

The Baroness and the Brain

Best known for her popular writing, neuroscientist Susan Greenfield has launched a new center at Oxford to investigate consciousness

OXFORD, U.K.—Chatting amicably around a long oval table sit a couple of dozen researchers interested in how the brain works. This is the first gathering of the Oxford Centre for the Science of Mind, an ambitious project involving people with a diverse set of skills and interests. Today's first order of business is to choose a keynote speaker for a conference on consciousness next year. All eyes turn to a commandingly tall woman with leonine features, Director Susan Greenfield, as she throws out a suggestion: "How about the Dalai Lama?" There are chuckles around the room, but it soon becomes clear that Greenfield is serious—and that she could probably make it happen.

A neuroscientist at Oxford University for 30 years, a politician, and celebrity, Greenfield rose through the academic ranks like a bottle rocket, but she didn't stop there. Over the past decade, she has become a household name in the United Kingdom, the author of 10 popular science books, the host of a TV series about the brain, and the first woman director of London's Royal Institution, a 200-year-old venue for the public

understanding of science. Along the way, she has been tapped as a scientific adviser by both the U.K. and Australian governments. In 2001, she became a lifetime member of the U.K. House of Lords with real decision-making power.

"She has been immensely energetic and effective," says Martin Rees, an astrophysicist and Master of Trinity College at the University of Cambridge, U.K., "expounding and debating scientific ideas and issues to a wider range of audiences than most scientists ever reach." But critics say Greenfield's ascendancy has been fueled by self-promotion rather than published research. They grumble that she appears to have left real science behind without delivering on the promise of her early ideas.

Science rock star

When it comes to the media, most scientists are shy creatures, preferring the snail's pace of peer-reviewed journals to the glamour—or terror—of a 30-second TV interview. Not Greenfield. She comes alive in the spotlight. "I get a terrific kick out of engaging with the public," she says. "As an academic,

you just sit there with all the ideas and have very little influence, ... but I'd rather see my ideas translate to policy that makes a difference in people's lives."

Greenfield's early career gave no clue that the neuroscientist, now 55, would become "the 14th most powerful woman in the U.K." and one of "the 300 most influential people in the world," as two British newspapers have ranked her. Her research has centered on a workhorse molecule of the nervous system called acetylcholinesterase (AChE).

"She first made a name for herself with a very bold idea about AChE," says Hermona Soreq, a neuroscientist at the Hebrew University in Jerusalem, Israel; namely, that the enzyme might be a link between several neurodegenerative diseases—Alzheimer's, Parkinson's, and possibly also motoneuron disease—"but not as an enzyme." Whereas an enzyme's job is to catalyze a chemical reaction—AChE splits the neurotransmitter acetylcholine into choline and acetic acid—Greenfield proposes that AChE does more: It may also interact with proteins to stimulate neuron growth during development, and this pathway may become deranged in the adult brain, she believes, leading to neuronal death and other symptoms shared by neurodegenerative diseases. "If her idea turns out to be true, it would be an amazing breakthrough," says Jean Massoulie, a neuroscientist at the National Center for Scientific Research in Paris, France. But, he adds, "in my view, it is still not proven that AChE even has nonenzymatic roles."

Everything changed for Greenfield in 1994 when she was invited to give the annual Royal Institution (RI) Christmas lecture on television, the first woman to do so. Soon after that lively presentation on brain function, she says, "one thing just led to another." She began writing regular columns for newspapers, weighing in on hot topics such as whether marijuana should be legalized—Greenfield believes not—and producing popular books about the brain. Greenfield became a familiar face on television. She even appeared in the U.K. tabloid magazine *Hello!*

In 1998, Greenfield was tapped to be director of the RI—again, the first woman so honored—running Britain's oldest institute for showcasing science. In 2001, a committee of U.K. politicians appointed her a member for life of the House of Lords as part of an effort to include nonpolitical experts in the legislative branch. Now known as the Baroness of Otmoor in the County of Oxfordshire, Greenfield can vote on laws, although she says her "most important contribution there is to take part in debates."



Big agenda. Dubbed Britain's "14th most powerful woman" by the press, Susan Greenfield is a skilled attention getter—here in an appeal for new high-tech ventures.

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But Greenfield is interested in more than talk; she wants to put ideas into action. One of her initiatives, called the Science Media Center, offers briefings for journalists on scientific issues and rallies researchers willing to be interviewed on short notice. “It makes a tremendous difference,” says David King, a chemist at the University of Cambridge and the U.K. government’s chief science adviser, particularly with fast-breaking news, such as the current threat of an avian influenza pandemic, in which disinformation can cause panic.

Greenfield is now working on a plan to establish a Science Peace Corps in the United Kingdom modeled on the U.S. Peace Corps. Scientists would spend a year or two in the developing world, broadening their horizons while sharing their expertise.

Meanwhile, Greenfield, who is single, says she still maintains a research laboratory at Oxford, when she isn’t flying around the world to collect honorary degrees—28 so far—or achievement awards. Her day begins at 5 a.m., but still, she says, “life is too short.”

At odds with her peers

Widely admired by the public, Greenfield nevertheless gets mixed reviews from her scientific peers. Although she has become one of the United Kingdom’s high profile “science ambassadors,” says King, she has taken an unusual path. “A good comparison,” he says, “is Lord [Robert] May,” an Oxford biologist who was also appointed to the House of Lords in 2001. “Everyone considers him to be one of the most important epidemiologists in the world, but when people are asked about Susan’s background, they falter.”

Greenfield’s new venture into the field of consciousness research is raising more hackles. Her Oxford Centre for the Science of Mind (OXCSOM) has received \$2 million in start-up funding from the U.S.-based Templeton Foundation (*Science*, 21 May 1999, p. 1257), and she could receive a further \$10 million next year. Greenfield admits she has never done an experiment involving consciousness, although she has described her theory for how the activity of neurons creates individual minds in her popular books, which she describes as “the work I am most proud of.”

In a nutshell, Greenfield argues that consciousness is generated by “highly transient assemblies of brain cells that wax and wane in size, from one moment to the next,” and the larger the assemblies, the higher the level of consciousness. She uses the analogy of a stone dropped into a pond, with associations between neurons rippling out from a “trigger.”

Greenfield gave a speech about her idea at the annual meeting of the Association

for the Scientific Study of Consciousness, held at the California Institute of Technology (Caltech) in Pasadena in June. “It went extremely well,” she told *Science* after the meeting, but some in her audience painted a different picture. Patrick Wilken, a psychologist at Otto von Guericke University in Magdeburg, Germany, and one of the



conference organizers, says people complained that Greenfield’s lecture was insubstantial—for example, some felt that “talks like this lower the perception of consciousness as a serious field of academic study.” Christof Koch, a Caltech neuroscientist who chaired the meeting, calls Greenfield “an excellent public speaker” but says her talk had “very little science” and focused more on metaphors than testable hypotheses.

Greenfield calls the assessment unfair and claims she is being “held to a different standard” from others, perhaps “because I’m a neuroscientist and most of the others were cognitive scientists.”

Wilken disagrees. A decade ago, “there were a number of researchers asserting [that they could] solve the problems of consciousness without having a great deal of data to back up their claims,” he says, but “things have moved a long way since then, and people who make statements like this today without having let their ideas go through the normal scientific practice of peer review are generally ignored.”

But Greenfield plans to get data to back her ideas with the help of OXCSOM. One of its research aims is “to test Susan’s theory,” says John Stein, an Oxford neurophysiologist and one of OXCSOM’s core group of researchers, although “obviously we won’t solve the problem of consciousness in a matter of months.” In line with the religious

interests of the Templeton Foundation, which bankrolls OXCSOM, its initial focus is on “the physical basis of beliefs.”

For example, Oxford neuroscientist Irene Tracey is investigating whether religious beliefs affect pain tolerance. The pain is delivered to volunteers in the form of heat or a chili paste applied to the arm. Subjects who identify themselves as “deeply religious” use rituals to cope, such as praying, whereas nonreligious subjects just grit their teeth. Meanwhile, she uses functional magnetic resonance imaging to observe patterns of brain activity during the ordeal.

Capturing the brain’s reaction is the easier part of the experiment, she explains, because it is readily detected. But to determine “how deep” beliefs are or “how much” pain is experienced, she must rely on reports from the subjects themselves. That subjective aspect is both a pro and a con. Although it can make comparisons very difficult without carefully chosen controls, it is also “exactly the aspect that we’re trying to figure out,” she says. “Pain is an incredibly flexible phenom-

Academics sit and discuss ideas, but “I’d rather see my ideas ... [make] a difference in people’s lives.”

—Susan Greenfield

enon, depending on your perceptions, expectations, and degree of self-awareness,” all ingredients of consciousness. And on the practical end, determining the mechanisms that might dampen pain for a believer could lead to better therapies for everyone.

Whether grappling with slippery concepts such as belief will bring us closer to understanding consciousness is an open question. “But even if the project fails in its ultimate aim,” says Erik Myin, a philosopher of consciousness at the University of Antwerp, the Netherlands, it could reveal how to convert such “big questions” into ones that can be scientifically validated.

But judging Greenfield on her own research may be missing the point. “She’s gutsy and an inspiration” to younger scientists, says King. And among the public, “her ability to communicate that science is fun and creative” and that “you don’t have to be a boring fuddyduddy wearing tweed skirts” is vital, says Stein. He says he can measure her impact every year in “the number of girls applying to do medicine or neuroscience who’ve said they’ve been enthused by Susan’s lectures or books.” Even if she doesn’t crack consciousness, he says, Greenfield has already made an enormous contribution.

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