Optofluidics technology accelerates discovery of COVID-19 treatments

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September 14, 2020 -- Known for its transformative technology, Berkeley Lights is a pioneer in optofluidics, which has supported the biopharmaceutical industry for years with its deep cell characterization capabilities. These efforts are highlighted by the rapid impact that Berkeley Lights' Beacon systems had during the early days of the COVID-19 pandemic.

Berkeley Lights was founded in 2011 to develop and commercialize technology developed by University of California, Berkeley researcher Ming Wu, PhD, that uses light to gently move single cells within microfluidic chips. The company has established partnerships throughout the biopharmaceutical industry to advance the development of biotherapeutics and advance cell line development.

When COVID-19 entered as a potentially disastrous situation, Berkeley Lights was poised to take immediate action.

"I'm really proud of how Berkeley Lights, as a small company, made a decision in early February when COVID-19 became more prevalent to prioritize helping any of our customers who were actively involved in looking for a treatment for COVID-19, either an antibody therapeutic or a vaccine," said John Proctor, PhD, senior vice president of marketing at Berkeley Lights, in an interview.

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These efforts began as early as February 4, when China-based customer GenScript screened transgenic mice infected by the novel coronavirus (then called 2019 nCoV, now SARS-CoV-2) for antibodies against the virus on its Beacon system using the OptoPlasma B Discovery Workflow. Within 24 hours, GenScript successfully identified several potential blocking antibodies.

In the following months Berkeley Lights partnered with Vanderbilt University Medical Center to screen human blood samples on the Beacon system to identify potential antibody-based therapeutic treatments. Proctor explained that the Vanderbilt team identified 500 antibodies in a single day. Since then, a small subset of these have been verified as potent, highly neutralizing antibodies, as confirmed in nonhuman primate models. At least one of these has been licensed to AstraZeneca and is currently undergoing clinical evaluation.

The company also worked directly with the University of Queensland in Australia to modify a Berkeley Lights SpotLight assay so researchers can find cells that were producing a high level of candidate vaccine molecule they are developing.

Perhaps most impressive of all, these significant changes to the platform were all made online. Due to COVID-19 travel restrictions, the scientists at Berkeley Lights and the University of Queensland worked together virtually to develop an entirely new assay and push the vaccine candidate toward a phase I clinical trial.

"It took 78 days, from the start of cell processing to dosing patients, and they were able to get their vaccine candidate online," Proctor recalled. "It's a testament to our scientists who were able to transition away from planned product development to ask how they could help, and together with customers have done something really amazing."

In total, the company is working with 10 of its customers for the development of COVID-19 therapeutics or vaccines.

The search continues

Berkeley Lights sees the cell therapy market space as a promising opportunity. The company's digital cell biology technology is well suited to help customers learn about their candidates and make observations at the single-cell level to guide decision-making.

"At the heart of our platform is our core belief that population-level cellular measurements cannot deliver the best results where individual cells matter, as in single B cell-based antibody discovery or T cell-based cell therapies," Proctor said. "By rigorously characterizing every cell we believe we can find the best cells producing a biotherapeutic at the highest rates or determine a set of cells likely to produce a safe and highly efficacious cell therapy."

The company's Opto Cell Therapy Development Workflow helps scientists automate some conventionally difficult processes using its OptoSelect chip. These include phenotypic characterization and cell sorting. Proctor notes that optimal T cells with desired phenotypes such as less differentiated memory phenotypes, high proliferative capacities, or polyfunctional cytokine secretion, can be easily identified using the workflow.

T-cell function can be directly assessed with a variety of on-chip functional assays. The functional readouts can then be correlated to the molecular mechanisms driving specific T cell phenotypes. Following on-chip analysis, researchers have the option to recover T cells for T-cell receptor sequencing, transcriptomic analysis, or expand a specific population of T cells to accelerate the development of cell therapies.

The power of the technology exists in the large amounts of data generated from thousands of cells that help scientists find exactly what they are looking for. For example, Proctor explains that workflow assays can provide scientists with insights into polyfunctional T cells within a population to help them identify -- and potentially select -- the specific cells that actually kill cancer.

"The company is focused on allowing scientists to thoroughly investigate functional phenotypes that will lead to very effective and efficacious cell therapies," explained Proctor.