

LI-COR®

2013 North American In-Vivo Molecular Imaging Technology Leadership Award



FROST & SULLIVAN



50 Years of Growth, Innovation & Leadership

Technology Leadership Award In-Vivo Molecular Imaging North America, 2013

Frost & Sullivan's Global Research Platform

Frost & Sullivan is in its 50th year in business with a global research organization of 1,800 analysts and consultants who monitor more than 300 industries and 250,000 companies. The company's research philosophy originates with the CEO's 360-Degree Perspective™, which serves as the foundation of its TEAM Research™ methodology. This unique approach enables us to determine how best-in-class companies worldwide manage growth, innovation and leadership. Based on the findings of this Best Practices research, Frost & Sullivan is proud to present the 2013 North American Technology Leadership Award in *in vivo* Molecular Imaging to LI-COR Biosciences.

Significance of the Technology Leadership Award

Key Industry Challenges Addressed by LI-COR Biosciences

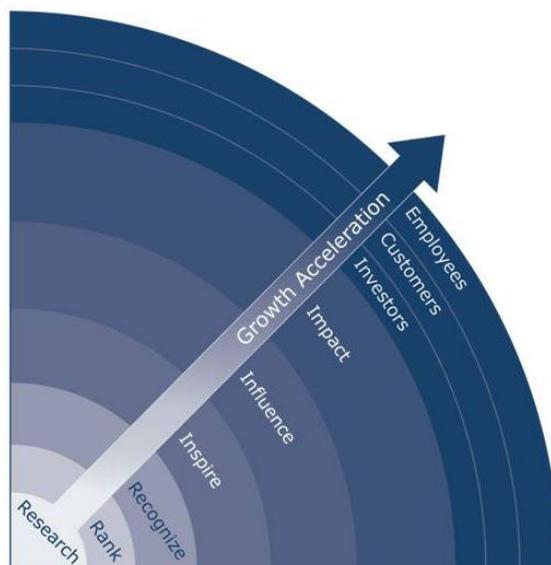
Molecular imaging has been a key resource in delivering the practice of molecular medicine from its beginning. In fact, biomedical imaging has performed a key role in the elucidation of the human genome, and continues being a strategic discipline in defining many cellular and biochemical mechanisms associated with disease pathophysiology. By assuming fluorescent dyes as labeling tools for life science research, the concept of molecular imaging allowed carrying out the major scientific milestone of the last decade - sequencing of the human genome by fluorescent detection. The first two approaches in automated sequencing were commercialized by Applied Biosystems (Life Technologies Corp.) and LI-COR® Biosciences. While Applied Biosystems utilized fluorescein- and rhodamine-related visible dyes, LI-COR Biosciences utilized a different approach. LI-COR Biosciences' approach involved the development of a near-infrared (NIR) fluorescence detection system with NIR dyes (currently commercialized under the label IRDye® infrared dyes), which offers a reduced autofluorescent background, while providing higher sensitivity and wider dynamic ranges. Therefore, LI-COR technology continues enabling the establishment of new standards for read length and accuracy.

Naturally, automated DNA sequencing technology has significantly evolved into massively parallel methods and single molecule detection. Nevertheless, fluorescence continues to play a remarkable role enabling the development of novel and more personalized biomedical tools, for both life sciences research and clinical practice.

Indeed, *in vivo* preclinical imaging has become increasingly important, not only in academic research, but also in drug discovery and development processes. Preclinical trials using animal models are subjected to numerous complications. Animal models of human disease present major disadvantages – the requirement of a large number of animals to achieve

statistical significance, difficulties in performing longitudinal studies on the same animal, inefficacy of metabolism studies, large amounts of economic and labor resources, and so on. Toward addressing these challenges, *in vivo* Molecular Imaging offers cost- and time-effective practices in trials.

Chart 1: Best Practices Leverage for Growth Acceleration



Key Benchmarking Criteria for Technology Leadership Award

For the Technology Leadership Award, the following criteria were used to benchmark LICOR Biosciences' performance against key competitors:

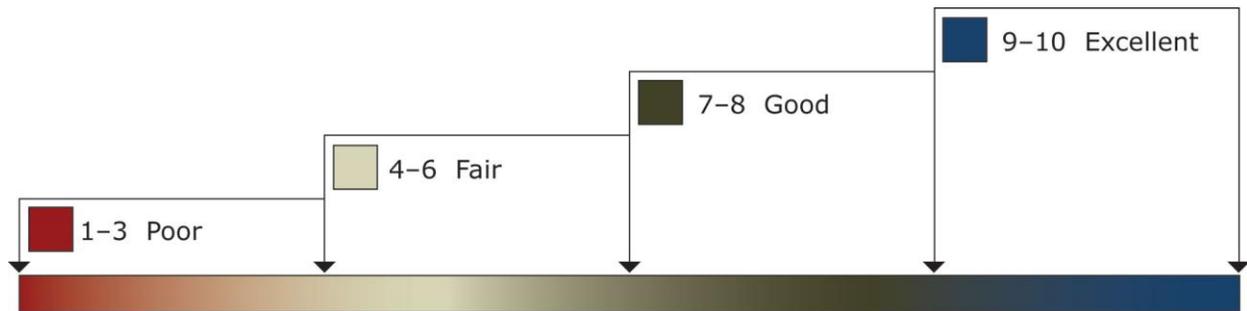
- Development of New Technologies
- Leverage of New Technologies
- R&D Spending as a % of Revenues
- Brand Perception
- Customer Value

Decision Support Matrix and Measurement Criteria

To support its evaluation of best practices across multiple business performance categories, Frost & Sullivan employs a customized Decision Support Matrix (DSM). The DSM is an analytical tool that compares companies' performance relative to each other with an integration of quantitative and qualitative metrics. The DSM features criteria unique to each Award category and ranks importance by assigning weights to each criterion. The relative weighting reflects current market conditions and illustrates the associated importance of each criterion according to Frost & Sullivan. Fundamentally, each DSM is distinct for each

market and Award category. The DSM allows our research and consulting teams to objectively analyze each company's performance on each criterion relative to its top competitors and assign performance ratings on that basis. The DSM follows a 10-point scale that allows for nuances in performance evaluation; ratings guidelines are shown in Chart 2.

Chart 2: Performance-Based Ratings for Decision Support Matrix



This exercise encompasses all criteria, leading to a weighted average ranking of each company. Researchers can then easily identify the company with the highest ranking. As a final step, the research team confirms the veracity of the model by ensuring that small changes to the ratings for a specific criterion do not lead to a significant change in the overall relative rankings of the companies.

Chart 3: Frost & Sullivan’s 10-Step Process for Identifying Award Recipients



Best Practice Award Analysis for LI-COR Biosciences

The Decision Support Matrix, shown in Chart 4, illustrates the relative importance of each criterion for the Technology Leadership Award and the ratings for each company under evaluation. To remain unbiased while also protecting the interests of the other organizations reviewed, we have chosen to refer to the other key players as Competitor 1 and Competitor 2.

Chart 4: Decision Support Matrix for Technology Leadership Award

Measurement of 1-10 (1 = lowest; 10 = highest)	Award Criteria					
	Development of New Technologies	Leverage of New Technologies	R&D Spending as a % of Revenues	Brand Perception	Customer Value	Weighted Rating
Relative Weight (%)	20%	20%	20%	20%	20%	100%
LI-COR Biosciences	9.9	9.8	9.7	9.8	9.9	9.8
Competitor 1	6.1	5.4	4.9	5.0	4.8	5.2
Competitor 2	5.8	5.5	4.6	4.7	4.4	5.0

Criterion 1: Development of New Technologies

Headquartered in Lincoln, Nebraska and holding international presence through its offices in Germany, UK, and distribution partners in more than 60 countries, LI-COR® Biosciences is providing researchers and life sciences developers with the most innovative solutions in *in vivo* Molecular Imaging worldwide.

Among the new technologies offered by LI-COR, NIR fluorescence technologies for *in vivo* Molecular Imaging of disease counts as one of the most remarkable advancements in the biomedical industry. Molecular imaging allows highlighting of biochemical disturbances underlying a certain disease pathophysiological state, providing notable advantages over the structural changes observed by anatomic imaging. The combination of optical imaging with fluorescent probes has allowed deciphering and understanding remarkable phenomena. An important challenge on that note relies on reaching deeper tissue penetration and higher sensitivity for certain types of studies. In general, animal tissue absorbs and scatters visible light, and only a few millimeters can be penetrated. LI-COR has leveraged the property observed in animal tissue by means of which the absorption coefficient present much lower values for NIR light than for visible light. NIR is capable of penetrating depths of several centimeters, additionally enabling improving sensitivity. Moreover, image processing for spectral unmixing is avoided because of tissue autofluorescence is very low in NIR wavelength range. According to the researchers, this pool of advantages enables a suitable detection of disease condition at early stages, thus making possible the enhancement of therapeutic protocols. Even events like metastasis can be detected with fluorophores, such as IRDye® 800CW, and other fluorescent targeting agents.

The adequate selection of the targeting agents for NIR optical imaging requires well-characterization and specificity in the evaluated compounds. Targeting agents are injected into the animal as an optical probe to be retained by interaction and are cleared from the animal's circulation over time. Frost & Sullivan recognizes the strong leadership position of LI-COR Biosciences as a developer of NIR solutions for life scientists. The IRDye 800CW infrared dye, a fluorescent label developed for a variety of targeting agents including peptides, small molecules, antibodies, antibody drugs, Affibody[®] molecules, and viruses, has been widely adopted and has been cited in scientific literature.

Criterion 2: Leverage of New Technologies

LI-COR Biosciences has positioned itself as a leader in designing and manufacturing life sciences and biomedical solutions. In order to provide its customer with the most suitable solution for specific studies and trials, LI-COR Biosciences offers a variety of ready-to-use IRDye optical probes capable of targeting a variety of diseases. For example, LI-COR's BrightSite[™] agents allow researchers to begin their experimentation without developing new imaging probes. BrightSite agents possess exceptional capabilities among the currently available imaging agents. In fact, they were rigorously validated with cultured cell assays, fluorescence microscopy, *in vivo* Molecular Imaging of animal models, and histology, with the purpose to ensure high purity, affinity, and specificity, thus allowing an accurate further interpretation of the animal study results.

IRDye optical imaging agents are suitable not only for *in vivo* and preclinical studies, but also for a wide variety of *in vitro* assays and *ex vivo* tissue analyses, including tissue section imaging and fluorescence microscopy. As an additional advantage, these agents are compatible with most NIR fluorescence imagers.

As demonstrated through the currently underway Dutch Clinical Trial: NL37479.042.11M, titled "Validation of Uptake of a VEGF-targeted Optical Fluorescent Imaging Tracer in Surgical Specimens of Breast Cancer", optical imaging agents labeled with IRDye 800CW have the potential for clinical translation. Additional trials utilizing IRDye 800CW manufactured under GMP have been approved and are pending in Europe and the United States.

On the other hand, LI-COR has also developed solutions for imaging small animals. The proprietary Pear^l[®] Impulse Imager has been optimized for dual-channel NIR optical imaging, allowing the obtaining of real-time imaging features. This technology, based on laser excitation, enables reaching smaller targets to be visualized at greater depths, thus facilitating earlier disease detection. In this regard, LI-COR has launched the unique FieldBrite[™] Xi optical design enabling life sciences researchers to achieve results with high levels of sensitivity and reproducibility.

Remarkably, manual exposure adjustments, and repeated exposures to ensure repeatability, are unnecessary. Signal saturation is eliminated by providing a dynamic range

of 22-bit width over six orders of magnitude. FieldBrite Xi technology enables researchers to acquire optimized saturation free images in 10 seconds, thus providing ease-of-use, high performance, and affordable images to be used by both inexperienced and experienced optical imaging workers.

Criterion 3: R&D Spending as a % of Revenues

As a leading designer and manufacturer of instrument systems for biotechnology and environmental research, LI-COR Biosciences possess a strong reinvestment policy in R&D. Four decades of expertise in the life sciences and biomedical industry undoubtedly supports LI-COR leadership position in this industry.

With a clear understanding of the potential of infrared dyes to improve reliability, accuracy, and performance of gene sequencing instruments, LI-COR led efforts to explore new applications of infrared dye detection technology. In 1992, the company launched the Model 4000 Automated DNA Infrared Sequencer. In the very next year, LI-COR delivered the 4000L Long Read DNA Sequencing System, setting global standards for long read lengths and accuracy.

A similar improvement of a technology development is evidenced with the release of the Odyssey[®] Infrared Imaging System in 2001 and the Odyssey Fc Imaging System in 2010. The former technology featured an unprecedented direct detection system by delivering two-color Western blots with superior reliability and accuracy through chemiluminescence. The latter leveraged both NIR and chemiluminescent detection technologies in order to provide simultaneous detection capabilities of two protein targets, or the use of one channel for normalization. Furthermore, the Odyssey CLx Infrared Imaging System was released in 2011, introducing a new AutoScan function that saves time and increases the available dynamic range to greater than six logs, thus representing the most flexible and multifunctional platform of all Odyssey imaging systems.

Remarkably, LI-COR has intensively diversified both the biotechnology and environmental product lines over time. Numerous instruments and applications in biological research have been enhanced through LI-COR's expertise with visible and infrared markers. This fact has significantly contributed to expanding drug discovery and development capabilities by opening up a broad spectrum of new investigational lines.

LI-COR's team of scientists and engineers are highly committed to continue developing cutting-edge instrumental platforms to provide researchers and scientists with the most suitable tools.

Criterion 4: Brand Perception

As a privately held ISO 9001:2008 certified company, LI-COR Biosciences has built long-stand working relationship with competitors, customers, and employees. More than 300 employees work in the company's offices of Lincoln, NE and their subsidiaries in Bad Homburg, Germany and Cambridge, UK. LI-COR instruments are used in more than 100 countries by more than 30,000 customers. They are adopted in studies that range from environmental issues to health and disease concerns.

In recognition of its brand perception, and LI-COR's success as a business and service to the Lincoln community, the Lincoln Chamber of Commerce awarded LI-COR with the Manufacturer of the Year Award in 2009. In addition, the Quantum Workplace awarded LI-COR with the Employee Voice Award for Exceptional Employee Engagement 2010. In the same year, LI-COR received the Governor's Bioscience Award from Bio Nebraska Life Sciences Association.

Closely involved with the scientific community, LI-COR scientists and engineers are engaged in conducting a variety of seminars and developing a series of training and educational materials for professionals and health practitioners. Maintaining close relationships with academic, governmental, and industrial research institutions, LI-COR's staff participates in scientific meetings and publishes their work in leading scientific journals.

LI-COR Biosciences has partnered with researchers in academic, pharmaceutical and government institutions for over 20 years, providing them with innovative solutions based on molecular imaging technologies, featuring NIR technologies. The company's proprietary technology integrates hardware, software, and labeling technologies to help researchers perform novel assignments, and solve challenges. For instance, LI-COR's innovative solutions enabled carrying out for the first time a truly quantitative Western blot analysis using the Odyssey Infrared Imaging system.

With global presence and leadership, LI-COR Biosciences is committed to deliver novel and innovative solutions in the life sciences and biomedical industry. LI-COR continues to develop outstanding technology approaches while establishing a solid collaboration network with service providers and developers, with the aim to provide its customers with well-suited solutions.

Criterion 5: Customer Value

With the aim to provide its customers with the most suitable set of tools for life science research and drug development, LI-COR has joined efforts to achieve a fluent interaction among instruments, kits, and reagents providers with the purpose to obtain superior laboratory results. On that note, LI-COR has cultivated a solid and fruitful life science network in collaboration with companies, such as MitoSciences (Abcam), R&D Systems, BioTek, BellBrook Labs, MTTI, Cambridge Research Biochemicals, Labeled Oligo Providers,

Metabion, Integrated DNA Technologies, and TriLink BioTechnologies.

On the other hand, LI-COR Biosciences holds an excellent intellectual property (IP) portfolio through the US granted patents 8,227,621 (IRDye[®] QC-1), 7,005,518 (IRDye[®] 700DX), 6,027,709 (IRDye[®] 700 phosphoramidite), 6,995,274; 7,597,878; 7,504,089; 8,303,936 (IRDye[®] 800CW and IRDye[®] 800RS products), 5,534,125; 6,495,812 (4300), 6,369,387 (LI-7000), 8,154,714; 8,130,379; 8,300,218 (LI-7200), 6,317,212 (LI-7500), 8,018,981; 7,953,558; 8,317,342; 8,374,209 (LI-7700), 7,856,899; 7,748,253; 7,568,374; 7,509,836 (LI-8100), 8,220,415; 7,286,232 (Pearl[®] Impulse Imager), 6,495,812 (Odyssey[®] Classic), 6,495,812 (Odyssey[®] CLx), 6,495,812 (Odyssey[®] Sa) and 7,286,232 (Odyssey[®] Fc). LI-COR also has numerous patent applications and analogous patents outside the United States.

Conclusion

Founded in 1971, LI-COR Biosciences has been a leader in the design and manufacture of instrument systems for biotechnology and environmental research. LI-COR pioneered the development of infrared fluorescence labeling and detection systems for life science domains, such as protein analysis and DNA sequencing. LI-COR Biosciences' technology platform offers unique infrared imaging solutions for a variety of applications, including Western blotting, protein arrays, cell-based assays, and *in vivo* Molecular Imaging. Additionally, LI-COR instruments for photosynthesis, gas analysis, and light measurement are recognized worldwide for setting standards in plant science research and environmental monitoring.

Frost & Sullivan recognizes the outstanding performance of LI-COR Biosciences commitment to provide researchers and developers with novel and innovative solutions.

About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best-in-class positions in growth, innovation and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best-practice models to drive the generation, evaluation and implementation of powerful growth strategies. Frost & Sullivan leverages 50 years of experience in partnering with Global 1000 companies, emerging businesses and the investment community from more than 40 offices on six continents. To join our Growth Partnership, please visit <http://www.frost.com>.