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MicroRNA market – Global Industry Size, Share, Trends, Opportunity, and Forecast, 2018-2028 Segmented By Product & Service (Products, Consumables, Services), By Application (Cancer, Infectious Diseases, Immunological Disorder, Cardiovascular Disease, Neurological Disease, Others), By End User (Biotechnology & Pharmaceutical Companies, Academic & Government Research Institutes, Other), by region, and Competition

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Abstracts

Global MicroRNA Market has valued at USD 1548.20 million in 2022 and is anticipated to witness an impressive growth in the forecast period with a CAGR of 12.20% through 2028. MicroRNAs (miRNAs) are a class of small RNA molecules that play a significant role in gene regulation. They are a fundamental part of the complex molecular machinery that controls gene expression and are involved in various biological processes in both plants and animals, including humans. MicroRNAs are typically short RNA molecules, usually composed of around 20 to 22 nucleotides. They have a characteristic stem-loop structure. MicroRNAs are transcribed from DNA sequences into a longer precursor molecule called pri-miRNA by RNA polymerase. This pri-miRNA is processed in the cell nucleus by the enzyme Drosha, resulting in a shorter hairpin-shaped molecule called pre-miRNA. The pre-miRNA is then transported to the cytoplasm and further processed by Dicer, an RNA-processing enzyme, into a double-stranded RNA molecule. One of the strands, known as the mature miRNA, is incorporated into a protein complex called the RNA-induced silencing complex (RISC).

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Dysregulation of microRNAs is associated with various diseases, including cancer, cardiovascular diseases, neurodegenerative disorders, and autoimmune conditions. Aberrant microRNA expression can contribute to disease development and progression. MicroRNAs have gained attention as potential therapeutic agents. Researchers are exploring their use in gene therapy, where they can be used to target specific genes involved in disease. This approach has applications in cancer therapy, among others. Ongoing advancements in genomics and molecular biology have fueled the exploration of non-coding RNA, including microRNAs. Researchers are increasingly uncovering the roles of microRNAs in gene regulation and their implications in health and disease. MicroRNAs have gained prominence as potential biomarkers for various diseases. Researchers are actively exploring their utility in disease diagnosis, prognosis, and monitoring, which has driven demand for microRNA-based diagnostic tools. The emergence of RNA-based therapeutics, including microRNA mimics and anti-miRNA agents, is expanding treatment options for previously challenging diseases. These therapies have the potential to target specific genes and pathways.

Key Market Drivers

Advancements in Genomic Research

One of the initial breakthroughs in microRNA research was the discovery of these small RNA molecules. In the early 2000s, researchers identified the existence of a large number of microRNAs in various species, including humans. This discovery opened the door to further exploration of their functions. The advent of high-throughput sequencing technologies, such as next-generation sequencing (NGS), has revolutionized microRNA research. These technologies enable the rapid and cost-effective profiling of microRNA expressions in various tissues and under different conditions. The establishment and continuous updating of miRBase, a comprehensive database of microRNA sequences, annotations, and target predictions, have provided a valuable resource for researchers worldwide. This database has supported the standardization and classification of microRNAs. Advancements in functional genomics and molecular biology techniques have allowed researchers to investigate the roles of specific microRNAs in gene regulation. These studies involve techniques like CRISPR-Cas9 for gene editing and gene knockout experiments to determine the effects of microRNA dysregulation. Single-cell RNA sequencing has enabled the study of microRNA expression at the single-cell level. This technology has provided insights into the heterogeneity of microRNA expression within tissues and the role of microRNAs in individual cells.

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Comparative genomics has enabled the study of microRNAs across different species. Researchers have identified conserved and species-specific microRNAs, shedding light on their evolutionary significance and functional conservation. Computational tools and databases have been developed to predict microRNA target genes and their functions. These tools assist researchers in understanding the regulatory networks in which microRNAs are involved. Research has extended beyond microRNAs to explore interactions and crosstalk with other non-coding RNAs, such as long non-coding RNAs (lncRNAs) and circular RNAs (circRNAs). These interactions can significantly impact gene regulation and are an area of active research. Investigations into the epigenetic regulation of microRNAs, including DNA methylation and histone modifications, have provided insights into how microRNA expression is controlled and how it can be dysregulated in diseases. Advances in genomic research have paved the way for clinical applications of microRNAs as diagnostic biomarkers, prognostic indicators, and therapeutic targets in various diseases, including cancer, cardiovascular diseases, and neurological disorders. RNA-Seq and small RNA sequencing techniques have allowed researchers to analyze the transcriptome comprehensively, including the identification and quantification of microRNAs. This factor will help in the development of the Global MicroRNA Market.

Growing Emphasis on Biomarker Discovery

MicroRNAs are being increasingly recognized as valuable biomarkers for the diagnosis and monitoring of various diseases, including cancer, cardiovascular diseases, neurodegenerative disorders, and infectious diseases. They can serve as non-invasive or minimally invasive diagnostic tools, enabling earlier and more accurate disease detection. Biomarker discovery, including microRNA profiling, contributes to the development of personalized medicine. By analyzing the microRNA profile of an individual, healthcare providers can tailor treatment plans to the specific characteristics of the patient's disease. This approach can improve treatment efficacy and reduce adverse effects. Biomarkers, such as microRNAs, are critical in drug development and clinical trials. They can be used to identify suitable patient populations for clinical studies, monitor treatment responses, and assess the safety and efficacy of new therapies. This accelerates the drug development process and reduces the cost of clinical trials. MicroRNAs are not only valuable for disease diagnosis but also for predicting disease prognosis and response to therapy. This information is essential for determining the likely course of a disease and for optimizing treatment strategies.

Biomarkers, including microRNAs, are used in companion diagnostics, which are tests developed alongside specific therapies to identify patients who are most likely to benefit

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from the treatment. This approach is increasingly important in precision medicine. MicroRNAs can be detected in various bodily fluids, such as blood, urine, and saliva. This non-invasive nature of microRNA-based biomarker testing makes it convenient and well-tolerated by patients, enhancing its appeal for both routine screenings and disease management. Early detection of diseases is often crucial for successful treatment outcomes. MicroRNA biomarkers are used in the development of tests that can identify diseases at their earliest, most treatable stages. Biomarker-based tests, including those utilizing microRNAs, are employed to monitor the progression of diseases over time. This information guides treatment decisions and helps assess the effectiveness of therapeutic interventions. Biomarker discovery is a critical aspect of research, enabling scientists to uncover new associations between microRNAs and diseases. This drives further investigation and innovation in the field. The demand for microRNA-based biomarker discovery fuels growth in the microRNA market. Companies invest in research, product development, and commercialization to meet the demand for biomarker-related services and products. This factor will pace up the demand of the Global MicroRNA Market.

Increasing Development of RNA-Based Therapeutics

MicroRNAs have shown promise as therapeutic agents due to their role in gene regulation. They can be harnessed to modulate the expression of specific genes, making them potential candidates for treating a wide range of diseases, including cancer, cardiovascular disorders, and genetic conditions. MicroRNA-based therapeutics can be highly specific in their action, targeting the expression of genes or pathways associated with a disease. This precision allows for more effective and less toxic treatments, as they spare healthy cells from harm. MicroRNA-based therapeutics have broad applications. They can be used for oncology, cardiovascular medicine, neurodegenerative diseases, metabolic disorders, and more. The versatility of microRNAs as therapeutic agents contributes to their high demand. RNA-based therapeutics, including microRNA mimics and anti-miRNA agents, represent innovative approaches to disease management. They can address diseases that were previously challenging to treat with traditional therapies. MicroRNA-based therapeutics align with the principles of precision medicine. By analyzing a patient's microRNA profile, healthcare providers can tailor treatments to the specific molecular characteristics of the disease, enhancing their effectiveness.

The development of microRNA-based therapeutics has driven a demand for services related to pre-clinical and clinical testing. Companies require diagnostic tools, biomarker identification, and other services to advance their therapeutic candidates through trials.

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The potential of microRNA-based therapeutics has attracted significant investment and funding from venture capital firms, government agencies, and pharmaceutical companies. This financial support has accelerated research and development efforts in this field. Regulatory agencies, such as the U.S. Food and Drug Administration (FDA), have provided guidance and support for the development of RNA-based therapeutics, including microRNAs. This regulatory clarity has facilitated the clinical translation of these therapies. Collaborations between biotechnology companies, pharmaceutical firms, and academic institutions have been pivotal in advancing microRNA-based therapeutics. These partnerships combine scientific expertise and resources to drive innovation. The competitive landscape of the biotechnology and pharmaceutical sectors has led to increased innovation and product development. The pursuit of novel therapies and approaches, including microRNA-based treatments, drives market growth. Many diseases, particularly those with complex genetic components, still lack effective treatments. The potential of microRNA-based therapeutics to address these unmet medical needs generates significant interest and demand. This factor will accelerate the demand of the Global MicroRNA Market.

Key Market Challenges

Standardization

MicroRNA research and analysis involve various analytical platforms, including quantitative polymerase chain reaction (qPCR), microarray technology, and next-generation sequencing (NGS). Each platform has its own protocols and techniques, making it challenging to ensure consistency and comparability of results. Variability in sample preparation methods, such as RNA extraction and quality control, can lead to differences in microRNA profiles. Standardizing these steps is critical to obtaining reliable and reproducible results. The analysis and interpretation of microRNA data can vary among researchers and laboratories. Standardizing data analysis methods and reporting criteria is essential to facilitate data sharing and comparison. The lack of standardized reference materials, including well-characterized microRNA standards, hinders the accuracy and reliability of microRNA quantification. Having validated reference materials is crucial for quality control. Researchers need standardized normalization procedures to account for variations in microRNA expression levels due to sample differences and technical factors. Lack of consistent normalization methods can lead to inaccurate results. Standardized quality control measures for assessing the integrity and purity of RNA samples are essential to ensure the reliability of microRNA data. Variability in quality control practices can impact data quality. When using microRNAs as biomarkers, their validation can be a challenge. There is a need for

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standardized guidelines and criteria for validating microRNA biomarkers, including sensitivity, specificity, and reproducibility.

Ethical and Privacy Concerns

MicroRNA profiles can provide insights into an individual's genetic and molecular characteristics. Concerns arise about the potential misuse of this information, such as genetic discrimination by employers, insurers, or other entities. Researchers and healthcare providers must ensure that individuals participating in microRNA studies or diagnostic tests provide informed consent. This involves explaining the potential risks and benefits, as well as how their data will be used and shared. The storage and transmission of microRNA data must be secure to protect against unauthorized access and data breaches. Ensuring robust data security measures is essential to safeguard sensitive genetic information. Biobanks that store biological samples for research purposes must adhere to ethical standards and consent guidelines. The use of stored samples for microRNA research should be clearly disclosed and controlled. It can be challenging to maintain patient anonymity when working with microRNA data, especially in small populations or rare diseases. Researchers must implement measures to protect patient privacy. Determining who owns and controls the microRNA data and results can be ethically complex. Balancing the interests of researchers, institutions, and patients is a challenge. The potential dual-use nature of microRNA research, where knowledge and technologies can be used for both beneficial and harmful purposes, poses ethical dilemmas. Researchers must consider the responsible conduct of research.

Key Market Trends

Personalized Medicine

MicroRNAs are increasingly being identified as valuable biomarkers that can help stratify patients into different subgroups based on their microRNA profiles. This allows for more precise diagnoses and treatment plans. MicroRNA-based diagnostics are being developed to detect specific microRNA patterns associated with diseases. These diagnostics enable early and accurate disease detection, improving patient outcomes. The molecular information provided by microRNA profiles can guide healthcare providers in selecting the most appropriate treatment options for patients. This is particularly relevant in cancer treatment, where different tumors may respond differently to therapies. MicroRNAs can be used to predict disease progression, treatment response, and prognosis. This information helps healthcare providers make informed decisions about treatment strategies and interventions. MicroRNA profiles can influence

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how individuals metabolize medications and respond to treatments. Pharmacogenomic research involving microRNAs can help determine the most effective and safe drug regimens for patients. MicroRNAs are being explored as therapeutic agents for personalized medicine. By modulating the expression of specific microRNAs, researchers aim to develop tailored treatments for various diseases and genetic disorders. MicroRNA-based risk assessment can identify individuals who may have a higher predisposition to certain diseases. This information can guide preventive measures and early intervention. MicroRNA profiles can be used to monitor the progression of diseases over time. Regular monitoring enables adjustments to treatment plans and interventions as needed.

Segmental Insights

Product & Service Insights

In 2022, the Global MicroRNA Market largest share was held by services segment and is predicted to continue expanding over the coming years. The services segment includes a wide range of offerings related to microRNA research and development. This can encompass contract research services, sequencing and analysis services, and assay development. Many researchers and institutions prefer to outsource these activities to specialized service providers with expertise in microRNA, driving demand for such services. Service providers in the microRNA market often possess advanced technological platforms and expertise that enable high-quality research and analysis. Researchers and companies may choose to leverage these specialized capabilities rather than invest in establishing their own infrastructure. Utilizing services can be cost-effective, especially for smaller research laboratories or organizations that may not have the resources to establish and maintain their own microRNA research capabilities. Outsourcing services can save time and reduce costs associated with in-house research. Service providers typically employ experts in microRNA research and analysis. Clients can benefit from the knowledge and experience of these specialists, enhancing the quality and reliability of their research. Service providers often offer customized solutions to meet the specific needs of their clients. This flexibility is particularly valuable in microRNA research, where the focus may vary depending on the research objectives.

Application Insights

In 2022, the Global MicroRNA Market largest share was held by cancer segment and is predicted to continue expanding over the coming years. Cancer is a leading cause of

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death worldwide, and its prevalence has been steadily increasing. MicroRNAs play a critical role in cancer development and progression, making them a focus of extensive research. The need for better diagnostic tools and treatments for cancer has driven the demand for microRNA-based solutions. MicroRNAs have been identified as potential biomarkers for various types of cancer. They can be used to detect cancer at an early stage, which is crucial for effective treatment and improved patient outcomes. MicroRNA-based diagnostic tests offer the promise of early cancer detection and monitoring. Cancer is a highly heterogeneous disease, and different types of cancer respond differently to treatments. MicroRNAs can provide insights into the molecular characteristics of a patient's cancer, allowing for more personalized treatment approaches. Pharmaceutical companies are actively exploring microRNA-based therapeutics to target specific cancer subtypes. MicroRNAs are not only valuable for cancer diagnosis but also for predicting the prognosis and response to therapy. This information is essential for tailoring treatment plans to individual patients. Biotechnology and pharmaceutical companies, as well as research institutions, have made significant investments in understanding the role of microRNAs in cancer. This has led to the development of innovative products and services for cancer management.

End-User Insights

In 2022, the Global MicroRNA Market largest share was held by Biotechnology & Pharmaceutical Companies segment in the forecast period and is predicted to continue expanding over the coming years. Biotechnology and pharmaceutical companies have invested heavily in research and development related to microRNA. They have the resources and expertise to conduct extensive research, which includes identifying and characterizing microRNAs, as well as exploring their potential applications in diagnostics and therapeutics. These companies are well-equipped to translate research findings into practical products and services. They can develop innovative microRNA-based diagnostic tests, therapeutic agents, and other related solutions. Biotechnology and pharmaceutical companies have experience in conducting clinical trials, which are crucial for testing the safety and efficacy of microRNA-based therapeutics and diagnostics. They also possess regulatory expertise to navigate the complex approval processes. These companies have established distribution networks and sales channels that allow them to reach a global market. This access to healthcare providers, laboratories, and healthcare systems is essential for commercializing microRNA products. Many of these companies have secured intellectual property rights for microRNA-related discoveries, technologies, and applications. This intellectual property can provide a competitive advantage and protect their innovations.

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Regional Insights

The North America region dominates the Global MicroRNA Market in 2022. North America, particularly the United States, has a robust biomedical and biotechnology research ecosystem. The presence of renowned research institutions, universities, and biotechnology companies has driven significant research and development efforts in the field of microRNA. The region is home to a large and well-established biotechnology industry. This infrastructure has supported the development and commercialization of microRNA-based products and services. The region benefits from access to substantial research funding, both from government sources and private investors. Funding agencies, such as the National Institutes of Health (NIH), have played a crucial role in advancing microRNA research. The North American scientific and business communities actively collaborate and network, fostering innovation and the exchange of ideas. This has accelerated progress in microRNA research and its applications.

Key Market Players

Thermo Fisher Scientific, Inc.

Horizon Discovery Ltd.

OriGene Technologies, Inc.

QIAGEN

GeneCopoeia, Inc.

Merck KGaA

Miltenyi Biotec

Sistemic Scotland Limited

SeqMatic LLC

Biodynamics Laboratory Inc.

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In this report, the Global MicroRNA Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

MicroRNA Market, By Product & Service:

Products

Consumables

Services

MicroRNA Market, By Application:

Cancer

Infectious Diseases

Immunological Disorder

Cardiovascular Disease

Neurological Disease

Others

MicroRNA Market, By End-User:

Biotechnology & Pharmaceutical Companies

Academic & Government Research Institutes

Other end-users

MicroRNA Market, By region:

North America

United States

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Canada

Mexico

Asia-Pacific

China

India

South Korea

Australia

Japan

Europe

Germany

France

United Kingdom

Spain

Italy

South America

Brazil

Argentina

Colombia

Middle East & Africa

South Africa

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Saudi Arabia

UAE

Competitive Landscape

Company Profiles: Detailed analysis of the major companies presents in the Global MicroRNA Market.

Available Customizations:

Global MicroRNA Market report with the given market data, Tech Sci Research offers customizations according to a company's specific needs. The following customization options are available for the report:

Company Information

Detailed analysis and profiling of additional market players (up to five).

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