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Genetic Code Unlocking Future of Medicine, Craig Venter Says

Ron Zimmerman | March 10, 2014

LA JOLLA, California — Craig Venter, PhD, has a different vision for medicine, which he calls downloadable biology; it involves collecting genomic data in every patient's workup. And Dr. Venter hasn't been shy about putting his own and his investor's money on the line to prove he's right.

"What I'd like to do," Dr. Venter told *Medscape Medical News*, "is have your genome done as a starting point of medicine — equivalent to having a TBC and urinalysis done when you go to a hospital."

Dr. Venter made his vision known here at the Future of Genomic Medicine VII meeting. He said that knowing a patient's genetic code will lead to individualized treatments for cancer and better detection and identification of rare diseases that sometimes befuddle clinicians.

Most important, Dr. Venter said he believes this effort will extend the human lifespan. He's staking his personal reputation on that expectation. Last week, he announced the founding of Human Longevity Inc., a company that will launch a huge private genomic research project to sequence at least 40,000 human genomes each year using new technology.

"One genome is basically worthless, but don't tell my mother that," Dr. Venter laughed. "Without something to compare it with, you can't interpret it. A hundred doesn't get you much better. We need 500,000 to a million genomes."

With millions of genomes sequenced across various ethnic ancestries and myriad medical conditions, the genetic causes of many diseases will begin to emerge.

Dr. Venter's new San Diego–based company, which has $70 million in private funding, has purchased 2 of the latest Illumina HiSeq X Ten gene-sequencing machines and has options on 3 more. These machines have brought the cost of mapping a single patient's genome down to $1000 or less.

The company will target diseases most often related to aging, such as cancer, diabetes, obesity, heart, liver diseases, and dementia.

Eric Topol, MD, director of the Scripps Translational Science Institute in La Jolla, California, and editor-in-chief of *Medscape*, said that Dr. Venter's announcement is emblematic of the rapid acceleration of genomic medicine. "More and more primary care physicians are getting it," Dr. Topol said during an interview. "Patients are asking, 'Should I be sequenced? How do I get sequenced? How do I get my data? Will you help me interpret it?' Primary care doctors are hearing this for the first time."

Individualized Medicine

Dr. Venter has partnered with the University of California at San Diego to sequence the genomes and tumors of every cancer patient treated at the Moores Cancer Center.

Some suggest that cancer is a disease of the genome; studies have shown that it can be caused by different mutations that all contribute to a tumor's growth. Doctors now have tools to identify which pathways might respond to precision treatments that would block aberrant gene expression.

"We call it individualized medicine, which I think is a better term than personalized medicine," said Dr. Venter. "We're not going to make a drug that's specifically for you or for me, but our genomes will help predict from the drugs that are out there which one would be most suitable for whatever ailment we have. Every tumor is different and every patient is different, but there are commonalities in the therapies. It's out of knowing your genetic code, your own chemical mystery," that physicians will be able to select the best treatment for you, he explained.

"The main goal is getting everything on a solid information-driven basis, where we at least have the facts to work with," he said.

We can finally answer questions about nature vs nurture.

Dr. Venter said he believes that once he has a database that integrates phenotypes and medical conditions, "we can finally answer questions about nature vs nurture."

He also said he is certain that an individual's genome only tells part of the story. For so long, biologists have been measuring a patient in separate buckets of data, he noted. The interconnections between one's own genome and the complexities of blood chemistry and one's individual microbiome in one's gut and mouth have been ignored. His company plans to collect massive amounts of data on the various metabolites, biochemicals, metabolome, and lipids circulating in the body to create a better overall picture of the body's mechanisms for maintaining health.

"A lot of the chemicals that circulate in your bloodstream are from your bacterial genomes metabolizing your chemicals," Dr. Venter explained. "They're not just from what you ate or your own chemical repertoire; we need to understand how they interplay with all these variants. In the area of cancer, trying to understand it with just a single set of parameters will never be sufficient. We're going to import all the medical records from the University of California at San Diego and measure these parameters on as many individuals as we can. We're putting together a team to measure physiologic parameters that wouldn't be part of a normal workup. Once it is all digitized, it should be the ultimate database answering every question about what is nature and what is nurture."

Dr. Topol pointed out that Dr. Venter's company is launching into a crowded landscape. Half a dozen major public and private genome-sequencing projects have already been announced, such as the Geisinger and Regeneron partnership to do 100,000 genomes. And of course, China has the greatest number of sequencers in the world, which are currently at work attempting to sequence the basis of intelligence.

"My favorite tweet that came out after the announcement of my company said, Do you want the Chinese government or Craig Venter to own your genome?," Dr. Venter noted.

Some researchers at the conference asked whether the sequences will remain exclusively Dr. Venter's, because they are coming primarily from patients treated at a public hospital.

Do you want the Chinese government or Craig Venter to own your genome?

"That's a tricky question," said Heidi Rehm, PhD, from Harvard Medical School in Boston and the Clinical Genome Project. She is trying to bringing together large datasets so that genomic-sequence data are pooled and shared among researchers. "I understand that some projects will never happen if you wait for public funding — that supports the competition model — but you have to take a hard look and make sure you aren't stifling medical development by making it private," Dr. Rehm said. "That's the cooperation model, and you have to decide which one is going to get us where we're going faster."

Dr. Rehm suggested that Dr. Venter might be given a window of exclusivity before his data join the larger centralized database that she is assembling. "Leave it to the public to decide which model is best — because the data have to come from somewhere — and let patients decide if they want their data to only be included in a private database," she said. "This is really the big issue before us."

"We can't expect our government to do this," he added. "It's well beyond the realm of the National Institutes of Health, but government funding should be like venture-capital funding; it should be catalytic to get things going." This belongs in private industry, he argued. "The press loves these things to be races, but this is the race to change medicine."

Dr. Venter is founder and CEO of Human Lonegvity Inc. and Synthetic Genomics Inc. Dr. Topol has disclosed financial relationships with GAltheaDX, Biological Dynamics, Cypher Genomics, Dexcom, Genapsys, Gilead Sciences, Portola Pharmaceuticals, Quest Diagnostics, Sotera Wireless, Volcano, the Qualcomm Foundation, and the National Institutes of Health. Dr. Rehm has disclosed no relevant financial relationships.

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