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Changing Disciplines: a Postdoc Switches to Studies of How the Brain Uses Moving Images

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By COURTNEY LEATHERMAN

It would have been natural for David Bradley to go into diabetes research. That was the subject of his dissertation and of a dozen papers and abstracts he produced during six years as a doctoral student in physiology and biophysics at the University of Southern California.

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But Mr. Bradley rarely takes the predictable path. Instead, he chose to study the brain. Inspired by journal articles on computational neuroscience, Mr. Bradley switched gears five years ago, just at the time he was looking for a postdoctoral fellowship.

"I like computers and math and statistics, and that's linked in with a fascination with the brain, because it's basically a computer," he says. "I just realized that's what blows my skirt up -- and I'd never felt the faintest genuine interest for molecular biology."

Changing fields as a postdoc -- essentially, starting from scratch -- was not only unorthodox, but also a big gamble.

It paid off. During his more than four years as a postdoctoral fellow under Richard A. Andersen at the Massachusetts Institute of Technology and at the California Institute of Technology, Mr. Bradley broke new ground in the area of visual motion

perception. He studied how our brains use the movements we see to understand things around us.

As a postdoctoral fellow in brain research, Mr. Bradley was the lead author of two papers published by the journal Nature, one published by Science, and a fourth, which is now under revision for The Journal of Neuroscience.

"That matches the output of our entire department over 10 years," says Howard Nusbaum, chairman of the psychology department at the University of Chicago, where Mr. Bradley became an assistant professor last month.

Mr. Bradley was among 400 applicants for five new positions at Chicago, which is planning a new biopsychology building, says Mr. Nusbaum. The postdoc "rose right to the top of the applicant field" because of the nature of his work, and also because he had so successfully changed course.

"The University of Chicago looks at interdisciplinary people as very valuable," says Mr. Nusbaum. "People who change disciplines and synthesize approaches and become hot are people we look at."

Mr. Bradley, who is 37, is used to changing directions. He earned his undergraduate degree in chemistry from the University of California at Davis in 1984. A year later, he moved to France

with his wife, Sylvie, to study medicine at the Universite de Montpelier. His father was a physician, which factored into his own career goals, and his wife was French, which factored into his relocation.

But after two years at Montpelier, Mr. Bradley decided that he wanted to go into basic research, not medical research. So he and his wife moved back to California, and he went to southern California to work with Richard Bergman, who he had heard was building mathematical models of sugar metabolism. "I thought that was wild -- that you could emulate what the body is doing with math," says Mr. Bradley.

He credits Mr. Bergman with teaching him how to be a scientist. "While I was studying diabetes, I was mainly learning to think as a scientist thinks," he says. "I was just too young and too green to decide what kind of science I wanted to go into."

But then he read those journal articles, he says, and "I realized that computational brain research is like the stuff I was doing, but squared."

Much of his research is conceptual, he says. "You have to work very hard to come up with the concepts before figuring out what experiments to do. You have to say, What does the brain do, and how does it do it?"

"What I like about neuroscience is the intrigue."

M.I.T.'s Mr. Andersen found him intriguing

enough to take a shot on a postdoc with no experience in neuroscience. Once again, Mr. Bradley packed up -- this time with his wife and two young sons -- and moved to Cambridge. When his mentor moved to Caltech, Mr. Bradley went along. "He's quite remarkable," says Mr. Andersen. "He was an unusually productive postdoctoral fellow."

To understand Mr. Bradley's research, it helps to picture the eye as nothing more than a pinhole camera, he says. Light makes a flat image on the retina. But movement in the image gives our brains clues about the three-dimensional shapes of things as well as where we are ourselves, and where we're going. Mr. Bradley wants to understand not only how we perceive motion, but also how that information is used in the brain.

One of the projects he worked on with Mr. Andersen involved "heading perception." Think about driving in a car: As you move forward, the image on the retina expands, radiating from a central focus, with objects appearing to get bigger as you get closer. The focus is the direction you're heading. But what happens when you turn your head to read a street sign, and the image on the retina -- and the focus -- changes? Somehow, your brain compensates for the eye movement, and you're able to continue driving down the road instead of veering off toward the new focus. Your brain maintains its heading perception.

"We tried to figure out which neurons in the brain

pull off the trick of compensating for the displacement of focus," says Mr. Bradley.

To conduct experiments, he used monkeys, implanting micro-electrodes into a tiny cortical area of their brain. The monkeys were trained to watch a display of an expanding pattern of dots (similar to computer screensavers of a field of stars coming at the viewer) that triggers the heading perception. All the while, Mr. Bradley measured the firing of neurons in the monkeys' brains, to try to understand what turned them on and off.

His work drew attention from lots of people. He was invited to interview for jobs at 12 institutions, and got offers from Chicago and the University of Wisconsin at Madison.

Perception itself will be the subject of Mr. Bradley's scholarly research at the University of Chicago. He plans more work with monkeys in his own lab, to find out what perception is and where it occurs in the brain.

"How does a neuron tell you anything?" he wonders.

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