

NEUROSCIENTIST ANN GRAYBIEL | MEETING THE MINDS

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## Her goal: Unlock the secrets of habits

By Keith O'Brien, Globe Correspondent | November 21, 2005

Ann Graybiel won't talk about her own bad habits. But people are always talking to her about theirs: their smoking, or coffee drinking, or the way they goof off instead of doing work.

Graybiel, 63, listens to their stories. She nods. She laughs. She's interested in habits, good and bad -- why Handel had the self-discipline to write the "Messiah" in three weeks and someone else can't muster the energy to even practice chopsticks on the piano.

Graybiel, a neuroscientist at the McGovern Institute for Brain Research at MIT, believes the choices we make about habits are intertwined, controlled by clusters of nerve cells deep inside the brain called the basal ganglia. Her work studying these clusters has earned her high praise. She has made a habit out of winning awards.

But as her lab's most recent studies show, Graybiel's work is far from done. The question she now wants to answer is how the brain can suppress a habit -- something anyone who has ever quit smoking knows all about, and something her new research shows is rooted in the basal ganglia. Now, she and others just have to figure out how to control that power.

Bad habits, beware.

"Wouldn't you love to know the secret for how to suppress [bad habits]?" she said. "Wouldn't you love to be able to pickle it and sell it?"

The latest research, published by Graybiel's lab in the journal *Nature* last month, focused on the brain patterns of rats as they navigated a T-shaped maze in search of chocolate.

Early on, as the rats struggled to find the chocolate, their neurons were active at all times. But as they learned, the neurons began to form a pattern, recording the habit deep inside the brain. Certain neurons that had once fired throughout the task, fell silent. The brain was on autopilot, Graybiel explained. The habit had formed. The patterns were crisp.

It was like the neurons were saying to each other, "We need to do this thing right," Graybiel said. But what proved most interesting was the way the patterns disappeared after researchers removed the chocolate and then reappeared later after returning the chocolate to the maze.

That told researchers two things: habits are very deep-seated, and we may also have a natural way of suppressing them, though our memory for them is strong. "This stuff gets ingrained in us so deeply," she said. And yet, Graybiel added, her study showed that people may also have the hardwired ability to forget.

"The brain is endlessly interesting," she said. "It controls our behavior and we have some very interesting behaviors. Some are pretty ordinary. Some are extraordinary. Some of them are bizarre, and this one brain controls it all."

Graybiel has long been interested in the brain. Science is in her genes. Her father, Ashton Graybiel, a cardiologist, made a name for himself studying the effects of weightlessness on the body, which helped prepare America's astronauts for manned space flight. Although she has now made a name of her own, Graybiel still likes to be

involved in the day-to-day work.

"She wants to know everything about what's going on," said Yasuo Kubota, a research scientist who works in Graybiel's lab. "She wants to be part of the group all of the time."

She hovers over the rats and the screwdrivers labeled "rodent behavior." She mentors graduate students like Terra Barnes, one of the author's on the Nature paper, and often finds herself wondering what her own basal ganglia are up to.

For her, it's not just about habits. The basal ganglia, she said, are like gates, controlling the flow of information and decisions, and problems with these gates have been linked to Parkinson's disease, Huntington's disease, obsessive-compulsive disorder and other psychiatric issues. If she can figure out how they work, then scientists might better understand what makes them fail. That, she said, is the ultimate goal.

Meanwhile, in a lab room at her MIT office, noise like radio static punctuates the silence, as a rat tries to locate a piece of chocolate.

"All these sounds are brain activity," she said.

## **FACT SHEET**

**Home:** Born in Boston, raised in Pensacola, Fla., and now living in Lincoln.

**Family:** Married to James Lackner, director of the Ashton Graybiel Spatial Orientation Laboratory in Waltham. That lab was named for Ann Graybiel's father, a cardiologist at Massachusetts General Hospital. The couple met while pursuing their PhDs at MIT.

**Education:** Earned a bachelor's degree in biology from Harvard University in 1964, did a two-year biology fellowship at Tufts University, and then earned a doctorate in psychology and brain science from the Massachusetts Institute of Technology in 1971. She became a professor there two years later and, as she says these days, "I just haven't left."

**Award-winning:** Graybiel won the National Medal of Science, the nation's greatest science honor, in 2001

and received MIT's James R. Killian Faculty Achievement Award in 2002.

**Nuts and bolts:** While other people were studying the major highways in the brain, Graybiel said she was

always drawn to the "byroads," the nuts and bolts of brain activity, hoping to understand volition, will, and why people move or don't move.

**Her science:** Graybiel studies the basal ganglia, clusters of nerve cells deep inside the brain, to better understand how people move, learn and think. She's especially interested in how people make and break habits and how certain diseases, like Parkinson's, develop. "I'm interested in it because it's fascinating, glorious, mysterious, and it's terribly important for human health." ■