By Taren Grom

Biotechnology
Companies

Biotechnology C-suite executives identify the biggest opportunities for innovation as well as the biggest barriers.

LLOYD EVERSON, M.D
CEO
MolecularHealth

Opportunities: The greatest opportunity for innovation within the biotechnology space lies in the rapidly increasing amount of data furthering the complexity of cell biology, and the ability to use it for clinical action. Big data is a term that gets tossed around liberally, and is typically associated with the storage of data in a data warehouse over an extended period of time, to eventually be sorted and parsed to reveal trends. While this method of data collection and analysis is very important, straying away from the typical cohort analysis characteristic of big data, and placing more focus on interpreting how data impact the individual, can be exceedingly beneficial to patients. The known data within the panomic of the cell are mature enough now that we can apply it to a particular patient's case and give actionable options for his or her care. This can be done today, rather than sitting on the data for years.

Barriers: The challenge of securing value-driven reimbursement is a massive barrier to innovation within the industry. It takes enormous investment and capital to demonstrate that a certain genomic test, proteomic expression, or metabolomic expression actually has an outcome that impacts patients. Unfortunately, we are working in an environment where those responsible for reimbursements — government as well as private payers — are lagging in understanding exactly this challenge that we in the industry face.

If you sit down with patients, they're interested in two things: what do you know that will help them with this devastating disease, and how are they going to pay for this. The industry has made a major leap forward in understanding the DNA and various pathways of very complex cell environments. This information could allow physicians to present patients with more personalized options for their treatment. However, the problem remains that regulators and the insurance industry haven't figured out how to best handle these economic concerns.

INGMAR HOERR, PH.D.
CEO and Co-Founder
CureVac

Opportunities: We have recently seen how mRNA has gained momentum as a novel class of therapeutics. In October 2013, researchers from academia, biotech, and pharma met at the 1st International mRNA Health Conference in Tübingento to discuss the tremendous medical potential of mRNA for many therapeutic indications. Many new contacts were established that may lead to fruitful collaborations and may build on the success of mRNA-based immunotherapies that are currently in clinical trials for oncology. mRNA-based vaccines also have shown potential in many other areas, such as prophylactic vaccines for infectious diseases and allergy or as mRNA-based protein therapeutics.

Barriers: Experts from pharma, biotech, and academia have acknowledged the tremendous medical potential of mRNA for many therapeutic indications, the safety aspects of mRNA, especially when compared with DNA, and its flexibility and potential areas of applications. An important topic that has to be addressed is the regulatory classification of mRNA. A panel discussion at the International mRNA Health Conference emphasized the differentiation of mRNA when compared with DNA, which should be reflected in the regulatory classification.

DAVID MEEK
Chief Commercial Officer
Endocyte

Opportunities: The co-development of molecular diagnostics and targeted therapeutics will provide safe, effective, and precise treatment options for various diseases. The development of molecular imaging strategies for treatment selection holds great promise for precision medicine with early success being demonstrated in oncology. One of the many advantagesof this approach is the ability to visualize the expression of a molecular marker on lesions in real-time, allowing physicians to choose therapies that are most likely to be effective. The most advanced companion imaging agent for several targeted therapeutics is linked to a small molecule that targets the folate receptor. A non-invasive, full body scan for the imaging agent is then used to detect the presence or absence of the folate receptor, the molecular target, in real-time. Patients in whom the molecular target is detected are thus most likely to respond to treatment with a small molecule drug conjugate composed of the same small molecule linked to a highly potent drug. This personalized medicine approach also has benefit to those patients who do not have the molecular target because they will not be exposed to a therapeutic that will not offer efficacy, but may have unwanted side-effects and potential delay to other therapies.

Barriers: Regulatory bodies encourage the development of medical treatments that are tailored to individual characteristics of each patient's disease, however one of the major challenges to innovation within this therapeutic space is the ability to identify new molecular targets and biomarkers. For example, cancer is a complex disease that can involve many cell types. Fundamental issues for

Spotlight on Biotech Pipeline

- The number of biotech products in clinical trials grew 155% in 11 years, from 355 in 2001 to 907 in 2012, with big pharma in 2012 engaged in about 40% of all biotech products in clinical development.
- Financing of biotech research increased almost 10-fold in a decade, from $10.5 billion in 2001 to $103 billion in 2012.
- Worldwide growth in biotechnology product sales grew 353% between 2001 and 2012, from $36 billion to $163 billion.

Source: Tufts Center for the Study of Drug Development

the identification of cancer biomarkers are often related to tumor heterogeneity, which includes not only the heterogeneity between patients' tumors, but also heterogeneity within an individual tumor and between the primary and metastatic tumor sites.

SCOTT MINICK
President and CEO
BIND Therapeutics

Opportunities: Despite advances in cancer treatments, a key challenge remains to selectively kill cancer cells while sparing healthy tissues. An innovative new approach to treating cancer is the use of targeted nanoparticle therapeutics that hone in on and attack tumors by recognizing biochemical and structural features that distinguish cancerous tissue from healthy tissue. Targeted nanoparticles are designed to concentrate a therapeutic payload at the site of disease in order to enhance efficacy while minimizing off-target toxicities.

For example, BIND Therapeutics is leveraging its proprietary targeted nanoparticle platform to develop nanomedicines called Accurins that can potentially outperform both new and existing cancer therapies, including cytotoxic drugs such as docetaxel and molecularly targeted agents such as kinase inhibitors. An added advantage of targeted nanoparticles, such as BIND's, is the ability to program the pharmacokinetics and biodistribution of the particle in order to optimize its efficacy and safety.

GARY RABIN
CEO and Chairman
Advanced Cell Technology

Opportunities: From the age of 40 on, the risk for a variety of age-related degenerative diseases doubles about every five years, producing a steep exponential risk curve for serious disease development later in life. While many of these diseases may not directly be life-threatening, as the average life span increases and the baby boomer population ages, age-related health problems will become numerous.

Regenerative medicine may significantly delay progression of degenerative diseases to later stages and perhaps even offer lasting cures. Beyond its impact on overall quality of life, delaying the progression of age-related degenerative disease from early to more serious intermediate/late stages can also impact the financial costs to society. Shifting the disease progression curve by even five years, would result in one less doubling of disease risk near the end of life, potentially eliminating a substantial number of severe cases of disease and representing an enormous cost savings.

Barriers: With respect to regenerative medicine, a decade of lean investing has, until recently, held back the pace of therapeutic innovation. A great deal of the regenerative medicine therapies in development are based on cell- or tissue-transplantation. For many global life science companies there is a perception of manufacturing and regulatory complexity to cell-based therapies that is only starting to be corrected. The wait-and-see approach of these industry leaders trickled down to investors, causing regenerative medicine companies to operate on lean budgets and to move cautiously and slowly along their regulatory and commercialization plans. With an increasing number of regulatory approvals to commence clinical trials and some regenerative medicine trials beginning to report favorable results, the pendulum is starting to swing in the right direction.

RON SQUARER
CEO
Array BioPharma

Opportunities: I see great opportunity for innovation in unlocking the value of early-stage pipeline assets. Both big pharmaceutical companies, as well as smaller companies such as Array BioPharma, have formed venture-backed spinout companies around early-stage compounds. Without the need to compete for resources with later-stage "lead" programs, these assets can move more quickly through pre-clinical and early clinical development, reaching proof of concept months, or years, earlier than they would have as part of the parent company portfolio. Through equity, milestone, and royalty participation, these deals can be structured to benefit both parent and spinout, and can result in accelerated development timelines, bringing important medicines to patients faster than ever.

NICHOLAS VAHANIAN, M.D.
President and Chief Medical Officer
NewLink Genetics

Opportunities: Harnessing a patient's immune system to fight the cancer within the body has become a compelling treatment option. Immunotherapy approaches hold significant promise because they have the potential to stimulate the body's own immune system to recognize and attack cancer cells on the one hand and to disrupt the mechanism by which tumors evade a patient's immune system on the other.

There are currently hundreds of studies under way using the concept of immunotherapy to battle breast cancer, lung cancer, and melanoma. For example, at this year's American Society for Clinical Oncology (ASCO) meeting, a number of big pharma players including Bristol-Myers Squibb and Genentech/Roche presented encouraging data on immunotherapies targeted against checkpoint pathway inhibitors such as CTLA-4, PD-1 and PD-L1.

Taking the cancer immunotherapy approach to the next level, innovative companies, such as NewLink, that have multiple checkpoint inhibitors and vaccines, have the opportunity to combine treatments to achieve optimal therapeutic effects.

SZILARD VOROS, M.D.
CEO and Co-Founder
Global Genomics Group (G3)

Opportunities: Systems biology-based approaches will provide important insights intopredictive, personalized and preventive medicine. Systems biology is an interdisciplinary field that profiles the complicated biological networks of health and disease by integrating biological information such as pan-omics, which includes genomics, epigenomics, transcriptomics, proteomics, metabolomics and others, and biology-based bioinformatics analyses. The understanding of the complex processes of diseases and disease development will lead to the identification of new disease biomarkers and disease-related pathways, and thus to new targets for the next generation of precise medicines. PV