DESTINATION STARTUP

Lab 79 Technologies, Inc.

One-Sentence Summary of What You Do: We are developing a method to sequence DNA by monitoring the changes in force as a piece of single-stranded DNA is pulled through an interface (for example, between water and air).

Affiliated Institution: N/A

Have you formed a company yet? Yes

Funding/Financing: Angel Funding (including Self or Friends/Family), Venture Capital

Please describe your company and the problem you are trying to solve: Sequencing of DNA and RNA is a core technology in biomedical and pharmaceutical research, and is increasingly important in diagnosing and treating disease. The goal of Lab79 is to develop a protein-ree, single-molecule platform that is capable of direct and highly accurate sequencing of individual DNA/RNA molecules. There are significant advantages to single- molecule sequencing methods including reduced reagent costs, long read lengths, elimination of inaccuracies caused by amplification, and the ability to measure epigenetic marks which are typically removed by amplification. While there are two single-molecule sequencing companies, PacBio (soon to be acquired by Illumina) and Oxford Nanopore, competing against the industry giant Illumina (which uses amplification), they are plagued by low raw accuracies of around 90% compared to Illumina's 99.9%.

Lab79 has measurements showing that using an atomic force microscope (AFM) to measure the force required to pull a piece of single-stranded DNA through an interface (such as between air and water) can provide information about the DNA sequence. We have demonstrated this on DNA molecules with runs of repeating bases and are working to push to single- base resolution. A significant advantage of the approach is that the piezo motors used to pull the DNA through the interface are capable of "flossing" the molecule back and forth many times, allowing averaging at a single molecule level to improve accuracy. The competing techniques use biological motors which are unidirectional, making averaging very difficult.

Lab79 filed a provisional patent application at the beginning of 2019 and is pursuing further IP.

What is/was your go-to-market strategy? The established DNA/RNA sequencing market is currently estimated to be between $5B and $10B annually and growing at a CAGR of nearly 20%. This is both an advantage in that it is clear there is a large customer base, but also a disadvantage in that we are entering an existing market with significant competition. However, the recent success of Oxford Nanopore shows that it is possible for a startup to break into the market if the technology changes are significant relative to the status quo.

It is a bit premature in the development cycle to expound on an exact marketing strategy. The next major step after demonstrating sequencing with single-base resolution will be the development of a commercial device. We have extensively studied engineering possibilities and believe it will be possible to build an inexpensive sequencer with significantly smaller consumable costs than existing technologies.

Our major differentiators will be lower costs and higher accuracy. The higher accuracy will be achieved by the ability to average at a single molecule level already mentioned. The cost reductions will arise because our method is physical as opposed to biochemical and eliminates the proteins used in existing technology. Proteins are inherently expensive and unstable molecules with a limited shelf life, and drive much of consumable costs in competing techniques.

An attractive early entry point for Lab79 could be direct RNA sequencing, where a high-accuracy, single- molecule technique brings significant advantages.

How will/do you generate revenue? Lab79's ultimate product will be a DNA/RNA sequencing instrument and revenue will be generated by sales of these instruments. The two important financial considerations for DNA sequencing instrumentation are instrument costs and consumable costs. The instrumentation costs of Illumina and PacBio are currently considerable (typically hundreds of $k), while the Oxford Nanopore sequencers start at a few $k. All three companies have very significant consumables costs.

A commercial device based on our technology would involve many force measurements in parallel. An interesting proof-of-concept device exists in the IBM Millipede project. This was a data storage project at IBM using AFMs. While the rapid improvement of flash memory meant the project was never commercialized, internal prototypes with 4096 AFMs in parallel were implemented on a chip about 1 cm across in a device the size of a modern hard drive with a projected cost- of- goods below $100. Based on this, we believe we could develop a commercial device at costs competitive with current Nanopore sequencers but with significantly higher throughput and accuracy. Further, we believe that eliminating proteins from the work flow could reduce consumables costs by 10X relative to existing methods.

An additional use of our technology we are exploring is DNA data storage. Several startups and larger companies, including Microsoft, are working on long term storage of information directly in DNA. As a reader for DNA data storage, the low device cost and especially the lack of proteins represent significant advantages.

How will this showcase benefit your company or technology? Lab79 is seeking private wealth or venture funding of $2M. An investment of this size will allow us to complete the R&D necessary to show that our technique works at the single-base level and to develop a base- calling algorithm. Should we demonstrate those results, and given the work we have already done studying paths to a

viable commercial device, we believe we will be able to raise significantly more investment to begin work on building a commercial sequencer. We have had prominent biotech companies review the technology and express interest in investing should we demonstrate a base-calling algorithm. However, we currently sit at a position where we are an early-stage investment, so exposure to both venture capital with the right risk profile, and perhaps more significantly, private wealth investors with an interest in early-stage investing through this showcase is a great opportunity for Lab79.

We feel our biggest current need is further expertise in machine learning. While our collaboration with the Flatiron Institute mentioned below will help significantly, should we be successful in raising funding we will be actively seeking at least one new team member with machine learning experience.

Who are the members of your team and why is this the right team to get the job done?

- Jason Cleveland, Ph.D., CEO — As a physicist and entrepreneur, Dr. Cleveland has a nearly 30-year track record of building and commercializing scientific instrumentation. He was a co-founder and CEO of Asylum Research, an AFM manufacturer, for nearly 13 years before its sale to Oxford Instruments.
- Jan Hoh, Ph.D., Senior Scientist — Dr. Hoh is a molecular biologist with significant AFM experience. He was on the faculty at Johns Hopkins for over 20 years.
- Allison Churnside, Ph.D., Research Scientist — Dr. Churnside is a biophysicist with expertise in AFM instrumentation design and single- molecule force measurements.
- Larry Gold, Ph.D. Chairman — Dr. Gold is a professor at CU- Boulder and a serial biotech entrepreneur. He cofounded and later sold Nexagen and Synergen, and is currently the chairman of SomaLogic as well as Lab79.
- Scott Kothlow, CFO — Mr. Kothlow was previously CFO of SomaLogic, a proteomics startup, and helped to grow the company from 20 to 150 people over 15 years.
- James Oury, CBO and General Counsel — Mr. Oury was formerly a cofounder of DNA Electronics, which developed a sequencing technology that was commercialized by Ion Torrent, and later Life Technologies and ThermoFisher.
- Beyond the core team, Lab79 also has a relationship with the Flatiron Institute of the Simons Foundation, who have agreed to collaborate with us on the computational and machine learning aspects of our technology. Additionally, we have a collaboration and IP agreement with Prof. Tom Perkin's lab at JILA/CU Boulder. Prof. Perkins is an expert in single-molecule force measurements and associated instrumentation.