2009 North American Technology Innovation Award

Singulex, Inc.

The 2009 North American Frost & Sullivan Technology Innovation Award in the field of Immunoassay Technologies for Biomarker Detection is presented to Singulex, Inc. for pioneering an immunoassay system capable of quantifying biomarkers at or below the subpicogram per mL concentrations. Known as the Erenna® Immunoassay System, it promises to assist drug developers in testing drug efficacy and drug safety parameters while also aiding physicians to monitor disease progression.

Company Background

Singulex, Inc. established itself in the life-sciences market with commercial operations based in the San Francisco Bay area. The company has pioneered technology that can quantitatively detect single molecules such as proteins and metabolites in complex biological samples. The proprietary Singulex technology has been further developed into the Erenna® immunoassay system, which radically addresses unmet needs in biomarker discovery and validation. The company provides their proprietary technology as a service business that can also be integrated in the pharmaceutical workflow. In addition, the company is leveraging this platform to build a menu of validated disease detection biomarkers and enhance its CLIA laboratory service.

Technology Overview

Great strides in genomics have been made so that it is now more feasible to determine an individual's predisposition for a disease. However, proteins and peptides mark the cellular origins of the phenotype and serve as disease indicators or even causal agents of a pathogenic process. Consequently, proteomics technologies hold immense potential for use in the diagnostic and drug discovery processes. Proteomic technology platforms are constantly evolving and vary significantly in their design, which influences speed, complexity, cost, and most importantly, the qualitative value of the data returned.

The lag phase between the transition of proteomic biomarkers from discovery to clinical validation can be attributed to the complexity and variability of the human proteome, in addition to the need for robust proteomic technology platforms that can carry out large biomarker studies with sufficiently high sensitivity and reliability. Research in immunoassay technologies is evolving next generation systems which can

detect specific proteins with a higher magnitude of increased sensitivity. These advances in immunoassay technology with ultra-sensitive detection seem to hold potential in molecular diagnostics and drug development. However, small sample volumes, and demands for increased sensitivity and dynamic reporting ranges challenge the clinical usage of protein biomarkers.

Salient Features

One of the company's key achievements is the invention of the Erenna® Immunoassay System which incorporates the single molecule counting (SMC)-technology into next generation immunoassays. From a complex biological sample, the Erenna® Immunoassay System uses paramagnetic microparticles (MPs) as the solid phase for immune-capture and detection of analytes.

The Erenna® Immunoassay System comes as an easy-to-use bench-top analytical instrument with ready-made reagents integrated in a micro-titer plate format. It also includes data management software to automatically display detailed assay reports in a user-friendly format. The technology behind this simple user friendly system comprises 2 important stages: a modified MP-based sandwich immunoassay followed by a single molecule counting technology. In addition, the Erenna® system combines a 384-well plate format for sample analysis, capillary flow, laser-induced fluorescence, and a highly sensitive detection optics module. The output method reports detected events for which the system has a robust digital molecule-counting module to count photons wherein ultra-sensitive fluorescence is measured in the presence of proprietary background reduction methodology. A large dynamic range of 4+ logs is obtained by combining single-molecule counting (low range) with photon counting (mid range) and total light measurements (high range). This reliable system addresses the needs for fast, efficient, and flexible proteomics workflows and produces results from biological specimens like serum or plasma in as little as one hour.

Best Practices

Harnessing the potential of their Erenna® System, Singulex has discovered that increased sensitivity allows the measurement and quantification of biomarkers in a robust manner. First, the system measures each fluorescent-labeled detection antibody as a digital event separating it from the background fluorescent signal as opposed to conventional analog systems that count total light. Second, the microparticle solid phase has been designed in a manner to reduce nonspecific binding of fluorescent-labeled detection antibodies.

Protein biomarker detection and analysis demand multiple technologies and there are several immunoassay technologies on the market. Singulex has an edge as their system offers enhanced specificity, sensitivity, and precision by 1-2 logs over existing plate-based methods.

With the Erenna® Immunoassay System, Singulex is expanding the sensitivity and dynamic range of biomarker quantification. The technology enables active patient monitoring, since it has the ability to measure minute changes in concentration over time while also being scalable. Apart from the fact that this technology can detect very low concentrations of biomarkers in serum samples, it can also detect the change in biomarker concentration in tissue lysates. These capabilities enable a drug developer to monitor drug efficacy and safety, while also helping a physician diagnose and monitor the progression of a disease. Pharmas are using implementing this system in upstream drug studies to determine whether the drug is working, if it is safe, and to identify responder and non-responder populations.

Singulex believes that the Erenna® Immunoassay System can bridge the gap across pre-clinical and clinical assessment of protein biomarkers for disease. With this single ultrasenstive technology platform, the transition in data validation across disparate technologies used in pre-clinical and clinical studies could be avoided. In deploying the Erenna® platform, the company has also developed several ultra-sensitive cytokine immunoassays to assess the role of inflammation in several disease states, including healthy individuals.

Singulex is also building on its diagnostic CLIA laboratory service and they have a strong product on this front, the cardiac troponin I (cTnI) for cardiac stress testing.

Singulex is actively pursuing partnerships with pharmaceutical companies wherein the company provides the technology as a service business which is integrated in the pharmaceutical workflow. Some publicized collaborations include Wyeth, Novartis, Washington University School of Medicine, GSK, and Roche. In another instance, Singulex partnered with Tethys Biosciences and demonstrated that the technology was scalable, robust, and can be automated.

To the company’s credit, in Q4 of 2008, Singulex successfully closed a round of $19 million in financing led by JAFCO Co., Ltd. and supported by existing investors including OrbiMed Advisors and Fisk Ventures.

Moreover, the company is actively building up its IP portfolio and has several patents published on the method, detection device, and its use. In 2008 alone, there were 3 peer reviewed articles based on the company's technology.

Conclusion

Frost & Sullivan's 2009 North American Award for Technology Innovation recognizes Singulex for its sensitive immunoassay approach, which has enabled the company to apply these workflows to monitor drug efficacy and drug safety. With an expanding arena of applications across the drug discovery and diagnostics spectrum, such an approach could set new benchmarks for clinical application of proteomics.

Award Description

Frost & Sullivan's Technology Innovation Award is bestowed upon a company (or individual) that has carried out new research, which has resulted in innovation(s) that have or are expected to bring significant contributions to the industry in terms of adoption, change, and competitive posture. This award recognizes the quality and depth of a company's research and development program as well as the vision and risk-taking that enabled it to undertake such an endeavor.

Research Methodology

To choose the award recipient, Frost & Sullivan's analyst team tracks innovation in key hi-tech markets. The selection process includes primary participant interviews and extensive primary and secondary research via the bottom-up approach. The analyst team shortlists candidates based on a set of qualitative and quantitative measurements. The analysts also consider the pace of research and technology innovation, and the significance or potential relevance of the innovation to the overall industry. The ultimate award recipient is chosen after a thorough evaluation of this research.

Measurement Criteria

In addition to the methodology described above, there are specific criteria used to determine the final rankings. The recipient of this award has excelled based on one or more of the following criteria:

- Significance of the innovation(s) in the industry, and across industries (if applicable).
- Potential of the products of innovation(s) to become industry standard(s).
- Competitive advantage of innovation vis-à-vis other related innovations.

- Impact (or potential impact) of innovation(s) on company or industry mind share and/or company bottom line.
- Breadth of intellectual property related to the innovation(s), that is, patents, scientific publications, and papers in peer-reviewed journals.

About Best Practices

Frost & Sullivan Best Practices Awards recognize companies in a variety of regional and global markets for demonstrating outstanding achievement and superior performance in areas such as leadership, technological innovation, customer service, and strategic product development. Industry analysts compare market participants and measure performance through in-depth interviews, analysis, and extensive secondary research in order to identify best practices in the industry.

About Frost & Sullivan

Frost & Sullivan, the Growth Consulting Company, partners with clients to accelerate their growth. The company's Growth Partnership Services, Growth Consulting and Career Best Practices empower clients to create a growth focused culture that generates, evaluates and implements effective growth strategies. Frost & Sullivan employs over 45 years of experience in partnering with Global 1000 companies, emerging businesses and the investment community from more than 30 offices on six continents. For more information about Frost & Sullivan's Growth Partnerships, visit **http://www.frost.com.**