

Frontiers of Science

At Columbia University, Darcy Kelley and colleagues have a new way to teach undergraduates science.

MARY HELEN BOWERS AND JENNIFER EVANS LEAN FORWARD, rapt, as their professors argue on the stage of Columbia University's Miller Theater. The debate: "Can we engineer consciousness?" The heated answers of a superstar faculty: "Yes," "no," and "maybe."

Bowers, 26, danced for a decade with the New York City Ballet before entering Columbia to earn a college degree. Evans, 18, is the daughter of scientists. Both are taking "Frontiers of Science," a novel course developed by Columbia neuroscientist Darcy Kelley and a cross-disciplinary assortment of colleagues to introduce undergraduates in all disciplines to research on the frontiers of science today and—more importantly—to the ways scientists think.

Bowers, Evans, and more than 300 other entering students attend weekly lectures by the cream of Columbia's scientists such as Horst L. Stormer, a Nobel Prize-winning physicist who used to head the physical research laboratory at the pioneering Bell Labs, and Kelley, one of 20 researchers nationwide named HHMI professors—each of whom received \$1 million to help transform undergraduate science education.

For 85 years, Columbia's undergraduate education has centered around a core curriculum comprising literature, music, art, history, and philosophy. With the advent of "Frontiers in Science," for the first time science joins the fields that generate what this university calls "the great ideas of Western civilization." The course will be offered on a pilot basis for 5 years.

"Frontiers in Science" is designed to make science come alive for students who are not necessarily planning to become scientists. "Despite the necessity of a science-informed pub-

lic," Kelley points out, "so-called nonscience students often are shunted into boring or irrelevant courses, if they take science at all." And the course is meant to be an inspiration for science majors as well. "Despite the need for interdisciplinary science," she notes, "the most able science students can be too narrowly educated."

The backbone of the course is a Web-based "book," *Scientific Habits of Mind*, developed by David J. Helfand, chairman of Columbia's Department of Astronomy and Astrophysics. It's far from your typical college text. Chapter headings read: "Expecting the Improbable," "Lies, Damned Lies, and Statistics," and "Discoveries on the Back of an Envelope." An anecdotal journey seen through a scientist's eyes, the book focuses on basic concepts in scientific reasoning and analytical thinking.

If the backbone is Helfand's book, and the heart and soul are the renowned scientists who lecture, the course's lifeblood comes from the Columbia Science Fellows, the postdocs who develop the curriculum and teach weekly undergraduate seminars.

While they are teaching, however, they're also learning. "The intellectual stimulation of working with people across disciplines has exceeded my wildest expectations," says Robin HerrNSTein, who is doing a postdoctoral fellowship in astronomy. "I understand my own field better for having taught this course."

The interdisciplinary aspect of the course can be a challenge—and a plus. "I've really had to struggle," admits Jennifer Blanck, a postdoc in biology. "But some of my best seminars have been in other fields, because I'm learning too."



JENNIFER ALTMAN

ABOVE _ CONCERNED THAT “SO-CALLED NONSCIENCE STUDENTS OFTEN ARE SHUNTED INTO BORING OR IRRELEVANT COURSES, IF THEY TAKE SCIENCE AT ALL,” DARCY KELLEY DECIDED TO DO SOMETHING ABOUT IT.

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The debate that holds Bowers and Evans spellbound is the capstone of the course. In May 2005, the neuroscientists, physicists, geologists, and astronomers who shared cutting-edge ideas in their disciplines throughout the semester, gathered to ponder controversial questions and, as diplomats might say, to have a “frank exchange of views.”

“Of course we will be able to engineer consciousness,” states Stormer. “The brain is circuits. There is no reason we cannot mimic those circuits. There are no computers with consciousness because we’re just not there yet.”

Julio M. Fernandez disagrees. “We can’t engineer something greater than ourselves,” protests the biophysicist who studies the stability and folding dynamics of proteins.

“With all due respect, I think you’ve totally missed the point,” replies psychologist Joy Hirsch, who defines consciousness as “the quality or state of being aware of something outside oneself.”

“With all due respect, your definition is trivial,” Kelley retorts.

Full professors, fully engaged in intellectual battle—and the undergraduates love it. “It’s refreshing,” says Rachael Gargano, a political science/economics major. Wei-Jen Hsieh, a premedical student, calls it “fascinating.” “They are so enthusiastic and passionate,” Bowers remarks. Jennifer Evans has the last word: “They make science so much more human.” ■

-Jennifer Boeth Donovan-