STARTUPCITY.COM

STARTUP CITY

BIOTECH STARTUPS SPECIAL

Laurie Goodman, Ph.D.,
CEO & Board Manager

Biotechnology Trailblazers

ClearLight Biotechnologies

NOVEMBER - 15 - 2018
$15

ClearLight Biotechnologies

Biotechnology Trailblazers

By Kevin Lobo

A young triathlete, Laurie Goodman, glides her tiring torso through the soft dirt path encircling a lake in Northern California on the final leg of her triathlon. She wants to beat her record of completing the 3rd leg of the race, a 10K run, in under 43 minutes. All of the spectators at the starting point have already deemed it impossible, especially after completing a long swim and bike ride. They gasp while the persevering runner draws nearer to the finish line well within 41 minutes. With every stride, she fights off chills and battles the gushing wind. Her muscles ache, heart pounds, but her mind was strong and the idea of giving up was non-negotiable.

So, what was it that kept Laurie Goodman running tenaciously? With a smile, Laurie says that it was the fear of not accomplishing my goals.

Laurie's life has been full of such instances where she could have easily given up, but the dynamic woman never bothered to. What didn't kill Laurie, only made her stronger! Like the point in her life where she was diagnosed with breast cancer. "I was diagnosed with breast cancer at the age of 36, and this urged me to focus a significant part of my career on the field of oncology," says Dr. Laurie Goodman, Ph.D., CEO of ClearLight Biotechnologies.

> "CLARITY enables the formation of a hydrogel matrix (HM) by crosslinking biological molecules to a 3D network of hydrophilic polymers, followed by lipid removal to generate a transparent and structurally intact tissue"

15 STARTUP CITY

MOST PROMISING

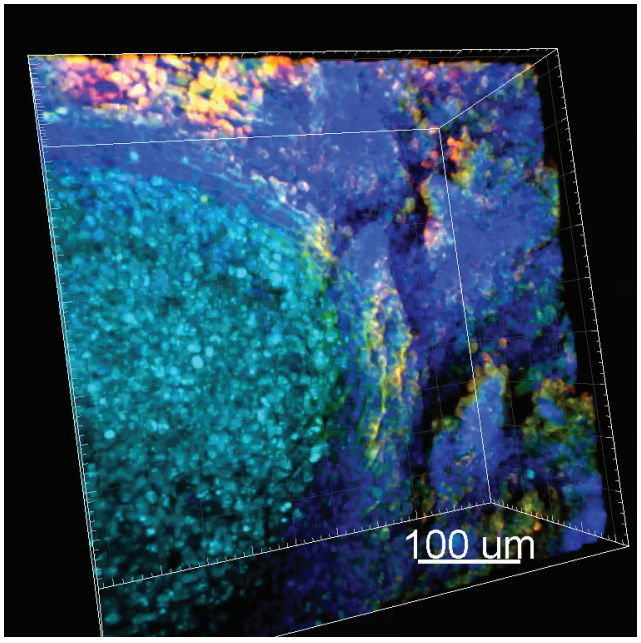
BioTech

STARTUPS-2018

Laurie Goodman, Ph.D.,
CEO & Board Manager

ADDING NEGATIVES TO PRODUCE POSITIVE

The mental and physical anguish that cancer diagnosis and treatment brought to Laurie also gave her the strength and perseverance to dedicate her life to improving outcomes for cancer patients around the world through research and development. This was an important reason why she accepted a leadership position with ClearLight Biotechnologies, initially as the Chief Scientific Officer (CSO) and more recently as the CEO and board manager of the company.



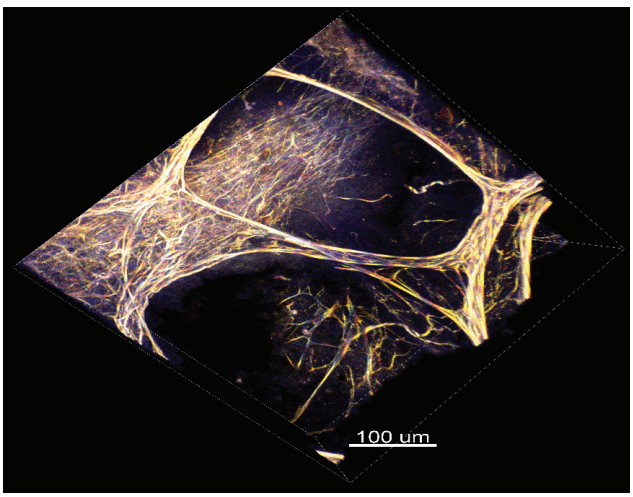
Founded by Karl Deisseroth M.D., Ph.D. in 2014, the main focus of ClearLight Biotechnologies is to develop automated instrumentation and associated reagents to simplify and expedite nondestructive 3-Dimensional (3D) tissue analysis, facilitating preclinical and clinical research applications. This enables an end-to-end solution for 3D analysis of preclinical and clinical models of disease and consists of an automated multi-sample and individualized 3D tissue processor paired with optimized biomarker panels as well as multi-sample imaging and custom 3D image analysis software.

The development program is a combination of external software and hardware engineering contractors, as well as strategic academic and business partnerships. Dr. Goodman's extensive experience in innovative technology development takes the company's mission of revolutionizing the diagnostic, prognostic, and predictive treatment of disease to another level. "The 26 years that I have spent in the biotech space has taught me to be humble, to lead by example, to mentor, and to listen carefully to my team's day to day needs and career desires. These tools, which I've honed over time, highly motivate the team that I am leading at ClearLight Biotechnologies," states Laurie. Additionally, the company's internal team is comprised of a Director of Operations, two Directors of Research and Development, one Head of Lab Operations along with the CEO. An extensive external team of over 30 contractors, supports the day to day operations of the company.

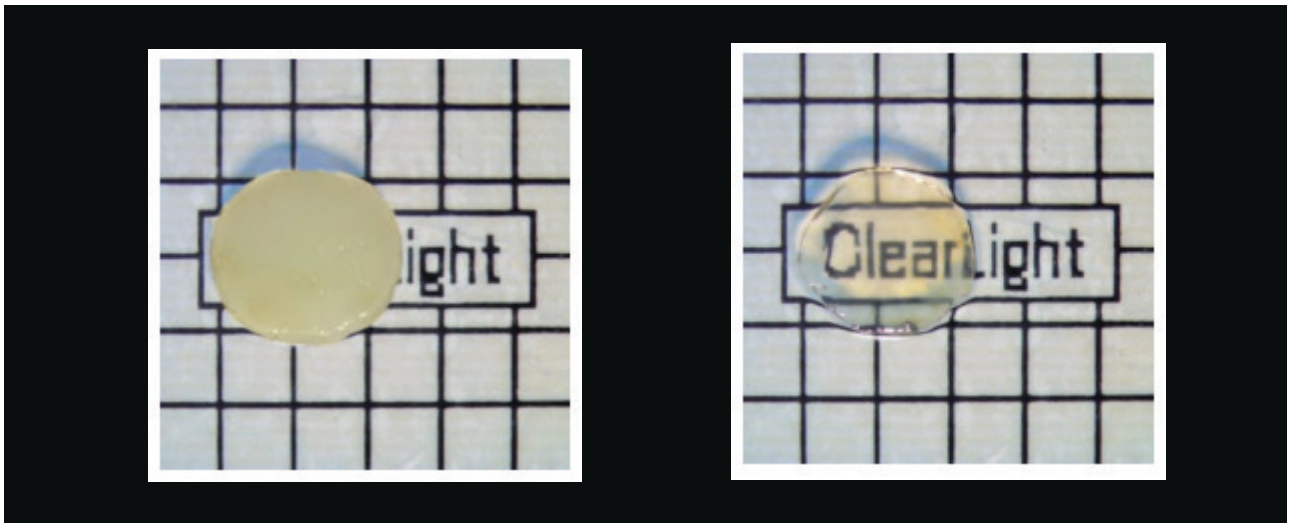
BRINGING 'CLARITY' INTO THE PICTURE

The current gold standard techniques for the analysis of diseased and healthy tissue are outdated and rely on the analysis of 2D thin-section formalin fixed paraffin embedded (FFPE) tissue techniques. The spatial analysis of a potentially heterogeneous tissue microenvironment can be highly limited by such methods, as can the study of the tissue morphology. Furthermore, the 2D analysis is destructive, slide-based, and manual and as a result, does not represent the entire biology. "The emergence of next-generation sequencing (NGS) in clinical decision making took more than 20 years, and has become a billion-dollar industry," mentions Laurie. The solution lies in the development of a revolutionary technology called Clear Lipid-exchanged Acrylamidehybridized Rigid Imaging/Immunostaining/In situ hybridization-compatible Tissue-hYdrogel (CLARITY).

Invented by Deisseroth and his colleagues at Stanford University, it is a novel and innovative approach in both function and utility and has been applied broadly to the field of neurobiology, primarily as a qualitative tool. Laurie informs, "CLARITY enables the formation of a hydrogel matrix (HM) by crosslinking biological molecules to a 3D network of hydrophilic polymers, followed by lipid removal to generate a transparent and structurally intact tissue." This tissue retains its original structural features and can be labelled with macromolecules and imaged without destruction of the tissue morphology.



CLARITY is compatible with frozen, fresh formalin-fixed, and FFPE research and clinical human or rodent tissue. "It is non-destructive, and therefore fewer samples allow recapitulation of spatial heterogeneity without laborious sectioning and



registering of samples," adds Dr. Goodman. It is compatible with standard nucleic acid and antibody interrogation techniques, and enables multiple interrogations of a single sample to increase 3D biomarker information. The workflow is simple and includes embedding the tissue in a hydrogel solution and removal of light scattering lipids that impede the ability to image deeply within a tissue. This is followed by multiplexed interrogation with directly or indirectly fluorescently labeled antibodies or nucleic acids to identify critical structural and microenvironment biomarkers. Next, the process of microscopic imaging of the tissues is initiated by refractive index matching and then leveraging long working distance objectives with a variety of imaging modalities including, confocal, light sheet, or SPIM. The process ends by operationalizing 3D image analysis through artificial intelligence (AI) and machine learning (ML) techniques.

TOWARD AN EXEMPLARY FUTURE

Recent months have been quite transformative for ClearLight Biotechnologies. The company has gone through leadership changes and a name transition from ClearLight Diagnostics, LLC to ClearLight Biotechnologies, LLC to accurately reflect the potential commercialization plan to introduce a Research Use Only (RUO) platform into the market. "The term 'diagnostics' implies a short-term solution to patient testing, with associated patient outcome and treatment decision reporting," states Dr. Goodman. "We have been inadvertently compared to companies that offer such potential solutions to patient biomarker testing. There is a pressing need regarding longterm RUO use of the platform to get adequate adoption before introducing the platform into the clinical markets."

ClearLight Biotechnologies aims to launch the RUO in-house service model along with limited beta platform testing in the field in the late Q4 2019 or early Q1 2020-time frame. The custom service model will be offered to academic and pharmaceutical customers in any field—preclinical, clinical drug development, exploratory inclusion in clinical trials—as a means to grow a profitable business over the next five years. Beta platform studies at customers' sites will allow validation of the system and facilitate the generation of critical clinical utility data. As such, it will inform the potential future product development and commercialization plans. Volumetric tissue clearing and 3D image analysis is novel and in its infancy as a technology, and it will take time to understand the market needs and requirements. This will enable refinements to the technology platform prior to a potential commercial launch of the RUO platform and associated reagents into the field in 2023 and beyond.

Following the long-term adoption of the RUO product by pharma, academics, and CROs, ClearLight Biotechnologies would also like to enter into the Laboratory Derived Testing clinical market or a potential FDA-cleared platform/companion diagnostic with potential partners. "Introduction into the clinical pathology market carries a sizeable burden in terms of product development and validation time, and requires a large body of retrospective/prospective clinical outcome data and significant regulatory hurdles," mentions Laurie. "It is a risk without first establishing the RUO and potential clinical utility along with developing the market for the technology." The company envisions the timeline for FDA approval and clinical utility to be similar to NGS technology market adoption. With any new disruptive and revolutionary technique, adoption takes time and patience. Nevertheless, the outcome is undoubtedly rewarding as in the case of ClearLight Biotechnologies, the company that holds exclusive intellectual property rights to develop the CLARITY technology for diagnostic, prognostic, and predictive future clinical applications.