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Biosensors are Poised for Accelerated Growth through 2025

INSIGHTS FOR SUCCESS | IDEAS TO EXECUTE

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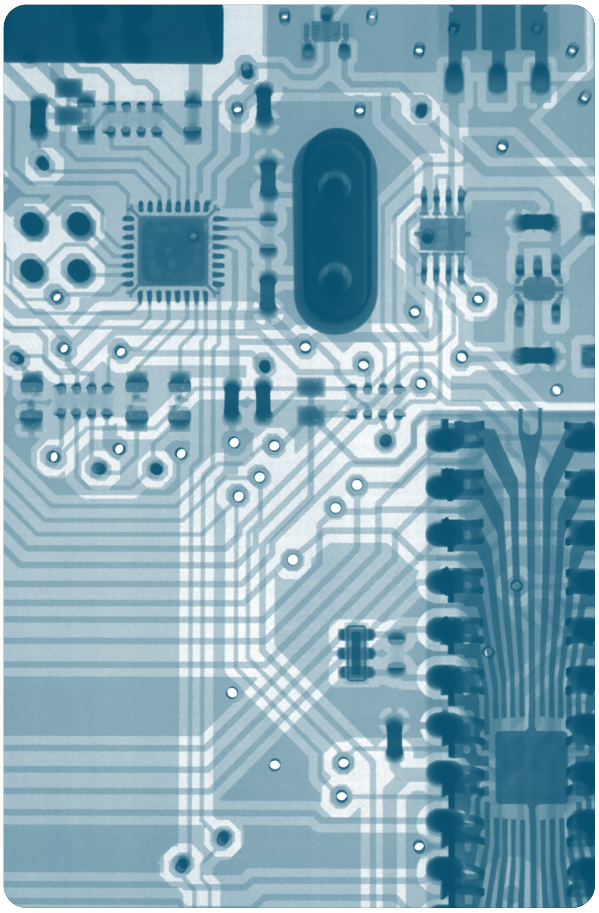
Overview

Biosensors have attained an enabling status in detection of diverse harmful pathogens. Biosensors are used in diverse and multiple end-user applications. Biosensors continue to be in growth phase of the product life cycle. Large investments are ploughed into R&D for product and technology innovations in biosensors. This propels large market growth in biosensors in most vertical end-user markets. In spite of many innovations that have improved the performance and usability of biosensors, there are many factors that have limited the breadth of applications. If these constraints are mitigated, biosensors will be poised for much higher growth over the next four years.

Approach

Adoption of microchip technology (small semiconductor-based crystal chips embedded with an IC capable of carrying out electronic functions) by biosensor manufacturers have enabled smaller foot prints. To stay ahead of the competition, a number of companies are trying to develop a single platform that can be used for multiple applications. Some of them have been successful in achieving this goal, for example by combining diabetic and cholesterol tests.

Most biosensors are patented, and their market penetration is limited by the resources of the patenting company. Large companies like Roche, Abbott, and Bayer with global infrastructure and resources have been able to penetrate into all geographic regions with their patented biosensors. Medium sized companies like Sartorius AG with their restricted focus has been able to penetrate into European markets only. While as companies like Agdia Inc., with limited infrastructure have got restricted in their operation to USA and Canada only.



Source: Twimbit

Overcoming Limitations

Biosensor awareness and use is limited by factors such as:

Sensitivity: The most important performance element in a biosensor is its sensitivity. It is the real-time detection and measurement of the reaction of the target analyte, and conversion of this measurement into a usable signal.

Readout Time: The readout times vary greatly from one biosensor to another. In some biosensors, readout times are very long, in certain cases more than 20 seconds. The development of rapid detection biosensors has greatly reduced it to few seconds.

High Cost: Some biosensors are too expensive for commercial production.

Ruggedness: Some biosensors are not sufficiently rugged for their intended applications.

Miniaturisation: Most biosensor devices have smaller footprints. Miniaturisation in sensors poses technical challenges.

Pretreatment: Often referred as preparatory, in certain cases, biosensors require a special pretreatment prior to each use.

Lifespan: Biomolecules have limited life span. A number of existing biosensors lack long-term stability.

Most of these limitations are inherent in the existing range of devices. However, many current designs are achieving readout time, miniaturization, and improvements in cost-effectiveness improvements. Enzyme sensors measure the concentration of a desired chemical substrate by measuring the potentiometric or amperometric response caused by the enzyme-catalyzed reaction between substrate and analyte.

Enzyme sensors remain limited to chemistries that allow for a clear signal, such as a change in color, pH (hydrogen ion value), or oxidation state. Use of these enzymes is not suitable for existing biosensor designs .This lead to redesigning of enzyme based biosensors.

Construction and design of biosensors is multidisciplinary approach. At the physical device level engineers from biotechnology, electronics and software contribute to it. At the design and detection process level experts from fields like diverse protein engineering, molecular biology, affinity chemistry, nucleic acid molecular dynamics, materials sciences, and nanotechnology significantly contribute to it. The biosensors interface with target ions or neutral molecules that bond (ligand) undergo some form of change and output signal is generated. All parts of such process spell diversity of possible different configurations.

In the last ten years extensive innovative design and development techniques of enzyme-based biosensing devices have proven to be disruptive techniques in the qualitative and quantitative analysis of diverse target substrates across multiple applications.

Key advantages of enzyme-based biosensors include high sensitivity and specificity, portability, ease of miniaturization and they are cost-effective. Enzyme based biosensors at low cost and high detection effectiveness makes it very attractive option in research beamed on monitoring of diseases, clinical analysis and control to ensure food safety. The application of enzyme based detection techniques are growing at a rapid rate.

Source: Twimbit

Key Trends and Takeaways

Biosensors have attained an enabling status in detection of diverse harmful pathogens. Biosensors are used in diverse and multiple end-user applications. Biosensors continue to be in growth phase of the product life cycle. Large investments are ploughed into R&D for product and technology innovations in biosensors. This propels large market growth in biosensors in most vertical end-user markets. In spite of many innovations that have improved the performance and usability of biosensors, there are many factors that have limited the breadth of applications. If these constraints are mitigated, biosensors will be poised for much higher growth over the next four years.

Life Cycle stage	• Biosensors are classified as a growth market and are expected to continue in the growth phase of its life cycle. Biosensors are the largest revenue contributors in global sensors market.
Technologies	• Biosensors are most widely used bio detection devices for viruses based on both optical and non-optical technologies.
Expanding User Segment	• Biosensors have successfully become an important part of preventive care as they are prognostic in their application. Product and technology research is a continuous process leading to innovation of biosensors for detection of different diseases and health abnormalities.
Key Shift in Detection Time and Sample Size	• The developments of rapid detection biosensors have eliminated the need to sample enrichment which would prolong test time. • Development of nano-biosensors has enabled bacterial/virus detection at a concentration as low as 1 cell per 5 ml of water. It has also facilitated miniaturization of biosensor devices. • Sensitivity of biomolecules determines the measurement of pathogen/ virus severity in real time. • Readout times vary from one biosensor to another within certain cases, it being more than 20 seconds. The development of rapid detection biosensors has greatly reduced readout times to a few seconds. • The need for rapid detection is getting stronger as they do not require sample amplification for detection.

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Key Trends and Takeaways

Shift to Multi-pathogen detection	• Biosensor development research is funded by number of stake holders like pharmaceutical companies, biotechnology companies, research institutions and sensor and device manufacturers. • Development of multi-pathogen detection biosensor devices enables detection of more than one pathogen. Multi-pathogen biosensors are being adopted at a higher rate as they facilitate differentiated detection of more than one pathogen strain from same or different virus families.
Funding Innovation	• The key investor in new biosensor development includes funding organizations such as Small Business Innovation Research spell out – first use, academic institutions, pharmaceutical companies and university laboratories. • Extensive research and development (R&D) to meet unmet needs and foray into new vertical markets resulted in exploring different technologies to conceive new and improved biosensor capabilities.
Key Innovation in 2020	• 2020 saw the first time a biosensor has been developed using surface wave acoustic technology. This is the first rapid detection device for various strains of Ebola.
Value Additions	• Among different stakeholders in the value chain the maximum value addition takes place by systems integrators and OEMs while the lowest value addition takes place at the transducer manufacturing level.
New End-user Markets	• Penetrations into new end-user markets include security, correctional/rehabilitation institutions, plant pathology, mobile platforms and automotive. • Healthcare/Health wellness comprising of point of care and home diagnostic segments is the largest end-user market for biosensors. • Among the vertical markets that are expected to exhibit large growth during the forecast period and increase their revenue market share are environmental, biodefense, home diagnostics, automotive, and mobile platforms.
Largest Revenue Contributing Biosensor	• Diabetes/glucose detection biosensors control the largest market share (25.47% in 2020) in revenue in the health wellness market

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Key Trends and Takeaways

Key Competitors and Market Leaders	• Among the biosensor companies pharmaceutical companies are top competitors. • Abbott improved its market share through implementation of a consolidation strategy. It acquired two biosensor companies namely Ibis Biosciences and MediSense. As a result Abbott's market share increased to 12.20% and is now the leader in the global biosensors market. • LifeScan competes in diabetic monitoring market with a customer base of 20 million users globally. Its OneTouch diabetes monitoring biosensor is most widely used. • Many top brands outsource manufacturing of biosensor devices. Universal Biosensors (UBI) with its core competence is in R&D capability. It manufacturers biosensors Johnson and test strips for Siemens' Xprecia StrideTM Coagulation Analyzer.
Dominant Technologies	• Non-Optical technologies dominate the biosensor devices market. Polymerase chain reaction (PCR) and surface plasmon resonance (SPR) are the most prominent technologies on which detection devices are based. Most successful COVID-19 detection devices are based on PCR technology.
Market Size	• In 2020, the global biosensors market generated $19.69B in revenue which is estimated to reach $37.51B in 2025 and is expected to grow at a CAGR of 13.8% during 2020-2025

Conclusion

Biosensor manufacturers have overcome most of the technical limitations. Key companies ploughed back billions of dollars into R&D to develop new and innovative biosensors and bio molecules. In 2020 investments into R&D by key companies include Abbott spending $2.42B, Roche spent $13276.63mil (12,153 Mil CHF) and LifeSensors over $300 Mil. R&D spending in the life sciences industry surged 22% in 2020. This has resulted in development innovative biosensors and higher adoption of biosensors especially in point of care and home diagnostic applications. Glucose is the largest monitored pathogen and continued to generate 25.47% of the total biosensor revenue in 2020. SPR and PCR are the most widely used technology in biosensors. Development and use of rapid detection biosensors is proliferating in most applications across diverse end-users. This continues to result in biosensors to be in growth phase with revenue expected to reach $37.51B in 2025.

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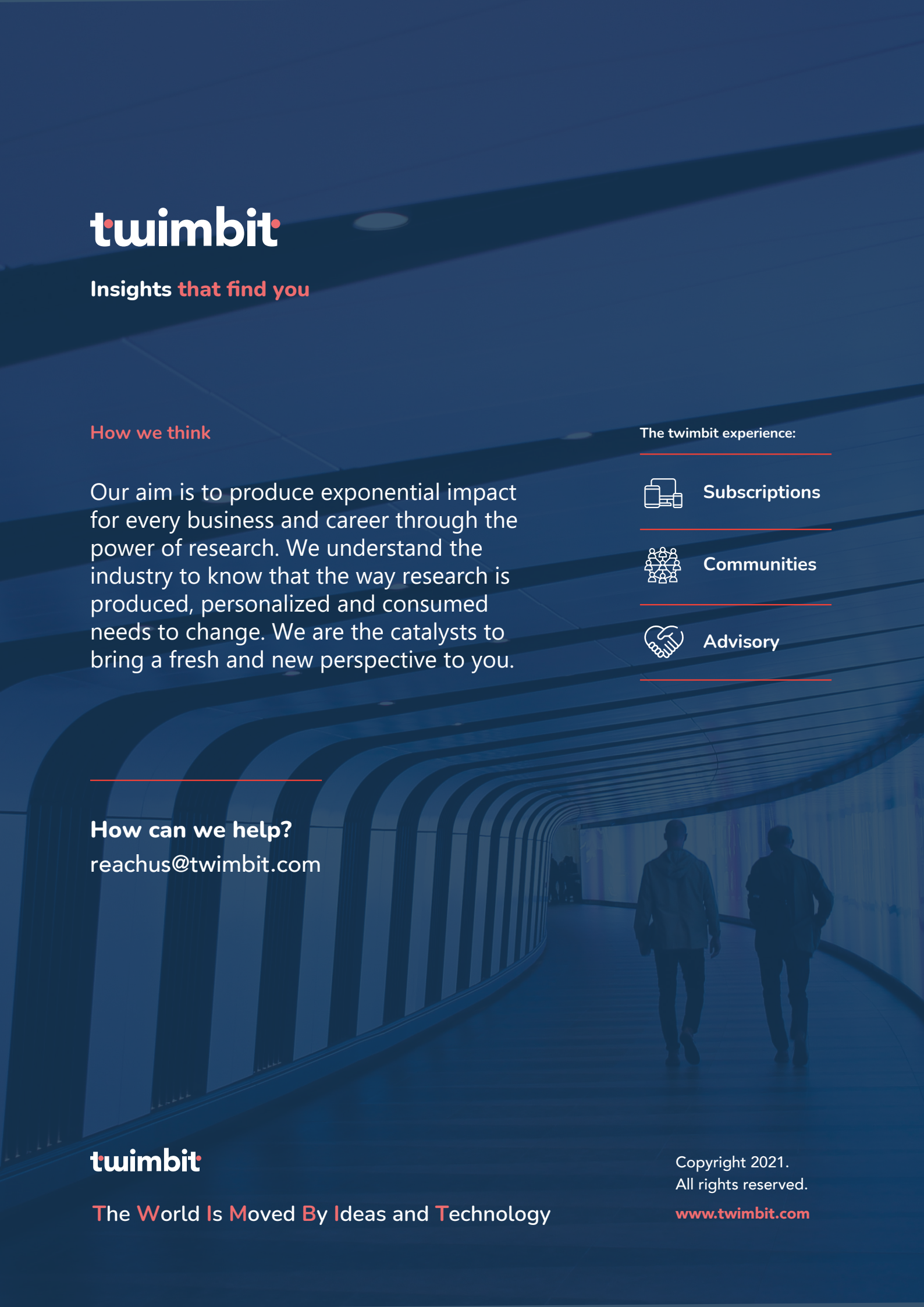

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