNA on its silicon platform. Moreover, growing support from public and private organizations, as well as R&D expenditures for medication research and improvement, are significant growth drivers anticipated to propel the market throughout the period.

Future Market Scenario (2024-2031F)

The main factors contributing to the anticipated growth of the synthetic biology market are the increasing demand for personalized medication and the need to develop better drugs. Not only this, but the declining cost of DNA sequencing and synthesizing is a factor that will always propel the market growth. Given that technology is advancing, cutting-edge technology in the area is expected. Players in this market are expanding at an unparalleled rate, introducing cost-effective and efficient technologies. Government policies and policies made by welfare bodies are also greatly fueling the market expansion. For instance, the Rice Synthetic Biology Institute was established by Rice University of the United States in January 2024 with the goal

of fostering cooperative research in synthetic biology and its application to the development of technologies that advance society.
Key Players Landscape and Outlook
Several companies such as Thermo Fisher Scientific, Inc., Merck KGaA, Novozymes AS, Eurofins Scientific, Amyris Inc., Codexis, Inc., GenScript Biotech Corporation, Viridos Inc. (Synthetic Genomics Inc.), Twist Bioscience Corporation, Ginkgo Bioworks, Inc., etc., are expanding business by planning and adopting new strategies. They are complying with new strategic initiatives regarding the launches of newly developed biologics to help researchers and to strengthen their presence in the market. New product launches, agreements based on contracts, acquisitions and mergers, investments and partnerships are a few ways through which they are trying to achieve the same.
For instance, to improve results for patients with chronic illnesses, AMC Health, a healthcare organization, established a service relationship with the University of Mississippi Medical Center in March 2023. The goal of this collaboration is to expand the market for synthetic biology and open up new avenues for patient care systems that go beyond conventional hospital settings.
Similarly, expanding their current biomanufacturing partnership, Sumitomo Chemical Co., Ltd. and Ginkgo Bioworks, Inc. announced a new project in July 2023 to use synthetic biology to create functional chemicals. The two have been using Ginkgo Bioworks Inc.'s platform since 2021 to create a variety of goods in the fields of personal care, cosmetics, agriculture, and pharmaceuticals. This latest initiative is their third collaborative effort and is positioned to enable large-scale fermentation-based manufacture of useful compounds.

Table of Contents:

5.1.6.3.5.Bioinformatics
5.1.6.3.6.Nanotechnology
5.1.6.3.7.Others
5.1.6.4.By Application
5.1.6.4.1.Healthcare
5.1.6.4.2.Non-Healthcare
5.1.6.5.By End-user
5.1.6.5.1.Pharmaceutical and Biopharmaceutical Companies
5.1.6.5.2.Academic and Research Institutes
5.1.6.5.3.Others
5.1.7.Canada
5.1.8.Mexico
*All segments will be provided for all regions and countries covered
5.2.Europe
5.2.1.Germany
5.2.2.France
5.2.3.Italy
5.2.4.United Kingdom
5.2.5.Russia
5.2.6.Netherlands
5.2.7.Spain
5.2.8.Turkey
5.2.9.Poland
5.3.Asia-Pacific
5.3.1.India
5.3.2.China
5.3.3.Japan
5.3.4.Australia
5.3.5.Vietnam
5.3.6.South Korea
5.3.7.Indonesia
5.3.8.Philippines
5.4.South America
5.4.1.Brazil
5.4.2.Argentina
5.5.Middle East and Africa
5.5.1.Saudi Arabia
5.5.2.UAE
5.5.3.South Africa
6.Market Mapping, 2023
6.1.By Tools
6.2.By Technology
6.3.By Application
6.4.By End-user
6.5.By Region
7.Macro Environment and Industry Structure
7.1.Demand Supply Analysis

13.10. Ginkgo Bioworks, Inc.
*Companies mentioned above DO NOT hold any order as per market share and can be changed as per information available during research work.
14. Strategic Recommendations
15. About Us & Disclaimer

Synthetic Biology Market Assessment, By Tools [Oligonucleotides, Enzymes, Cloning Kits, Synthetic Cells, Chassis Organisms, Xeno Nucleic Acid], By Technology [Genome Engineering, PCR Technology, Bioprocessing Technology, NGS Technology, Bioinformatics, Nanotechnology and Others], By Application [Healthcare, Non-Healthcare], By End-user [Pharmaceutical and Biopharmaceutical Companies, Academic and Research Institutes, Others], By Region, Opportunities and Forecast, 2017-2031F

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