PROFILES

Rising Star: André Fenton, playful problem-solver

BY **CHARLES Q. CHOI**

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On the Fourth of July in Woods Hole, Massachusetts, you might find **André Fenton** dressed up as a neuron, surrounded by students pretending to be calcium ions and electrical signals. You might also find him quietly pondering the meaning of 'reality.'

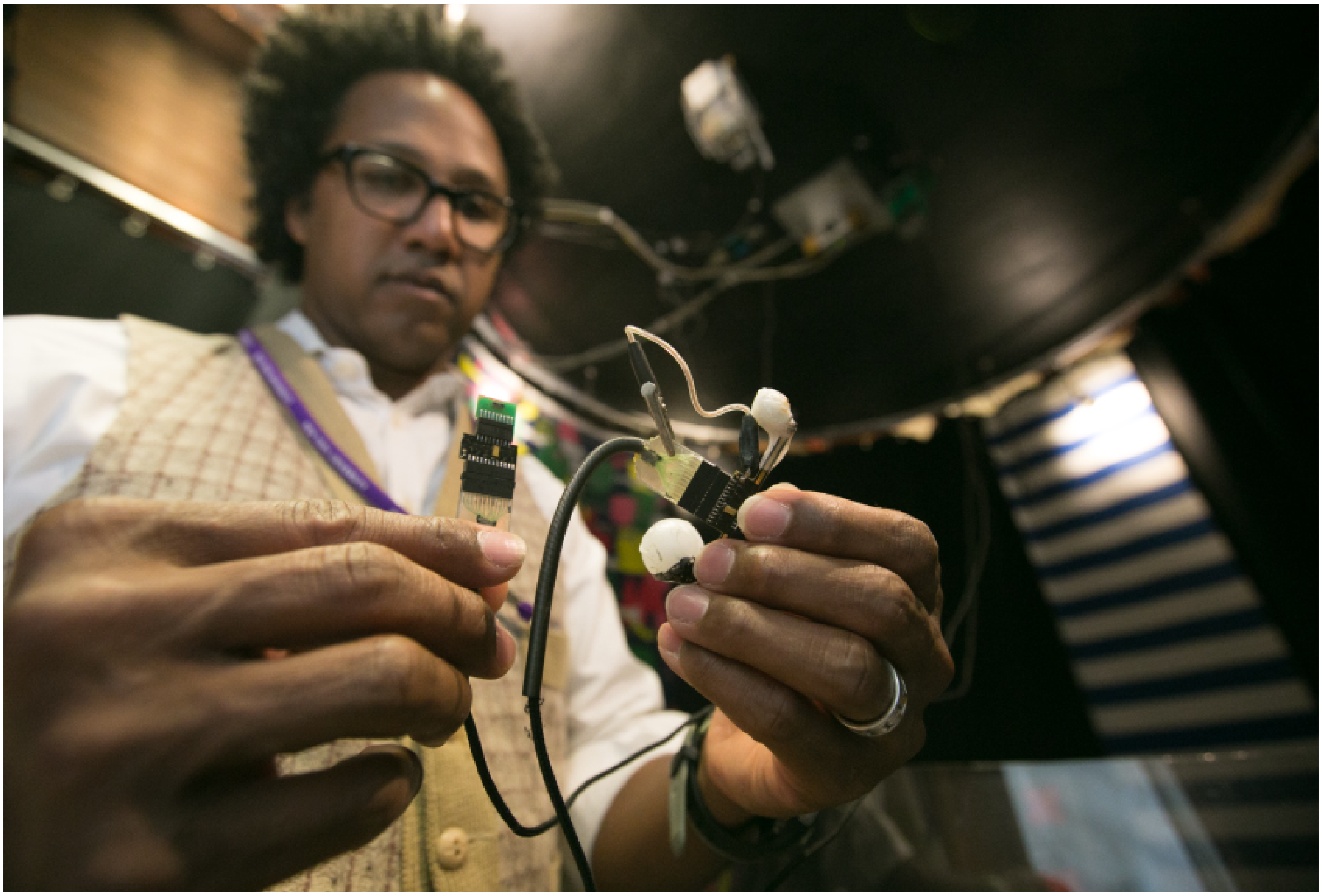
Fenton, professor of neural science at New York University (NYU), is equal parts fun and philosophical. At the Marine Biological Laboratory in Woods Hole, where he co-directs an eight-week course on the neural basis of behavior, he mixes deep discussions of the mind with water-balloon fights.

“He really gets into it, and has really good aim, too,” says **Hans Hofmann**, professor of integrative biology at the University of Texas at Austin, who co-directs the course with Fenton. “I think that tells you that whatever he does, he does with a passion and a vengeance. And he also has a very strategic mind.”

Fenton funnels this passion and planning into his research. At NYU, he is teasing out the role of the brain’s memory center, called the hippocampus, in autism. He has helped design experimental tasks that scientists worldwide use to investigate memory. In 2006, *Science* magazine heralded a discovery that he and his colleagues had made about long-term memories as one of that year’s biggest breakthroughs.

“He's really at the forefront of research into how patterns of firings of neurons encode different types of memories — why we remember this and not that, and how memories can get confused and mixed up,” says his long-time collaborator, **Todd Sacktor**, professor of physiology, pharmacology and neurology at the State University of New York (SUNY) Downstate in Brooklyn.

Fenton is now exploring how the behavior of neurons in the hippocampus might be different in autism. With a focus on this memory center, he is trying to better understand why the brain of a person with autism may be less capable of adapting to changing circumstances, with an eye toward making it more flexible.



Brain analyst: Fenton holds sensors that can measure tiny electrical signals from the brains of free-moving rodents.

Images of how memory and the brain work surround Fenton as he tries to answer such questions. In Fenton's lab stands a 15-foot-long table topped with a half-ton slab of glass. Embedded in the glass is an orange, black and white image — a fragmented cityscape meant to resemble a memory.

Versed in versatility:

Fenton was born in Guyana in 1967. His family moved to Toronto when he was 7 after his mother got a job with IBM, so he learned at an early age to go with the flow.

“The kids in Toronto were nice, but none played anything I knew how to play; nobody knew how to play cricket,” Fenton says. “So I learned to play hockey and ice-skate.”

Fenton's adaptability has carried him through an eclectic career, from neuroscientist to inventor to entrepreneur, says **Clifford Kentros**, professor of medicine at the Norwegian University of Science and Technology, who worked with Fenton at SUNY Downstate. Fenton developed tiny devices that wirelessly record brain data from rodents. A start-up Fenton helped form, **BioSignal Group**, advanced this concept by miniaturizing electroencephalography (EEG) machines to measure brain activity in people. In 2012, the U.S. Food and Drug Administration approved the device, called the MicroEEG, which Fenton says could one day help doctors routinely check the brain function of people in hospitals.

"[Fenton] has reinvented himself again and again, moving into new fields with ease," Kentros says. "And each time he's remade himself, he brings something from other fields he knows."

> "Whatever he does, he does with a passion and a vengeance."

Fenton's first field of choice was literature. In high school, he gravitated toward novelists such as Albert Camus and Joseph Conrad, who celebrated what he calls "lives of the mind." Fenton recalls, "I was obsessed with the nature of reality and how we understand the world."

He planned to major in English at McGill University in Montréal, but happened to take a biology course. He rarely attended that early-morning class during the cold winter term, but made it to one lecture on a paper titled "What the Frog's Eye Tells the Frog's Brain."

The landmark paper, by the late cognitive scientist **Jerome Lettvin**, revealed that frogs are limited in what they see because of how their eyes communicate with their brains. For instance, frogs can easily detect dark moving dots, such as flies, but cannot see dark, still objects.

When he heard that, Fenton realized that reality is simply a construct of the brain. "It just blew my mind," he says.

Shocking discovery:

Fenton quickly swapped English for biology, focusing on the neurobiology of crickets for his senior thesis. After graduating in 1990, he took a job as a research assistant at the Institute of Physiology in Prague in the Czech Republic, in the lab of the late neuroscientist Jan Bures. There, he became enchanted by the hippocampus, which he considers "one of the most philosophical brain regions."

Beyond its role in memory and learning, the hippocampus also helps people to navigate their surroundings. Famed philosopher Immanuel Kant speculated that space and time are concepts that a person understands innately, not through experience.

"The fact that brain cells knew something about space, when space might not even exist, was very interesting to me," Fenton says.

In Bures' lab, Fenton invented the rotating arena — a large spinning platform designed to study how long rats can keep track of where they are. Neuroscientists worldwide use the device for experiments on memory.

In 1992, Fenton pursued a Ph.D. at SUNY Downstate. There, he studied 'place field neurons,' which are crucial for remembering locations. He discovered, for example, that these cells operate as part of a cohesive network, and that cognitive factors such as attention can influence their firing patterns in ways that can explain their variability.

After receiving his degree, he collaborated with Sacktor to investigate molecules that help the brain store long-term memories. Using the rotating arena, the researchers discovered that blocking a certain enzyme makes rats forget where the shock zone is. *Science* heralded this finding as **1 of 10 breakthroughs of 2006**. The enzyme, PKM-zeta, was the first molecule linked directly to storage of long-term memories.

"There's no question that was the right behavioral task to use for the cleanest and most beautiful result that was also easy and fast," says Sacktor. "Whenever I tie myself up into knots and can't figure out a problem, I just talk to André, and he solves it quickly."

Keeping calm:

Fenton's calm demeanor and problem-solving skills come in handy outside the lab, too. On a kayaking trip in 1997, in the Channel Islands off the coast of Los Angeles, a rising tide trapped him and Kentros in a sea cave.

"We noticed that the high-tide line in the caves was well over our heads," says Kentros. "André thought rationally that as the tide came in, it'd get scarier, but also easier to paddle out, and that was indeed the case."

Lab leader: Fenton and graduate student Ain Chung talk about what genes do in the brain during learning

Fenton’s disposition has helped him in his career, too. “I feel I'm pretty easygoing when there are challenges, because they're not that scary in the end,” he says.

On the wall of his office at NYU, where he arrived in 2008, is a large piece of art that represents a view of the brain through the eye — an image that evokes the frog’s-eye lecture that inspired his foray into neuroscience.

With a lab of about 10 people, Fenton has a number of ongoing projects. For example, the team is investigating whether neural activity in the hippocampus is slower to organize into patterns that represent a memory in mouse models of autism than it is in control mice. They are also exploring whether they can make the brains of these mice more adaptable, either by stimulating their brains electrically or by manipulating certain genetic pathways in neurons.

Fenton says he hopes to change the way scientists study memory — paving the way for them to look at neurons directly rather than just at behavior. “Mostly we observe a behavior, such as a rat avoiding an area, and infer from that behavior that the animal has a memory it is recalling,” he says. “I'd like to take memory research away from such indirect measures to actually looking at what the brain is doing when it is remembering.”

This research continues the interest in the inner life of the mind that first brought Fenton to neuroscience.

"How many thoughts do we enjoy that involve very little in the way of behavior?" Fenton asks. "We may sit in a chair with wonderful thoughts and magnificent ideas, and no outside observer will recognize that. Most of my thoughts, my contributions to the world, are like that — unrecognizable by explicit behavior."