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Organ-on-Chip Market - Global Industry Size, Share, Trends, Opportunity, and Forecast, 2018-2028 Segmented By Type (Liver, Heart, Lung, Kidney, Others), By Offering (Products v/s Services), By Material Type (Polymer, PDMS, Glass, Silicon, Others), By Application (Physiological Model Development, Drug Discovery, Toxicological Research, Molecular Biology, Others), By End User (Pharmaceutical & Biotechnology Companies, Academic & Research Institutes, Others), By Region and Competition

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Abstracts

Global Organ-on-Chip Market is anticipated to project impressive growth in the forecast period. Organs-on-chip are sophisticated artificial replicas of human organs. These cutting-edge devices utilize multichannel 3D microfluidic cell culture technology to faithfully mimic organ functions, processes, and physiological responses. By combining labs-on-chips (LOCs) with cell biology, researchers have successfully created a novel model of in vitro multicellular human beings, allowing for the analysis of human physiology within organ-specific environments.

These chips feature intricately designed microchannels that facilitate blood and air flow, enabling the simulation of various organs such as the lung, intestine, brain, liver, and heart. The microchips are populated with live cells, fostering tissue and organ function through constant perfusion. Organ-on-chip technology, with its unique blend of silicone nourishment, tissue engineering, and microfluidics, has the potential to revolutionize the field. These advancements hold great promise in addressing longstanding challenges in

drug discovery and disease treatment, making it a crucial component in drug development investigations and propelling the organ-on-chip industry forward.

Key Market Drivers

Growing Demand of Miniaturization of Electronic Chips

The growing prevalence for microchips in the field of medical devices is a direct result of remarkable technological advancements. These advancements have not only fueled the demand for such devices but also paved the way for significant improvements in their construction and maintenance. The process of miniaturization has played a key role in achieving these advancements, as it allows for the reduction of materials required to build and sustain the system.

Moreover, the utilization of microfluidic chips has revolutionized the development of miniaturized tissues, enabling the simulation of real tissue in organ-on-a-chip systems. By creating an in vitro environment at the microscopic scale, these microfluidic chips effectively mimic the function and structure of actual organs. This breakthrough technology holds tremendous promise in advancing our understanding of organ function and disease progression. The integration of microchips and microfluidic chips in medical devices marks a significant milestone in the field of healthcare. With continued research and innovation, we can expect even greater advancements in this fascinating area, ultimately leading to improved diagnostics, treatments, and overall patient care.

Rising Healthcare Expenditure in Developed Countries

The rising prevalence of chronic diseases and an expanding elderly patient population are expected to drive up demand for market growth. The increasing burden of chronic conditions and the aging population necessitate a greater need for healthcare services and products. Moreover, rising healthcare expenditures in many countries, driven by factors such as advancements in medical technologies and an increasing focus on preventive care, are expected to further fuel the market in the approaching years. As a result, an exponential increase in the number of patients seeking treatment is anticipated, leading to a significant surge in product demand over the projection period.

For instance, in February 2019, a comprehensive report by the World Health Organization (WHO) on global health expenditure highlighted a rapid upward trajectory in healthcare spending, particularly noticeable in low and middle-income countries. These regions have been witnessing an average annual growth rate of 6%, compared

to 4% in high-income countries. This trend underscores the growing recognition of the importance of healthcare and the need for increased investments to address the healthcare needs of the population.

With the convergence of these factors, the market is poised for significant growth, presenting new opportunities for healthcare providers, innovators, and investors alike.

Increasing Use an Alternative for Animal Testing

The increasing need for alternatives to animal testing is driving the growth of the global organ-on-chip market in the forecast period. Concerns about the ethical treatment of animals have led to a paradigm shift in scientific research. According to the People for the Ethical Treatment of Animals (PETA), each year, more than 110 million animals, including rats, fish, rabbits, dogs, frogs, monkeys, hamsters, mice, cats, guinea pigs, and birds, are sacrificed in U.S. laboratories for various purposes such as biology studies, medical internships, curiosity-driven investigations, and testing of chemicals, pharmaceuticals, food, and cosmetics.

A Pew Research Center poll revealed that 52% of U.S. adults oppose the use of animals in scientific research. Other surveys indicate that the remaining group that supports animal research does so because they believe it is necessary for medical progress. However, it is important to note that the majority of animal studies do not significantly contribute to improving human health. The role that animal research plays in most medical advancements is a subject of debate and controversy. These concerns have led to a growing demand for alternative testing methods, such as organ-on-chip technology. Organ-on-chip devices aim to replicate the functions of human organs, providing a more accurate and humane approach to studying diseases and testing potential treatments. As the awareness and support for alternatives to animal testing continue to rise, the global organ-on-chip market is expected to witness significant growth in the coming years.

Integration of Technologies

The increasing demand for organ-on-chip technology is primarily driven by its unique combination of tissue engineering and microfluidics. This innovative approach not only offers effective solutions to long-standing challenges in individualized disease treatment and medication discovery but also holds immense potential for revolutionizing the field of biomedical research. By replicating the complex structures and functions of human organs, organ-on-chip platforms provide a more accurate and reliable model for drug

development studies. This enables researchers to gain deeper insights into the efficacy and safety of potential medications, leading to improved patient outcomes. With its ability to mimic the physiological conditions of specific organs, organ-on-chip technology allows for personalized testing and analysis, paving the way for tailored treatment approaches.

Moreover, the versatility of organ-on-chip technology extends beyond drug development. It holds promise in various areas of research, such as toxicology studies, disease modeling, and precision medicine. By simulating the intricate interactions between cells, tissues, and fluids, organ-on-chip devices enable scientists to investigate complex biological processes in a controlled and reproducible manner. Overall, organ-on-chip technology has the potential to transform the way we approach healthcare. By bridging the gap between traditional in vitro models and animal testing, it offers a powerful tool for accelerating medical research, improving drug discovery, and ultimately enhancing patient care.

Key Market Challenges

Concerns Pertaining due to High Cost of Organ Chip Device

The high cost associated with the organ chip device, coupled with the fact that organ-on-chip (OOC) technology is still in its early stages, is projected to limit the expansion of the market. This is primarily due to the significant investment required for research and development, manufacturing, and commercialization of organ-on-chip devices. The complex nature of the technology, involving the integration of multiple organ models and microfluidic systems, adds to the manufacturing challenges and cost considerations.

Furthermore, certain countries have imposed restrictions on cosmetic testing on animals, which is likely to further hinder the growth of the global organ-on-chip market. In these countries, the government has prohibited the use of animals for testing cosmetics developed within their borders, reflecting a growing awareness and concern for animal welfare. This shift in regulatory policies has prompted the need for alternative testing methods, such as organ-on-chip technology, which can simulate the physiological conditions of human organs and provide more accurate and ethical results.

These factors collectively contribute to the complex landscape surrounding the adoption and market potential of organ-on-chip technology. While the technology holds great promise for revolutionizing drug discovery, toxicity testing, and personalized medicine,

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overcoming the barriers of cost, scale-up, and regulatory requirements remains crucial for its widespread adoption and market success. Continued advancements in technology, coupled with collaborative efforts between academia, industry, and regulatory bodies, will play a vital role in addressing these challenges and unlocking the full potential of organ-on-chip technology in improving healthcare outcomes.

Availability of Substituents

The availability of the substituent in the market to organ-on-chips is hampering the global market growth in the forecast period. This is because the availability of organoids, which serve the same purpose of mimicking tissue and organ physiology, poses a major hurdle for the organ-on-chip market during this time. Organoids are gaining traction in the market due to their ability to replicate the complex structure and functionality of organs, making them a potential alternative to organ-on-chips.

Furthermore, the increasing developments in the organoids market are presenting threats to the global organ-on-chip market in the upcoming forecast years. For instance, on October 3, 2022, AIM Biotech Pte. Ltd. introduced the organiX System, a cutting-edge 3D tissue culture platform. This innovative system enables the addition of vascularization and immune competence to spheroids, tumor biopsies, and organoids, further enhancing their functionality and applicability.

These advancements in organoids technology highlight the evolving landscape of tissue engineering and regenerative medicine, paving the way for more sophisticated and versatile models. As a result, the organ-on-chip market faces the challenge of keeping up with these developments and finding unique value propositions to maintain its competitive edge in the market. While the availability of substitutes like organoids poses challenges to the organ-on-chip market, the continuous advancements and innovations in the field of organoids present opportunities for further growth and improvement in the overall market.

Key Market Trends

Increasing Market Developments

The organ-on-chip market is experiencing significant growth due to various market developments such as product launches, collaborations, mergers, acquisitions, and more. These developments are driving the global market growth in the forecast period.

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For example, in September 2021, Fidia Farmaceutici S.p.A. and BiomimX S.r.l. entered into a research collaboration aimed at presenting and introducing new specialized solutions based on Organs-on-Chip to enhance the intra-articular medical device discovery process.

Furthermore, in November 2021, AIM Biotech introduced its idenTx 40 Plate, a high-throughput organ-on-a-chip technique. This revolutionary technique enables investigators at pharmaceutical and biotechnology companies to simulate the operation of human tissues and organs without the need for animal experimentation, thus advancing the field of research while upholding ethical standards.

Rapidly Rising Number of Applications

Microfluidic devices and organotypic slices have been combined to improve culture survival in the field of neuroscience research. Traditionally, cultivating organotypic brain slices, which are approximately 300 microns thick, has relied on semi-porous membranes to establish an air-medium interface. However, with the integration of microfluidic technologies, a more sophisticated approach has emerged. These technologies enable the laminar flow of essential nutrients and gases, resulting in enhanced tissue viability and improved transportation within the brain slices.

Furthermore, the advent of brain-on-a-chip technologies has revolutionized the cultivation of thicker brain slices, which previously posed a significant transport barrier due to their thickness. By leveraging brain-on-a-chip systems, researchers can now achieve a more in vivo-like environment, while preserving cell viability and the native tissue architecture found in thicker slices. This innovative combination of microfluidic devices, organotypic slices, and brain-on-a-chip technologies has opened up new avenues for studying complex neural networks, exploring drug responses, and advancing our understanding of brain function. These advancements hold great promise for unlocking the secrets of the brain and developing novel therapeutic strategies for neurological disorders.

Segmental Insights

Type Insights

Based on the type, the market for organ-on-chip is predominantly driven by the liver-on-chip model segment, and this trend is expected to persist during the projected period (2024-2028). As the largest internal organ in the human body, the liver plays a crucial

role in the synthesis and metabolism of various substances, including drug metabolites.

Modeling the liver has posed challenges due to its diverse range of vital functions, encompassing nutrient and vitamin processing, detoxification, and regulation of bodily metabolism. The limitations inherent in conventional two-dimensional (2D) cell culture techniques for studying pharmacokinetics in hepatic cells (hepatocytes) have yielded suboptimal outcomes in clinical trials and drug development. Recent advancements in microfluidics have facilitated the development of highly automated, biomimetic liver-on-a-chip (LOC) devices that closely mimic the shape and function of the natural liver. These LOC devices offer an economical and precise model for pharmacodynamics, pharmacokinetics, and toxicity research. One noteworthy example is the Emulate human Liver-Chip, which faithfully replicates the in vivo physiological processes of the human liver through essential microenvironmental factors such as 3D multicellular architecture and vascular flow. With these characteristics, the Emulate human Liver-Chip provides a more accurate representation of the human liver compared to conventional sandwich cultures, animal models, and spheroids.

End User Insights

Based on the end user segment, the market is categorized into Pharmaceutical and Biotechnology companies, Academic and Research institutes, and Others, based on the end user. Among these, the pharmaceutical and biotechnology sector significantly contributes to the market. This technique holds immense potential for predicting side effects and the success of drugs and biological products, particularly for the pharmaceutical and biotech industries. The increasing rate of drug approval failures necessitates the development of a comprehensive biological dataset to assess innovative therapies and ensure the safety of novel treatments, where Organ-on-Chip (OoC) technology plays a crucial role. Numerous pharmaceutical and biotechnology firms are leveraging this technique to expedite the discovery and development of novel medications. The market's growth is primarily driven by the growing adoption of Organ-on-Chip technology for drug development by enterprises.

Regional Insights

The North America region is projected to dominate the global market share of organ-on-chip technology. This can be attributed to several factors, including the presence of key pharmaceutical companies, the availability of advanced organ-on-chip models, and favorable government initiatives in terms of funding and programs for drug development and research. The region is also witnessing an increase in targeted diseases such as

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UI, bladder blockage, urine retention, BPH, and bladder cancer, which further drives the market. Conversely, the Asia Pacific region is expected to experience the fastest growth during the forecast period. Countries like China, India, and Japan present attractive opportunities due to the rising disposable income and increasing adoption of Organ-on-a-Chip technology. Government support for regenerative medicines, along with investments in R&D activities and cell-based clinical trials, are expected to facilitate the expansion of the Organ-on-a-Chip market in the Asia-Pacific region.

Key Market Players

Altis Biosystems

AxoSim Inc.

BiomimX SRL

Emulate Inc.

Hesperos

Allevi Inc.

InSphero AG

MIMETAS BV

Nortis Inc.

Hesperos, Inc.

Report Scope:

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

Organ-on-Chip Market, By Type:

Liver

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Heart

Lung

Kidney

Others

Organ-on-Chip Market, By Offering:

Products

Services

Organ-on-Chip Market, By Material Type:

Polymer

PDMS

Glass

Silicon

Others

Organ-on-Chip Market, By Application:

Physiological Model Development

Drug Discovery

Toxicological Research

Molecular Biology

Others

Organ-on-Chip Market, By End User:

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- Hospital & Clinic
- Home Care
- Ambulatory Surgical Centre

Organ-on-Chip Market, By Region:

- North America
  - United States
  - Canada
  - Mexico
- Europe
  - France
  - United Kingdom
  - Italy
  - Germany
  - Spain
- Asia-Pacific
  - China
  - India
  - Japan
  - Australia

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South Korea

South America

Brazil

Argentina

Colombia

Middle East & Africa

South Africa

Saudi Arabia

UAE

Kuwait

Turkey

Egypt

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Organ-on-Chip Market.

Available Customizations:

Global Organ-on-Chip 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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