UC Santa Cruz researcher leads cancer's digital revolution

By Patricia Waldron Santa Cruz Sentinel San Jose Mercury News
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SANTA CRUZ -- David Haussler wants to cure cancer. But he's not a medical doctor. He can't prescribe drugs or order an MRI. His only tools are his computer, his mind -- and a whole lot of data.

Haussler, a self-described "computer geek," is the director of the Center for Biomolecular Science and Engineering at UC Santa Cruz. He wants to amass the entire sequence of DNA, called a genome, from a million tumors. He hopes the resulting collection will reveal why cancerous cells begin their voracious growth -- and how best to stop them.

"That's what drives him forward: thinking of some cool new insight for how to interpret DNA information," said Josh Stuart, a computational systems biologist at UC Santa Cruz who works with Haussler to analyze the genomes.

Haussler, 60, runs the Cancer Genome Hub, which is housed at the San Diego Supercomputer Center. The free database holds all of the cancer genomes from several National Institutes of Health projects, including the Cancer Genome Atlas.

The perpetually Hawaiian-shirt-wearing Haussler is best known for his work on assembling the human genome in 2000 after one of his graduate students, Jim Kent, created software that assembled short segments of DNA into one cohesive genome. The updated sequence is available through the UCSC Genome Browser, which receives hits from 180,000 biomedical researchers each month.

When he started the cancer genome project four years ago, it was like "déjà vu," he said: Researchers had too much genetic information and needed huge computers to sort it out.

Haussler says cancer is such a complicated disease that it's impossible for the human mind to comprehend its deadly varieties. Multiple genes control how cells grow, and countless combinations of mutations can turn a cell cancerous. At the molecular level, each person's tumor is unique. With 1.2 million Americans being diagnosed with cancer each year, these mutations create "astronomical numbers of possibilities," he said.

"It's the marriage of computers and biotech that has the power really to start to unlock the complexity of cancer," Haussler said.

He envisions a day when cancer patients will routinely have their entire tumor genome sequenced. Doctors, Haussler said, can then develop personalized treatments, prescribing drugs or chemotherapy tailored to each tumor's mutations.

"I think cancer genomics is changing the world, and he's a big part of that," said Richard Gibbs, director of the Human Genome Sequencing Center at the Baylor College of Medicine in Houston. "Without his enterprise, we wouldn't have the permeation of genomics into the community and the usability that we enjoy now."

To reach his goal of collecting 1 million genomes, Haussler and seven colleagues co-founded the Global

Alliance, an international collaboration of major medical institutes. The alliance has more than 100 contributing members, but he's always on the lookout for more hospitals who will share their cancer genomes.

Haussler's characteristic envelope-pushing approach isn't confined to his research.

His colleague Stuart recalls a snorkeling trip with Haussler a year ago during a trip to the big island of Hawaii for a scientific conference. They swam out far from their hotel, beyond the safety buoy. When they finally turned back, swimming against the wind and the waves, Stuart said, they almost didn't make it back to shore.

"He's just one of these fearless guys who just takes you way out there," Stuart said.

Haussler did not set out to work with biological systems. As a youngster, he tried painting, but admits he wasn't very good at it. He grew up in Los Angeles, but worked in his family's organic orchard in Paso Robles, tending 79 varieties of fruits and nuts. He studied psychology, philosophy and math before turning his talents to logic and computers.

After completing his doctorate in computer science at the University of Colorado in Boulder, he became interested in artificial intelligence and designing machines that could recognize speech and images. When biologists started to generate large amounts of genetic information in the 1990s, he developed a digital method to recognize genes within the sequence data.

Next on Haussler's agenda is to create a genomics institute to accelerate research into cancer and other human genetic diseases. UC Santa Cruz can act "like Switzerland," he said, to broker the sharing of data between medical schools and cancer hospitals that might otherwise be rivals.

He also wants to team with Silicon Valley computer scientists to create nonprofit groups and private companies -- both to develop new ways of analyzing genome data and to solicit donations for the institute.

"Silicon Valley is really into Big Data, and the cancer genomics issue is a Big Data issue," said George Blumenthal, UC Santa Cruz's chancellor. "It's going to have social implication far beyond the computer sciences."

Funding for the institute, which would initially require at least $50 million, may come from UC Santa Cruz's latest capital campaign, which was announced in October, Blumenthal said.

The chancellor met Haussler 23 years ago, back "before either one of us was known to anybody," Blumenthal said. They struck up a friendship after their families met in the park.

"He is very much a part of the community -- you can see him biking up the bike path every day," Blumenthal said.

Haussler and his wife, Lu, who have lived in Santa Cruz since 1986, are deeply involved in town-gown events. The Santa Cruz Chamber of Commerce recently named him Man of the Year.

"I've been recruited at many places -- and I won't leave Santa Cruz," Haussler said. "Here I get to look at the Monterey Bay out my window every day and think about great, challenging things."