



Tanya Keenan

**Enhancing our understanding of psychiatric disorders**

This is the first in a series of Pitt Chronicle articles profiling outstanding University of Pittsburgh undergraduate researchers.

August 23, 2006 Issue

By Bruce Steele

Static-static-static...

Pop!

Static-static-static-static, static...

Pop!

Leaning forward in her chair, focusing intently on the task before her, Tanya Keenan ever-so-gently turns a control wheel with her hand, glancing repeatedly at a little electronic display screen to her right. She pauses each time a pop! interrupts the static coming out of an audio speaker connected to the screen.

A nonscientist seeing and hearing Keenan at work in the laboratory of Anthony A. Grace—a Pitt professor of neuroscience, psychiatry, and psychology—might think she is fiddling with the dial of an AM radio while keeping an eye on a small-screen TV.

So much for nonscientists and their cheesy analogies. In truth, Keenan's hand is controlling a sophisticated hydraulic microdrive that can move an electrode up and down by 10ths, 100ths, even 1,000ths of a millimeter. Keenan is monitoring the activity of neurons in the basolateral amygdala (BLA) area of a rat's brain. The screen to Keenan's right is an oscilloscope; it pops and displays flashes of light whenever the probing electrode comes across actively firing BLA neurons. A computer automatically records the voltage changes those neurons produce when they fire off their signals.

In rats as in humans, the BLA is involved in regulating emotions, Keenan explains. It tells the body's autonomic nervous system when to be afraid, relaxed, happy, sad, and so forth. But in healthy brains, the prefrontal cortex has the power to overrule the BLA. For example, when the BLA gets a message that a dog—any dog—is barking within earshot, it may signal: Flee or fight! But if the prefrontal cortex also receives stimuli indicating that the barking dog in question is harmless, it ought to tell the BLA in return: Chill out! No reason to fear this dog!

"Unfortunately, in people suffering from certain psychological disorders like schizophrenia and depression, the prefrontal cortex isn't doing its job," says Keenan. As a result, such people may respond emotionally—often, inappropriately so—to all sorts of stimuli and situations that a



Tanya Keenan, a junior majoring in neuro-science, and Anthony Grace, professor of neuroscience, psychiatry, and psychology.

healthy-brained person would ignore or not even consciously notice.

Exactly how the prefrontal cortex regulates the BLA is unclear. Keenan is recording the activity of BLA neurons in order to learn more about that process. Running such experiments would be an appropriately responsible assignment for any of the graduate students or postdoctoral fellows in Grace's lab, where the goals include gaining a better understanding of the role of neural circuitry in such psychiatric disorders as schizophrenia, addiction, and depression.

But Keenan isn't a grad student or a postdoc. She's a 20-year-old undergraduate, a neuroscience major in Pitt's School of Arts and Sciences and a University Honors College Chancellor's Scholarship recipient who is beginning her junior year at Pitt this fall.

"Tanya is bright, she's capable, and she learns incredibly fast," says Grace, a proud grin stretching his mustache across his face. "She came to my lab very highly recommended by several faculty members, and she's been doing brilliantly. She literally wins every award she applies for"—including a Barry M. Goldwater Scholarship, one of two awarded to Pitt undergrads in 2006. (Pitt students have won 35 Goldwaters since Congress established the award two decades ago to encourage outstanding students to pursue careers in mathematics, the natural sciences, and engineering. It is the country's premier undergraduate award of its type in those fields.)

Hank Jedema, a postdoc who has supervised most of Keenan's day-to-day training in Grace's lab, observes: "When you teach a class, you always see some students who are interested in the subject you're teaching and other students who are not so interested. Tanya is an extreme example of a student who very clearly wants to be here and learn as much as she can about neuroscience and research techniques. A student like that is going to grow tremendously fast in terms of her scientific knowledge and ability, and that process is fun to watch.

"Tanya has been working with me for about a year and a half," continues Jedema. "She has grown from just being somebody who runs through experiments under my supervision to somebody who can design her own research project and execute experiments on her own. Sure, I'll still check on how things are going, but if I were not here today, she would be able to run a whole experiment from A to Z."

Throughout the 2006-07 academic year, Keenan will be participating in the National Institute of Mental Health (NIMH) Undergraduate Fellowship Program in Mental Health Research. The NIMH-supported program gives selected Pitt and Carnegie Mellon University students opportunities to conduct supervised research and participate in clinical and educational activities. One of the program's long-term goals is to recruit and train future scientists—especially women and members of under-represented racial and ethnic groups—for careers in the mental health professions.

Participating in the program is consistent with Keenan's own long-term goals of earning her M.D. and Ph.D. degrees and then working as a neuroscientist at a major research institution, both as an investigator and an active player in the global scientific community. (International health policy and politics are among Keenan's other academic interests. This past summer, she spent four weeks traveling and studying in the People's Republic of China, mainly in Tibet, through the Pitt-in-China program.)

"Growing up, I always thought of myself as a 'science person,'" says Keenan, a willowy, poised young woman whose brown eyes light up when she talks about her studies and career plans. "My parents both work in the pharmaceutical business—my dad is an organic chemist, my mom's in the development side, making sure that new drugs meet FDA regulations. I used to love Take Your Child to Work Days, when I'd get to visit where they worked. I remember things like my dad pouring a chemical solution in a beaker so I could watch it foam up."

Keenan chose to attend Pitt over a number of elite private universities after being offered a Chancellor's Scholarship here and, more importantly, after touring the Pittsburgh campus. A native of Phoenixville, Pa., near Philadelphia, Keenan says she had no particular expectations about Pitt or Pittsburgh.

"When I visited, I found I liked Pittsburgh as a big city that's more manageable than a really big city like Philadelphia or New York," Keenan recalls. "But the main thing was that people I met

here, like [Honors College Dean G. Alec] 'Doc' Stewart, were so interesting and so ready to help me, and there seemed to be so many opportunities here to do research as an undergraduate. I knew that if I came here, I could do lab research or pretty much whatever else I dreamed of doing, without having to wait until I was in grad school."

It wasn't until the spring of her freshman year at Pitt that Keenan considered majoring in neuroscience. "That's when I took a very inspiring course, Introduction to Neuroscience, taught by Ed Stricker," University Professor of Neuroscience and former chair of the neuroscience department, she says.

"Neuroscience combines a bunch of different fields. Chemistry plays a huge part, for example," Keenan points out. "Even today, there's so much about the brain that we don't know, and I'm really excited by the possibility of someday contributing to further exploration of the brain's chemistry and circuitry. In addition, I've had some friends who have gotten through depression, and helping to find a new drug to treat disorders like that would be really rewarding for me."

After taking Stricker's Intro to Neuroscience course, Keenan searched the Pitt neuroscience department's Web site for research projects in which she might be able to participate. "I found Dr. Grace's site, and his work seemed very interesting, so I e-mailed him," she remembers.

With recommendations from Keenan's professors, Grace took her on in his lab. Their collaboration has been mutually rewarding, Grace says.

"Postdocs and grad students do have more experience [than undergrads], but everybody in this lab is basically treated as an equal, from myself down through our undergraduates and technicians," he emphasizes. "We all get together at lab meetings to talk about the different projects we're doing, and information from one project feeds into other ones."

"Pitt's neuroscience department is among the best in the world, and we have some very bright undergraduates who are every bit as talented as the graduate students you see at a lot of other universities. Actually, it would be easy for me to feel a little jealous," Grace adds, glancing at Keenan with a wry smile, "because Tanya has opportunities that I didn't have when I was an undergraduate—for example, presenting her work at an international meeting and discussing it, one-on-one, with top-level neuroscientists."

"He's talking about the Society for Neuroscience meeting in October," Keenan interjects. "It's a very big thing for me."

During a poster session to be held at the society's annual meeting in Atlanta, Keenan is scheduled to present an abstract about her BLA research. More than 30,000 scientists from around the world are expected to attend the meeting. Some 18,000 research abstracts will be presented, the vast majority by faculty members, postdocs, and graduate students.

A few other Pitt neuroscience undergraduates have presented abstracts during major scientific meetings, according to Grace, "but it's still very rare for undergraduates from any university to be doing that."

During the Society for Neuroscience meeting poster session, any attendee, conceivably even a Nobel laureate, will have the opportunity to question Keenan about her Pitt lab experiments.

"It's kind of intimidating to think that some of the biggest names in neuroscience could come up and drill me about my research, scientists who know so much more than I do," she says, with an exaggerated shudder, "but it's exciting at the same time."

"The way Tanya presents herself," says Grace, "nobody will guess that she's an undergraduate."