

Genome Editing Market - Global Industry Size, Share, Trends, Opportunity & Forecast, Segmented By Technology ((CRISPR)/Cas9, TALENs/MegaTALs, ZFN, Meganuclease, Others), By Deliver Mode (Ex-vivo, In-vivo), By Application (Genetic Engineering, Clinical Applications), By Mode (Contract, In-house), By End User (Biotechnology and pharmaceutical companies, Academic and government research institutes, Contract research organizations), By Region & Competition, 2020-2030F

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Report description:

Global Genome Editing Market was valued at USD 8.05 Billion in 2024 and is anticipated to project impressive growth in the forecast period with a CAGR of 16.65% through 2030. The global genome editing market is undergoing substantial growth, fueled by cutting-edge technological advancements, significant increases in research funding, and a broadening of its applications in both healthcare and agriculture sectors. Despite the market's promising expansion, it faces key challenges such as off-target effects, ethical dilemmas, and the high cost of genomic tools and technologies. However, these challenges offer a unique opportunity for innovation and the potential for market growth through the development of more precise and cost-effective solutions. As the industry continues to evolve, ongoing technological breakthroughs and strategic investments are expected to accelerate the market's trajectory, reinforcing its strong growth prospects in the coming years.

Key Market Drivers

Rising Incidence of Genetic Disorders

The rising incidence of genetic disorders is a critical driver of the growth of the global genome editing market, as it directly creates a significant demand for advanced therapeutic solutions. Genetic disorders, which are increasingly prevalent worldwide, present a complex challenge for the healthcare sector, pushing the need for innovative treatments. Genetic disorders and

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congenital abnormalities affect approximately 2%-5% of all live births, contribute to up to 30% of pediatric hospital admissions, and are responsible for nearly 50% of childhood deaths in industrialized nations. Contrary to common assumptions, available epidemiological data from many countries in the Eastern Mediterranean Region (EMR) reveal that congenital and genetically linked disorders are equally significant in this region, if not more so, compared to their prevalence in more industrialized countries. This underscores the importance of addressing genetic health challenges within the EMR, highlighting an emerging market for targeted medical solutions. Genome editing technologies, particularly CRISPR-Cas9 and other gene-editing tools, offer transformative potential in addressing these challenges, thereby fueling the market's expansion. The growing number of individuals diagnosed with genetic conditions such as cystic fibrosis, sickle cell anemia, muscular dystrophy, and various forms of inherited cancers is expanding the addressable patient population for genome editing treatments. These disorders, often linked to specific genetic mutations, present significant challenges to traditional medical approaches, thereby accelerating the need for alternative therapies. Genome editing technologies offer a direct approach to altering defective genes, potentially providing long-term cures or treatments for conditions that previously lacked effective solutions.

With the rise in genetic disorders, there has been a clear shift toward personalized or precision medicine, which aims to tailor treatments based on an individual's genetic makeup. Genome editing plays a pivotal role in this evolution by enabling the modification of specific genes responsible for disease. As the focus on personalized therapies grows, the demand for genome editing tools and techniques intensifies, propelling further market growth. The ability to provide individualized treatments that address the root causes of genetic disorders is a major selling point for genome editing, offering a competitive edge in the healthcare industry. Gene therapy, which involves the direct modification of genes to treat or prevent diseases, is becoming an increasingly important field in medical research. As the prevalence of genetic disorders rises, gene therapy is increasingly seen as a viable solution to combat these conditions. Genome editing technologies provide the precision necessary to modify genes accurately, ensuring that therapeutic interventions target the exact genetic mutations causing the disorder. The rising demand for gene therapies, driven by the increasing incidence of genetic disorders, accelerates the adoption of genome editing tools in both research and clinical settings, creating substantial growth opportunities for companies operating in this space. As the incidence of genetic disorders increases, governments and regulatory bodies are placing greater emphasis on research and development in the field of gene editing. This rising focus is translating into more funding for genomic research initiatives aimed at combating genetic diseases. Moreover, regulatory frameworks are evolving to address the safety and ethical concerns surrounding gene editing, which in turn is facilitating the progression of clinical trials and the eventual commercialization of genome editing therapies. With increased governmental support and clearer regulations, pharmaceutical companies and biotech firms are better positioned to invest in genome editing technologies, leading to growth in the market.

Rising genetic disorder prevalence drives demand for novel and cost-effective treatment models, beyond traditional pharmaceutical approaches. Genome editing, with its potential to correct genetic defects at the DNA level, is seen as a more targeted and efficient treatment modality compared to conventional methods like symptom management or gene therapy involving viral vectors. As the market for these advanced treatments grows, companies that focus on genome editing as a core part of their strategy stand to benefit from the escalating demand for new, more effective solutions for genetic disorders. Rising awareness of genetic disorders, along with advocacy from patient organizations, is further fueling the demand for genome editing solutions. As more individuals are diagnosed and educated about their genetic conditions, there is a growing societal push for viable and effective treatments. Public demand for breakthroughs in the treatment of genetic diseases encourages research and development in genome editing, thereby driving market growth. Additionally, public pressure can accelerate regulatory approvals and reduce time to market for genome editing therapies.

Increase in Precision Medicine

The increase in precision medicine is a key driver of growth in the global genome editing market, as it directly intersects with the capabilities of genome editing technologies. Precision medicine, which tailors medical treatment to an individual's genetic profile, is reshaping the healthcare landscape, and genome editing plays a pivotal role in its implementation. Precision medicine is centered around understanding the genetic makeup of individual patients to create personalized treatment plans. As more focus is placed on genetic insights, there is a growing demand for interventions that can directly modify the genetic causes of diseases. Genome editing technologies, such as CRISPR-Cas9, enable precise alterations to the genome, offering a highly targeted approach to treating genetic disorders. This demand for personalized genetic therapies, driven by the broader adoption of precision

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medicine, increases the reliance on genome editing tools to provide customized solutions for individual patients. Precision medicine is gaining significant traction among start-ups in the life sciences sector, as it is increasingly recognized as a key component of future healthcare innovations. The approach offers several compelling advantages, including optimized healthcare resource utilization, enhanced treatment effectiveness, fewer adverse drug reactions, and improved patient adherence to treatment regimens. Moreover, precision medicine has become a central focus in regulatory approvals, accounting for approximately 35% of FDA approvals annually since 2018, with projections indicating continued growth in this trend. This rising emphasis on precision medicine highlights the substantial market opportunity for companies in this space to capitalize on emerging trends in personalized healthcare.

As precision medicine advances, the ability to address genetic disorders at their molecular origin becomes a primary focus. Many genetic diseases, such as sickle cell anemia, cystic fibrosis, and muscular dystrophy, result from specific mutations within a patient's DNA. Traditional treatments often focus on managing symptoms rather than addressing the root cause of the disease. Genome editing, by contrast, offers the potential for permanent cures or long-term management by directly correcting these genetic mutations. As precision medicine progresses, the need for genome editing technologies to enable these transformative treatments becomes even more pronounced, thereby driving market growth.

Precision medicine relies heavily on genomic sequencing and diagnostics to identify genetic variants that may contribute to diseases. As the field of genomics expands, so too does the amount of genetic data available for analysis. Genome editing technologies are increasingly integrated into these diagnostic workflows to provide not just identification but actionable solutions to correct genetic variations. This seamless integration between genomics, diagnostics, and therapeutic interventions amplifies the demand for genome editing tools and accelerates their adoption within precision medicine frameworks. The synergy between these fields results in a more robust and dynamic healthcare model that directly impacts the growth of the genome editing market. The expansion of precision medicine has led to a surge in gene therapy applications, which aim to treat or prevent diseases by modifying genes. Genome editing is the cornerstone of many gene therapy techniques, providing the precision necessary to target and edit specific genes associated with diseases. The ability to perform gene modifications at a highly accurate level is crucial for the success of gene therapies. As precision medicine progresses toward more targeted and personalized therapies, the reliance on genome editing technologies to achieve these outcomes increases. The continued advancement and application of gene therapies, made possible by genome editing, is therefore a major factor driving market growth.

The rise of precision medicine is fostering a new era of clinical research that focuses on the development of treatments based on individual genetic profiles. Genome editing plays a central role in this research by enabling the creation of disease models, studying genetic mutations, and developing therapeutic interventions tailored to specific patient populations. Clinical trials are increasingly using genome editing to test the effectiveness of precision treatments, further driving the demand for these technologies. The success of these trials and the subsequent approval of gene-edited therapies will contribute to the growth of the global genome editing market. One of the promises of precision medicine is its ability to optimize treatment plans for individuals, reducing unnecessary treatments and improving overall healthcare outcomes. Genome editing technologies contribute to this cost-effectiveness by offering targeted, potentially one-time therapies that address the root cause of diseases. By reducing the need for long-term symptomatic treatment, genome editing presents a cost-efficient approach to managing genetic diseases. As healthcare systems worldwide increasingly prioritize cost-effective treatments, genome editing tools that enable precision medicine will become more integral to healthcare providers, driving demand and further expanding the market.

Collaborations and Strategic Partnerships

Collaborations and strategic partnerships are pivotal drivers of growth in the global genome editing market, accelerating the development, commercialization, and adoption of cutting-edge gene-editing technologies. The complexity of genome editing requires a multidisciplinary approach, combining expertise in molecular biology, genetics, biotechnology, and clinical applications. Strategic partnerships foster innovation, provide financial resources, and streamline the pathway from research to market. Moderna, Inc, a leader in messenger RNA (mRNA) therapeutics and vaccines, and Life Edit Therapeutics Inc., a subsidiary of ElevateBio specializing in next-generation gene editing technologies, have announced a strategic research and development partnership. The collaboration will leverage Life Edit's proprietary gene editing technologies, including base editing, alongside Moderna's mRNA platform to advance in vivo gene editing therapies targeting specific therapeutic indications. This partnership

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aims to explore the potential of mRNA for the precise delivery of gene editing tools, offering significant promise in addressing rare genetic disorders and other challenging diseases. Genome editing is a rapidly evolving field, with continuous advancements required to enhance precision, reduce off-target effects, and develop new applications. Strategic collaborations between biotech companies, academic institutions, and research organizations are crucial in facilitating accelerated R&D. These partnerships pool resources, talent, and expertise, enabling faster breakthroughs in gene-editing technologies. Collaborative R&D efforts allow for the sharing of knowledge, technology, and infrastructure, thus improving the pace of innovation. This expedited development is essential for keeping up with growing market demands and positioning companies as leaders in the competitive genome editing market.

Genome editing technologies require substantial investment in research, development, and clinical trials. Through strategic partnerships with venture capitalists, pharmaceutical companies, and academic institutions, genome editing firms gain access to critical financial resources and infrastructure. Collaborations with established pharmaceutical companies, for example, provide smaller biotech firms with the capital and facilities needed to scale up production, conduct clinical trials, and meet regulatory requirements. This influx of funding helps genome editing companies move from laboratory innovations to commercially viable products, thus expanding the market. Additionally, financial backing allows firms to overcome the high costs associated with genome editing research and development. Collaborations with regulatory bodies, industry leaders, and global research networks can help streamline the regulatory approval process for genome editing technologies. Strategic partnerships often involve sharing clinical data, results from preclinical studies, and expertise on regulatory compliance, which can expedite the approval process for gene-editing therapies. Partnering with established pharmaceutical or medical companies that have deep experience navigating regulatory environments can help new players in the genome editing market ensure that their products meet regulatory standards more efficiently. This collaboration not only accelerates time-to-market for genome editing treatments but also reduces the risks associated with navigating complex regulatory landscapes independently. Strategic alliances with global players, such as multinational pharmaceutical companies and medical device manufacturers, significantly expand the market reach and distribution channels for genome editing technologies. These partnerships allow genome editing companies to leverage the extensive networks, sales teams, and global market penetration of larger, established firms. By collaborating with industry giants, genome editing companies gain access to a wider customer base, including hospitals, research institutions, and biotechnology firms across different regions. As the global demand for genome editing solutions continues to rise, these collaborations enable faster market entry and broader commercialization of gene-editing products, thus driving overall market growth.

One of the most promising outcomes of collaborations in the genome editing space is the co-development of novel therapeutics. Strategic partnerships between biotech companies and pharmaceutical firms can combine the strengths of both parties—such as genome editing expertise and a strong drug development pipeline. These partnerships often focus on the development of gene therapies for genetic diseases, where genome editing plays a critical role in modifying the DNA of patients to cure or manage disease. By joining forces, these companies can share the financial burden of clinical trials, reduce risks, and increase the likelihood of bringing new, life-changing therapies to market. The increasing number of gene therapies under development in collaboration with large pharmaceutical companies is significantly driving the growth of the genome editing market. In an industry as dynamic as genome editing, access to proprietary technologies and intellectual property (IP) is crucial for maintaining a competitive advantage. Collaborations with leading academic institutions or other research organizations provide genome editing companies with access to cutting-edge research, patented technologies, and new gene-editing tools. For example, partnerships with universities or renowned biotech firms allow access to novel genome editing technologies, such as the next-generation CRISPR systems, which can improve the precision and efficiency of gene modification. By acquiring or licensing these technologies through collaborations, companies can enhance their product offerings and stay ahead of competitors, thereby driving growth and innovation within the genome editing market.

Key Market Challenges

Technical Limitations and Off-Target Effects

One of the primary challenges facing the genome editing market is the technical limitations of current gene-editing tools, particularly off-target effects. While technologies such as CRISPR-Cas9 have revolutionized the field, their accuracy remains a concern. Off-target effects refer to unintended changes in the genome, which could result in harmful or unpredictable outcomes. These inaccuracies raise safety concerns, especially in clinical applications where precision is paramount. For example, gene

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therapies aimed at treating genetic disorders could inadvertently cause other mutations, leading to unforeseen consequences. The lack of consistency and precision in genome editing tools limits their widespread use in therapeutic applications, particularly in human clinical trials. Overcoming these technical challenges requires further research, innovation, and refinement of gene-editing technologies, which can delay market adoption and hinder growth.

Regulatory and Ethical Barriers

The regulatory landscape surrounding genome editing is complex and varies significantly across regions, creating barriers to market entry and expansion. Regulatory bodies such as the FDA and EMA have stringent approval processes for gene-editing therapies, which often require extensive preclinical and clinical trials to ensure safety and efficacy. The long timelines and high costs associated with regulatory approval can slow down the commercialization of genome-editing-based treatments. Additionally, the ethical implications of gene editing, particularly in human germline editing, remain a significant concern. Modifying the genetic makeup of embryos or germline cells raises ethical questions about the potential for misuse, unintended consequences, and societal impacts. These ethical dilemmas, along with evolving regulatory frameworks that are still adapting to new gene-editing technologies, pose a challenge to industry growth. Companies must navigate these regulatory complexities and address public concerns to ensure successful product development and approval.

Key Market Trends

Integration of Artificial Intelligence and Machine Learning

The integration of artificial intelligence (AI) and machine learning (ML) with genome editing technologies is a transformative trend that is accelerating the development of more precise and efficient gene-editing tools. AI and ML algorithms can analyze vast amounts of genomic data, identify patterns, and predict the outcomes of gene edits, which significantly enhances the accuracy of genome editing. These technologies are particularly useful in identifying potential off-target effects and improving the overall efficiency of gene-editing processes. By reducing errors and optimizing editing techniques, AI and ML are helping researchers design more precise and reliable genome-editing strategies. The growing application of AI in genome editing not only improves the quality of gene therapies but also shortens development timelines, driving future growth in the market. As these technologies evolve, they will further transform how genome editing is utilized across therapeutic and agricultural applications.

Expansion of Gene Therapy and Personalized Medicine

A key trend that is accelerating the future growth of the genome editing market is the increasing adoption of gene therapy and personalized medicine. Gene therapy, which uses genome-editing technologies to modify genes in order to treat or cure genetic disorders, is quickly becoming a mainstream approach in the treatment of various diseases. As the medical community moves toward personalized medicine—where treatments are tailored to an individual's genetic profile—genome editing plays a critical role in enabling highly specific and effective therapies. This shift toward personalized approaches is particularly relevant for diseases with a strong genetic basis, such as inherited disorders, cancers, and neurological conditions. The ability to edit genes in patients' cells to address the root causes of these diseases is driving demand for genome-editing solutions. As regulatory approvals for gene therapies continue to expand and success stories of gene-edited treatments emerge, the market for genome editing is expected to experience rapid growth, with gene therapy becoming a cornerstone of modern healthcare.

Segmental Insights

Technology Insights

Based on the category of Technology, the CRISPR/Cas9 segment emerged as the dominant in the global market for Genome Editing in 2024. The key reasons CRISPR/Cas9 has become the dominant technology in genome editing is its unparalleled precision and efficiency compared to earlier methods, such as zinc-finger nucleases (ZFNs) and transcription activator-like effector nucleases (TALENs). CRISPR/Cas9 uses a guide RNA to direct the Cas9 enzyme to a specific location in the DNA sequence, where it induces a targeted cut. This simplicity in design allows researchers to modify specific genes with high accuracy, reducing the likelihood of off-target effects that can occur with older technologies. The efficiency of CRISPR/Cas9 not only speeds up the process of genetic modification but also lowers the cost and resources required, making it the preferred method for both academic research and clinical applications.

CRISPR/Cas9's dominance in the global genome editing market is also attributed to its broad applicability in healthcare and therapeutic development. Gene editing has gained significant momentum in the field of gene therapy, particularly in the treatment of genetic disorders, cancers, and other complex diseases. CRISPR/Cas9 enables the precise modification of

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disease-causing genes, offering the potential to cure or manage conditions that were previously considered incurable, such as sickle cell anemia, muscular dystrophy, and cystic fibrosis. The technology's ability to target and edit specific genes within a patient's cells is driving its widespread adoption in clinical research, making it a central focus of gene-editing-based therapies. The growing success of clinical trials and the increasing number of regulatory approvals for CRISPR/Cas9-based treatments further bolster its dominance in the healthcare segment, providing a strong foundation for continued market growth. CRISPR/Cas9 technology offers significant cost advantages over older genome-editing tools. Traditional methods, such as ZFNs and TALENs, are complex, time-consuming, and expensive, requiring the production of custom proteins for each target gene. In contrast, CRISPR/Cas9 uses RNA molecules to guide the Cas9 enzyme to the target gene, significantly simplifying the process and reducing production costs. The scalability of CRISPR/Cas9 also contributes to its market dominance. The technology is adaptable to high-throughput applications, such as screening large gene libraries or conducting genome-wide association studies, making it suitable for both academic research and large-scale commercial applications. This affordability and scalability enable widespread adoption, especially among biotech startups, academic institutions, and research organizations with limited budgets, further cementing CRISPR/Cas9's market leadership. These factors collectively contribute to the growth of this segment.

Delivery Mode Insights

Based on the category of Delivery Mode, the Ex-Vivo segment emerged as the dominant in the global market for Genome Editing in 2024. Ex-vivo gene editing offers greater precision and control over the editing process, which is one of the primary reasons it dominates the market. In this approach, cells are harvested from the patient, edited in the laboratory, and then reintroduced after the modifications are complete. This process allows researchers and clinicians to closely monitor the genetic changes, ensuring that only the intended edits are made. Unlike in vivo techniques, where editing occurs inside the patient's body, ex-vivo gene editing can minimize the risk of off-target effects and unintended mutations. The ability to conduct these procedures in controlled laboratory environments adds a layer of assurance in terms of safety and accuracy, which is especially crucial in therapeutic settings.

The success of ex-vivo gene editing in clinical trials has been a significant driver of its dominance in the market. Several gene-editing therapies, such as those aimed at treating genetic blood disorders like sickle cell anemia and beta-thalassemia, have relied on ex-vivo techniques to modify the patient's own hematopoietic stem cells (HSCs) before reintroducing them into the body. For instance, therapies such as Kymriah and Yescarta, which involve the modification of immune cells to fight cancer, have used ex-vivo gene editing successfully, leading to groundbreaking results and regulatory approvals. These proven successes have helped build confidence in the efficacy and safety of ex-vivo gene editing, attracting significant investment and encouraging the market's expansion. The track record of ex-vivo approaches in clinical applications has set a strong precedent, propelling it as the dominant mode of delivery in therapeutic gene editing. Ex-vivo genome editing allows for a reduced risk of immune rejection compared to in-vivo methods. When editing cells outside the body, clinicians can select the best candidates for reintegration, ensuring the cells are compatible with the patient's immune system. This process of selecting, editing, and reintroducing the patient's own cells minimizes the risk of the body's immune system rejecting the edited cells, which is a concern in in-vivo editing approaches where foreign genetic material might be introduced. For instance, in ex-vivo approaches involving the re-engineering of immune cells, such as in CAR-T cell therapy, the cells are often derived from the patient's own body, further reducing the likelihood of adverse immune responses. This compatibility makes ex-vivo a safer and more reliable choice for personalized medicine applications, particularly in immune therapies and genetic disorder treatments.

Regional Insights

North America emerged as the dominant in the global Genome Editing market in 2024, holding the largest market share in terms of value. North America boasts one of the most advanced research and development (R&D) ecosystems in the world, which has been instrumental in positioning the region at the forefront of the genome editing market. Leading academic institutions, such as Harvard University, MIT, and Stanford University, along with a high concentration of specialized research centers, have been driving innovation in genome editing technologies like CRISPR/Cas9 and TALENs. These institutions consistently produce cutting-edge research, attract top talent, and collaborate with private sector players, thereby accelerating the development and application of genome-editing tools. Additionally, North American countries, particularly the United States and Canada, invest heavily in biotech and life sciences research, fostering an environment where genome editing technologies can thrive. North America is home to many of the world's leading biotechnology firms, which are driving commercialization and innovation in the

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genome editing space. Companies such as Editas Medicine, CRISPR Therapeutics, Intellia Therapeutics, and Thermo Fisher Scientific are based in the region and are actively involved in advancing genome editing technologies for therapeutic, agricultural, and industrial applications. These companies have secured significant investments, raised capital through public offerings, and formed strategic partnerships to accelerate the development of gene-editing products. The strong presence of these firms not only contributes to the region's market dominance but also provides a foundation for the continuous growth and expansion of the genome editing market in North America.

Key Market Players

- ☐ Merck KGaA
- ☐ Cibus Inc.
- ☐ Danaher Corporation
- ☐ GenScript Biotech Corporation
- ☐ Thermo Fisher Scientific Inc
- ☐ Lonza Group Ltd
- ☐ Takara Bio Inc.
- ☐ AstraZeneca
- ☐ Precision BioSciences
- ☐ Sangamo Therapeutics, Inc

Report Scope:

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

☐ Genome Editing Market, By Technology:

- o (CRISPR)/Cas9
- o TALENs/MegaTALs
- o ZFN
- o Meganuclease
- o Others

☐ Genome Editing Market, By Delivery Mode:

- o Ex-vivo
- o In-vivo

☐ Genome Editing Market, By Application:

- o Genetic Engineering
- o Clinical Applications

☐ Genome Editing Market, By Mode:

- o Contract
- o In-house

☐ Genome Editing Market, By End User:

- o Biotechnology and Pharmaceutical Companies
- o Academic and Government Research Institutes
- o Contract Research Organizations

☐ Genome Editing Market, By Region:

- o North America
 - ☐ United States
 - ☐ Canada
 - ☐ Mexico
- o Europe
 - ☐ France
 - ☐ United Kingdom

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- Colombia
- o Middle East & Africa
- South Africa
- Saudi Arabia
- UAE

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Genome Editing Market.

Available Customizations:

Global Genome Editing market report with the given market data, TechSci 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).

Table of Contents:

1. Service Overview
 - 1.1. Market Definition
 - 1.2. Scope of the Market
 - 1.2.1. Markets Covered
 - 1.2.2. Years Considered for Study
 - 1.2.3. Key Market Segmentations
2. Research Methodology
 - 2.1. Objective of the Study
 - 2.2. Baseline Methodology
 - 2.3. Key Industry Partners
 - 2.4. Major Association and Secondary Sources
 - 2.5. Forecasting Methodology
 - 2.6. Data Triangulation & Validation
 - 2.7. Assumptions and Limitations
3. Executive Summary
 - 3.1. Overview of the Market
 - 3.2. Overview of Key Market Segmentations
 - 3.3. Overview of Key Market Players
 - 3.4. Overview of Key Regions/Countries
 - 3.5. Overview of Market Drivers, Challenges, Trends
4. Voice of Customer

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- 5. Genome Editing Market Outlook
 - 5.1. Market Size & Forecast
 - 5.1.1. By Value
 - 5.2. Market Share & Forecast
 - 5.2.1. By Technology ((CRISPR)/Cas9, TALENs/MegaTALs, ZFN, Meganuclease, Others)
 - 5.2.2. By Delivery Mode (Ex-vivo, In-vivo)
 - 5.2.3. By Application (Genetic Engineering, Clinical Applications)
 - 5.2.4. By Mode (Contract, In-house)
 - 5.2.5. By End User (Biotechnology and pharmaceutical companies, Academic and government research institutes, Contract research organizations)
 - 5.2.6. By Region
 - 5.2.7. By Company (2024)
 - 5.3. Market Map
- 6. North America Genome Editing Market Outlook
 - 6.1. Market Size & Forecast
 - 6.1.1. By Value
 - 6.2. Market Share & Forecast
 - 6.2.1. By Technology
 - 6.2.2. By Delivery Mode
 - 6.2.3. By Application
 - 6.2.4. By Mode
 - 6.2.5. By End User
 - 6.2.6. By Country
 - 6.3. North America: Country Analysis
 - 6.3.1. United States Genome Editing Market Outlook
 - 6.3.1.1. Market Size & Forecast
 - 6.3.1.1.1. By Value
 - 6.3.1.2. Market Share & Forecast
 - 6.3.1.2.1. By Technology
 - 6.3.1.2.2. By Delivery Mode
 - 6.3.1.2.3. By Application
 - 6.3.1.2.4. By Mode
 - 6.3.1.2.5. By End User
 - 6.3.2. Canada Genome Editing Market Outlook
 - 6.3.2.1. Market Size & Forecast
 - 6.3.2.1.1. By Value
 - 6.3.2.2. Market Share & Forecast
 - 6.3.2.2.1. By Technology
 - 6.3.2.2.2. By Delivery Mode
 - 6.3.2.2.3. By Application
 - 6.3.2.2.4. By Mode
 - 6.3.2.2.5. By End User
 - 6.3.3. Mexico Genome Editing Market Outlook
 - 6.3.3.1. Market Size & Forecast
 - 6.3.3.1.1. By Value
 - 6.3.3.2. Market Share & Forecast
 - 6.3.3.2.1. By Technology

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- 6.3.3.2.2. By Delivery Mode
- 6.3.3.2.3. By Application
- 6.3.3.2.4. By Mode
- 6.3.3.2.5. By End User
- 7. Europe Genome Editing Market Outlook
 - 7.1. Market Size & Forecast
 - 7.1.1. By Value
 - 7.2. Market Share & Forecast
 - 7.2.1. By Technology
 - 7.2.2. By Delivery Mode
 - 7.2.3. By Application
 - 7.2.4. By Mode
 - 7.2.5. By End User
 - 7.2.6. By Country
 - 7.3. Europe: Country Analysis
 - 7.3.1. Germany Genome Editing Market Outlook
 - 7.3.1.1. Market Size & Forecast
 - 7.3.1.1.1. By Value
 - 7.3.1.2. Market Share & Forecast
 - 7.3.1.2.1. By Technology
 - 7.3.1.2.2. By Delivery Mode
 - 7.3.1.2.3. By Application
 - 7.3.1.2.4. By Mode
 - 7.3.1.2.5. By End User
 - 7.3.2. United Kingdom Genome Editing Market Outlook
 - 7.3.2.1. Market Size & Forecast
 - 7.3.2.1.1. By Value
 - 7.3.2.2. Market Share & Forecast
 - 7.3.2.2.1. By Technology
 - 7.3.2.2.2. By Delivery Mode
 - 7.3.2.2.3. By Application
 - 7.3.2.2.4. By Mode
 - 7.3.2.2.5. By End User
 - 7.3.3. Italy Genome Editing Market Outlook
 - 7.3.3.1. Market Size & Forecast
 - 7.3.3.1.1. By Value
 - 7.3.3.2. Market Share & Forecast
 - 7.3.3.2.1. By Technology
 - 7.3.3.2.2. By Delivery Mode
 - 7.3.3.2.3. By Application
 - 7.3.3.2.4. By Mode
 - 7.3.3.2.5. By End User
 - 7.3.4. France Genome Editing Market Outlook
 - 7.3.4.1. Market Size & Forecast
 - 7.3.4.1.1. By Value
 - 7.3.4.2. Market Share & Forecast
 - 7.3.4.2.1. By Technology

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- 7.3.4.2.2. By Delivery Mode
- 7.3.4.2.3. By Application
- 7.3.4.2.4. By Mode
- 7.3.4.2.5. By End User
- 7.3.5. Spain Genome Editing Market Outlook
 - 7.3.5.1. Market Size & Forecast
 - 7.3.5.1.1. By Value
 - 7.3.5.2. Market Share & Forecast
 - 7.3.5.2.1. By Technology
 - 7.3.5.2.2. By Delivery Mode
 - 7.3.5.2.3. By Application
 - 7.3.5.2.4. By Mode
 - 7.3.5.2.5. By End User
- 8. Asia-Pacific Genome Editing Market Outlook
 - 8.1. Market Size & Forecast
 - 8.1.1. By Value
 - 8.2. Market Share & Forecast
 - 8.2.1. By Technology
 - 8.2.2. By Delivery Mode
 - 8.2.3. By Application
 - 8.2.4. By Mode
 - 8.2.5. By End User
 - 8.2.6. By Country
 - 8.3. Asia-Pacific: Country Analysis
 - 8.3.1. China Genome Editing Market Outlook
 - 8.3.1.1. Market Size & Forecast
 - 8.3.1.1.1. By Value
 - 8.3.1.2. Market Share & Forecast
 - 8.3.1.2.1. By Technology
 - 8.3.1.2.2. By Delivery Mode
 - 8.3.1.2.3. By Application
 - 8.3.1.2.4. By Mode
 - 8.3.1.2.5. By End User
 - 8.3.2. India Genome Editing Market Outlook
 - 8.3.2.1. Market Size & Forecast
 - 8.3.2.1.1. By Value
 - 8.3.2.2. Market Share & Forecast
 - 8.3.2.2.1. By Technology
 - 8.3.2.2.2. By Delivery Mode
 - 8.3.2.2.3. By Application
 - 8.3.2.2.4. By Mode
 - 8.3.2.2.5. By End User
 - 8.3.3. Japan Genome Editing Market Outlook
 - 8.3.3.1. Market Size & Forecast
 - 8.3.3.1.1. By Value
 - 8.3.3.2. Market Share & Forecast
 - 8.3.3.2.1. By Technology

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- 8.3.3.2.2. By Delivery Mode
- 8.3.3.2.3. By Application
- 8.3.3.2.4. By Mode
- 8.3.3.2.5. By End User
- 8.3.4. South Korea Genome Editing Market Outlook
 - 8.3.4.1. Market Size & Forecast
 - 8.3.4.1.1. By Value
 - 8.3.4.2. Market Share & Forecast
 - 8.3.4.2.1. By Technology
 - 8.3.4.2.2. By Delivery Mode
 - 8.3.4.2.3. By Application
 - 8.3.4.2.4. By Mode
 - 8.3.4.2.5. By End User
- 8.3.5. Australia Genome Editing Market Outlook
 - 8.3.5.1. Market Size & Forecast
 - 8.3.5.1.1. By Value
 - 8.3.5.2. Market Share & Forecast
 - 8.3.5.2.1. By Technology
 - 8.3.5.2.2. By Delivery Mode
 - 8.3.5.2.3. By Application
 - 8.3.5.2.4. By Mode
 - 8.3.5.2.5. By End User
- 9. South America Genome Editing Market Outlook
 - 9.1. Market Size & Forecast
 - 9.1.1. By Value
 - 9.2. Market Share & Forecast
 - 9.2.1. By Technology
 - 9.2.2. By Delivery Mode
 - 9.2.3. By Application
 - 9.2.4. By Mode
 - 9.2.5. By End User
 - 9.2.6. By Country
 - 9.3. South America: Country Analysis
 - 9.3.1. Brazil Genome Editing Market Outlook
 - 9.3.1.1. Market Size & Forecast
 - 9.3.1.1.1. By Value
 - 9.3.1.2. Market Share & Forecast
 - 9.3.1.2.1. By Technology
 - 9.3.1.2.2. By Delivery Mode
 - 9.3.1.2.3. By Application
 - 9.3.1.2.4. By Mode
 - 9.3.1.2.5. By End User
 - 9.3.2. Argentina Genome Editing Market Outlook
 - 9.3.2.1. Market Size & Forecast
 - 9.3.2.1.1. By Value
 - 9.3.2.2. Market Share & Forecast
 - 9.3.2.2.1. By Technology

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- 9.3.2.2.2. By Delivery Mode
- 9.3.2.2.3. By Application
- 9.3.2.2.4. By Mode
- 9.3.2.2.5. By End User
- 9.3.3. Colombia Genome Editing Market Outlook
 - 9.3.3.1. Market Size & Forecast
 - 9.3.3.1.1. By Value
 - 9.3.3.2. Market Share & Forecast
 - 9.3.3.2.1. By Technology
 - 9.3.3.2.2. By Delivery Mode
 - 9.3.3.2.3. By Application
 - 9.3.3.2.4. By Mode
 - 9.3.3.2.5. By End User
- 10. Middle East and Africa Genome Editing Market Outlook
 - 10.1. Market Size & Forecast
 - 10.1.1. By Value
 - 10.2. Market Share & Forecast
 - 10.2.1. By Technology
 - 10.2.2. By Delivery Mode
 - 10.2.3. By Application
 - 10.2.4. By Mode
 - 10.2.5. By End User
 - 10.2.6. By Country
 - 10.3. MEA: Country Analysis
 - 10.3.1. South Africa Genome Editing Market Outlook
 - 10.3.1.1. Market Size & Forecast
 - 10.3.1.1.1. By Value
 - 10.3.1.2. Market Share & Forecast
 - 10.3.1.2.1. By Technology
 - 10.3.1.2.2. By Delivery Mode
 - 10.3.1.2.3. By Application
 - 10.3.1.2.4. By Mode
 - 10.3.1.2.5. By End User
 - 10.3.2. Saudi Arabia Genome Editing Market Outlook
 - 10.3.2.1. Market Size & Forecast
 - 10.3.2.1.1. By Value
 - 10.3.2.2. Market Share & Forecast
 - 10.3.2.2.1. By Technology
 - 10.3.2.2.2. By Delivery Mode
 - 10.3.2.2.3. By Application
 - 10.3.2.2.4. By Mode
 - 10.3.2.2.5. By End User
 - 10.3.3. UAE Genome Editing Market Outlook
 - 10.3.3.1. Market Size & Forecast
 - 10.3.3.1.1. By Value
 - 10.3.3.2. Market Share & Forecast
 - 10.3.3.2.1. By Technology

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- 10.3.3.2.2. By Delivery Mode
- 10.3.3.2.3. By Application
- 10.3.3.2.4. By Mode
- 10.3.3.2.5. By End User
- 11. Market Dynamics
 - 11.1. Drivers
 - 11.2. Challenges
- 12. Market Trends & Developments
 - 12.1. Recent Developments
 - 12.2. Product Launches
 - 12.3. Mergers & Acquisitions
- 13. Global Genome Editing Market: SWOT Analysis
- 14. Competitive Landscape
 - 14.1. Merck KgaA
 - 14.1.1. Business Overview
 - 14.1.2. Product & Service Offerings
 - 14.1.3. Recent Developments
 - 14.1.4. Financials (If Listed)
 - 14.1.5. Key Personnel
 - 14.1.6. SWOT Analysis
 - 14.2. Cibus Inc.
 - 14.3. Danaher Corporation
 - 14.4. GenScript Biotech Corporation
 - 14.5. Thermo Fisher Scientific Inc
 - 14.6. Lonza Group Ltd
 - 14.7. Takara Bio Inc.
 - 14.8. AstraZeneca
 - 14.9. Precision BioSciences
 - 14.10. Sangamo Therapeutics, Inc
- 15. Strategic Recommendations

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