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Who's who of genomics muses on industry's future

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By KATHERINE CONNOR, The Daily Transcript
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Comic-Con may have drawn bigger crowds, but for anyone with an interest in genomics, it's hard to imagine a more star-studded room than the meeting space at **Arris** in Sorrento Valley on Thursday night.

A CommNexus panel on accelerating the genomic revolution drew speakers from San Diego's — which also happen to be the world's — top companies: **Illumina, Thermo Fisher Scientific, Human Longevity, Sequenom, Edico Genome, AllSeq and Cypher Genomics.**

They might be biased, but the speakers all agreed that genomics, which has already experienced exponential growth, is primed to become one of the most important industries in the coming years, and San Diego could lead the charge. There are some large challenges still ahead though, not the least of which is the great amount of data produced by sequencing even a single genome.

“Ten years down the road, I have no idea how it's going to be,” said Michael Heltzen, chairman and CEO of AllSeq, an online marketplace similar to hotels.com that connects researchers with sequencing projects to providers.

“It blows my mind a lot of the things that happened — Sequenom as a company, if you had asked me four years ago I would probably have said ‘No way that's going to be doable’ ... but every two years we look back and it seems like a new generation.

With the introduction of Illumina's HiSeq X Ten sequencer in January, which is said to enable the sequencing of a genome for \$1,000, the reality of getting the data and machines to the public took a huge leap forward. Medical uses are typically top of mind, though the panelists laid out a wide array of both short- and long-term uses for the technology.

Alex Dickinson, senior vice president of strategic initiatives at Illumina (Nasdaq: ILMN), said he believes the area with both the most short- and long-term potential is cancer.

Being able to sequence the non-mutated DNA of an individual and compare it to the DNA contained in a tumor allows researchers to narrow down which parts of DNA are involved in the mutation, and consequentially better their understanding of the disease and possible treatments.

In addition to the population-level data this would give, it could also be used to learn about an individual's risk for a certain disease, and screen accordingly.

“For example, mammograms: They involve X-rays, so they're screening, but by X-raying also giving a certain number of those people cancer, so there's a tradeoff there,” Dickinson said. “What you really want to be doing is avoiding that screening test on some people altogether because they're low risk, and use more expensive technology like an MRI on people who are high risk.”

Another use of genomic data that may take longer to realize is the ability to detect cancer in the bloodstream. Dickinson explained that all humans have strands of cancerous DNA in their bloodstream, and whether this leads to mutated cells and tumors is a matter of the person's immune system.

“It's quite some distance away, but from a regular annual blood test, one could tell if one is susceptible to cancer, or might already have cancer,” Dickinson said. He predicted that cancer will be a manageable chronic disease in 10 years.

Sean Freeman, leader of corporate development with Thermo Fisher Scientific (NYSE: TMO), agreed that cancer is an area expected to benefit from genomics solutions, but said that as sequencing devices become cheaper and smaller, he foresees portable sequencing devices that can be used for tasks ranging from speeding up forensic DNA testing — which in many cases has a six-month lag, despite the quick return that TV shows like “CSI” portray — to the testing of animals in the field for food safety.

Using genome sequencers to unravel non-human DNA also has potential, with discovering more about the microbiome — the bacteria that make up our gut — at the forefront.

“An area where an acceleration in sequencing technology can be quite beneficial is on genomes that have a very short frequency, things like the microbiome, where our gut is full of certain microbes that, depending on the position of the microbes, you have a tendency to gain weight or lose weight,” said Mathias Ehrich, senior vice president of research and development at Sequenom (Nasdaq: SQNM).

“These kinds of tests, when we talk about long-term, might become really interesting ... and might be more consumer-driven.”

Pieter Van Rooyen, CEO of Edico Genome, predicted that in five or 10 years everyone will have a personal sequencing device, and said his company is working with **Qualcomm** (Nasdaq: QCOM) to make this consumer-oriented approach to sequencing a reality.

Part of the benefit of a personal device is it would cut down on the amount of infrastructure a company would need to process and store of the data generated from sequencing, which seems to be a contentious point in the industry.

Dickinson said that while sequencing one human genome results in over 200 gigabytes of data — read: a lot — only 1.5 gigabytes of those is actually the genome itself, since the sequencer also collects overhead data and extra data to ensure results are as accurate as possible.

And of the 1.5 gigabytes, a mere 100 kilobytes of data — read: a small amount — is what differentiates humans from each another, with only 0.1 percent of DNA varying from person to person.

Dickinson hinted that finding ways to sequence only the areas that are different may solve part of the data problem, although Felix Frueh, chief scientific officer at Human Longevity Inc. disagreed.

“I think the 100-kilobyte version, only looking at the differences, is not useful information because it changes very quickly,” Frueh said. “What we really need to do is pull information and potentially be able to put it into context of over time. ... That’s really the only way were going to be able to find correlations that you don’t know of quite yet.”

Regardless, both paths result in a large amount of data when dealing with millions, and potentially billions, of humans. In addition to questions of how to store and run such a large amount of data, there is still the question of what to do with it, which Ehrich said is equally as pressing.

“Obviously, managing all the data and having the data for knowledge generation is a huge technical challenge,” Ehrich said. “I think an additional challenge to that is information management — so we can put the genome on an iPad, that’s fine, but what do I do with that?” he said, highlighting the need for user experience and user interface experts within the genomics field.

Heltzen said another industrywide problem is the lack of standards in sequencing, which leads to different results, even from qualified sequencers.

“We send a task out in the marketplace and get five different responses, and it doesn’t come back with the different models and different methodologies that have been used,” Heltzen said. “As long as we are that ad hoc and get different results because they used different channels, the industry won’t really, really take off.”

Along with a lack of standard practices and procedures making cross-referencing work and results difficult, Heltzen said that with each advance in the technology and systems — which at this point is occurring about once a month — the algorithms to decode the DNA trip up with the new inputs, and manually correcting each error is not feasible.

Even with other challenges — including FDA regulation, protection of intellectual property regarding algorithms, and the ethical questions associated with genomic testing — the panelists were confident that this will become an even more important industry globally, and said San Diego is in a good spot — for now.

“I think the basis for a good part of the success here is a very strong understanding and workforce with experience in microbiology,” Dickinson said.

“I think one of the challenging parts of your question is what happens in the future? If there was a word cloud in the conversation today, it would be a giant ‘data.’ ... So much more of the work is becoming in bioinformatics. The last three companies that Illumina bought were all purchased up in the Bay Area, all informatics-based.

“We’re building a facility up there just so we can access a lot of the expertise in informatics in that area. ... So we’re very concerned about what happens with regard to informatics in the future.”