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Startups Take On Illumina in Race for Cheaper DNA Sequencing

As sequencing costs fall, applications widen across research, medical care

'We're in the early innings of decades of growth in genomics data,' said Ultima Genomics founder and CEO Gilad Almogy.

PHOTO: ULTIMA GENOMICS

By Brian Gormley

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Startups are challenging market leader Illumina Inc. in the race to lower the cost of DNA sequencing and expand use of the technology throughout research and medicine.

DNA sequencing lets scientists read the individual bases, or letters, of genetic code. It fuels biological research and the hunt for new medicines and diagnostics.

San Diego-based Illumina, whose market capitalization is over $33 billion, has dominated the sector by launching instruments that have whittled the cost of sequencing the complete set of genetic material in cells, the genome, to $600. Twenty years ago, that cost ran around $100 million.

Two well-funded startups aim to reduce costs further. Element Biosciences Inc., backed with more than $400 million in venture capital, says its instruments can sequence a

genome for $200; Ultima Genomics Inc. has secured more than $600 million to develop technology to cut the cost to $100.

Competing with Illumina, which is rolling out new, low-cost sequencing technology of its own, will be challenging for these startups, which have begun selling their systems to academic and commercial scientists.

Capturing even a small part of the sector would be significant for small companies, said Kyle Mikson, an analyst with investment bank Canaccord Genuity. He projects the global sequencing market to more than double to $110 billion by 2030 as falling costs enable wider use of the technology.

"If you were to look 10 years out, our estimate is that pretty much every person will undergo some test based on genetic sequencing, probably at least once a year," said Yair Schindel, co-founder and managing partner of aMoon Fund, an investor in Ultima.

The Human Genome Project, an international effort to sequence a human genome for the first time, ran from 1990 to 2003. Scientists used Sanger sequencing—developed in the 1970s by Nobel laureate Frederick Sanger —which uses fluorescent dyes to identify individual genetic letters.

Next-generation systems, including Illumina's, have scaled up DNA sequencing.

Instead of reading one fragment at a time, as in Sanger sequencing, next-generation sequencing enables DNA fragments to be sequenced en masse. Illumina's approach involves creating billions of clusters of DNA on a substrate, called a flow cell.
Illumina in 2010 released a machine enabling genome sequencing for about $10,000, said Alex Aravanis, Illumina's chief technology officer. Subsequent innovations dropped the cost to $1,000 in 2014, and to $600 in 2020. Illumina is rolling out a new instrument series, NovaSeq X, that reduces it to $200, he added.

Several advances enabled this new system, including improvements in chemistry, hardware and optics, according to Illumina.

As DNA sequencing costs have declined, venture capitalists have sought to capitalize on the growth of the industry.

DNA sequencing's use in prenatal and cancer testing has exploded in recent years as costs have declined, and the $200 genome will drive the technology into routine care, said Jim Tananbaum, chief executive of Element Biosciences investor Foresite Capital.

"We are all unique because we have a unique genetic code," Dr. Tananbaum said. "Reading that code enables individualization of care to be deliverable at scale."

Element, founded in 2017, and Ultima, launched in late 2016, operated quietly until recently as they developed systems they say have reimagined sequencing.

San Diego-based Element says its system reduces background light and makes it easier, and cheaper, to identify individual bases. The difference is like viewing stars at night, with no background light, versus trying to see them during the day, said co-founder and Chief Technology Officer Michael Previte.

Element flow cells also have a nonstick surface, so less dye sticks to them, which reduces background light, said co-founder and Chief Executive Molly He.

Ultima CEO Gilad Almogy founded the Newark, Calif.-based company to apply knowledge gained from a career in the semiconductor industry to an effort to lower the cost of DNA sequencing.

Instead of a typical flow cell, Ultima says it has created a 200-millimeter silicon disk that allows DNA to be packed densely across the wafer. Nozzles near the center of the wafer dispense chemicals needed for sequencing in a thin, uniform layer across the surface, according to Ultima.

The silicon wafer is low-cost and the system enables highly efficient use of reagents, which also lowers expenses, Dr. Almogy said, adding that Ultima has about a dozen initial customers and plans a full commercial launch later this year.

"We're in the early innings of decades of growth in genomics data," Dr. Almogy said.

Cheaper sequencing will have implications across biotechnology research, scientists said.

Omid Farokhzad, CEO of protein-analysis technology company Seer Inc., said increased use of genomic sequencing will encourage more research into the proteins genes code for. Barry Wark, co-founder and chief strategy officer of Ovation.io Inc., which provides genomic sequencing data to drugmakers, said researchers increasingly will use sequencing to discover treatments for complex conditions such as autoimmune, metabolic and neurological diseases.

Growing use of sequencing will push scientists to build better tools to deal with larger genomic data sets, said Adam Felsenfeld, program director in the division of genome sciences at the National Human Genome Research Institute.

Different instruments might be better in certain circumstances, said Tom Maniatis, CEO of the New York Genome Center, a nonprofit academic research institute, which uses Illumina sequencers and is working with Ultima technology.

"It's wonderful to see there's competition," Dr. Maniatis said.

New sequencing technologies will have to be easy to use and not present new hurdles if scientists are to adopt them, said Catharine Aquino, group leader of genomics analytics at the Functional Genomics Center Zurich, a joint research and training center of ETH Zurich and the University of Zurich.

"In the community, there is a lot of good will to give these new companies a chance," she said. If new technologies are clunky, "this good will will wear off very quickly."

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