Breaking new ground in biomarker discovery

How SCIEX is pioneering the discovery of non-genetic biomarkers to adopt a holistic approach to precision medicine

by Aaron Hudson

In 2016, a new facility opened in The University of Manchester that would quickly become Europe's leading facility for the discovery of biomarkers. The Stoller Biomarker Discovery Centre – a partnership between the Stoller Charitable Trust, the UK Medical Research Council and SCIEX – is one of the largest clinical proteomics facilities in the world, created to industrialize clinical research into biomarkers on a previously unseen scale.

One of Stoller's fundamental objectives has been to adopt a more holistic approach to the discovery and use of biomarkers. Most coverage of novel biomarkers to date has been focused on genetics, or so-called Molecular Diagnostics; how a patient's genetic signatures can indicate their susceptibility to a disease, its possible severity, and what treatments may prove most effective.

But the experts at Stoller have recognized this is only half of the picture. With genome sequencing reaching new levels of maturity, it needs to be acknowledged that further investment in discovery of genomic indicators alone will only drive the advent of precision medicine so far. Other 'omic' features, such as proteomics, lipidomics and metabolomics, coupled with environmental and lifestyle factors, will contribute even more to differences in disease risk and drug response.

It is on these aspects that much of the research at Stoller has focused since its inception. Embracing the potential of these non-genetic biomarkers can ensure the 'right drug' is administered to the 'right patient' at the 'right time', and hold the key to a new era of efficient, predictive and precise medical science.

Beyond genetics

At SCIEX, our purpose is to deliver new technology that enables translational researchers to break new ground in biomarker discovery and accelerate the path to precision diagnostics in pathology labs around the world. These mass spectrometry-based technologies are used to target a wide array of diseases, including paediatric and gynecological cancers, cardiac diseases, lupus, dementia and rheumatoid arthritis.

Two areas in particular have been the focus of our effort: proteomics; and metabolomics. Proteomics is vital as proteins can provide a comprehensive link between the genome, external factors and the phenotype – crucial in the study of many cancers and longer-onset diseases in which a multitude of factors influence susceptibility and best possible treatments. Metabolomics, meanwhile, gives us the most representative picture of what is going on in an organism in the here-and-now; the behavior of which often acts as a signifier of early stage onset of diseases that would have *no genetic markers* and produce no early changes in the proteome.

The use of genetic and non-genetic markers of disease risk, diagnosis, response to therapy and prognosis to improve patient stratification and drug targeting has the potential to be truly transformative for patients. By giving the right drug to the right patient at the right time, not only do chances of improved patient outcomes increase, drug failure rates will reduce, which provides added-value to health systems and payors. At the same time, patient experience will ultimately be improved as the historic trial and error approach to treating complex diseases such as systemic lupus erythematosus (SLE) could become a thing of the past, as we understand what works in different cohorts of patients, with interrelated omic and lifestyle factors.

Transformational changes

Patient stratification and drug targeting at a strategic level is just the tip of the iceberg when it comes to what biomarkers can bring to public health in future.

It won't be long before labs will offer direct-to-consumer testing for multi-analyte biomarker panels from a single drop of blood, acquired in the home and sent through the post, as we've seen with the ancestral heritage industry in recent years. But unlike genetic testing, this won't be a one-time activity – you would send off samples on a regular basis, with non-genetic biomarkers tracked so that deviations from the steady-state baseline can be flagged.

From there, it's not too much of a stretch to run a massively-multiplexed omics profile and obtain a direct, tailored assessment on a person's current wellness and susceptibility to various diseases, which they can use to make informed choices about their health, lifestyle and need for clinical intervention. Underpinning all these advances, data analytics and machine learning will be key to making biomarkers become an integral part of daily life and the foundation of public health tools worldwide.

For this vision to become reality it will also require an evolution of the current governmental regulatory pathways and testing reimbursement mechanisms in countries around the world. Achieving the right balance between the safety, efficacy and security of diagnostic testing, and accelerating the use of new biomarkers, is not trivial. Nor is the shift for payors from the cost of illness to the cost of wellness.

Next steps

At Stoller, the key to success is scale, and we are only just beginning to realize the facility's full potential. It is now working 24 hours a day, seven days a week and is using innovative techniques and technologies to continuously improve the rate at which it can process samples. Using SWATH acquisition on a mass spectrometer – a technique that allows comprehensive detection and quantification of virtually every detectable protein in a sample – Stoller is now able to measure thousands of proteins across hundreds of samples running in parallel, significantly increasing the speed and confidence with which biomarkers can be detected.

This rate will continue to increase, enabling us to adopt a truly industrialized approach, while looking at the broadest spectrum of biomarkers, both genetic and non-genetic. This is vital if we are to deliver precision medicine that is truly targeted and predictive. The future lies in advancing high-throughput technologies in the lab and combining this with artificial intelligence and machine learning to overlay regularly measured biomarker profiles with patient metadata. In doing so, this could drive the evolution of biology and medicine exponentially and help realize the promise of precision medicine – ultimately leading to huge benefits for patients and the healthcare industry around the world. ■

Aaron Hudson is Vice President of Global Marketing and Clinical Diagnostics at SCIEX, a Danaher operating company and a global leader in the accurate quantification of molecules.