



## WOMEN IN SCIENCE

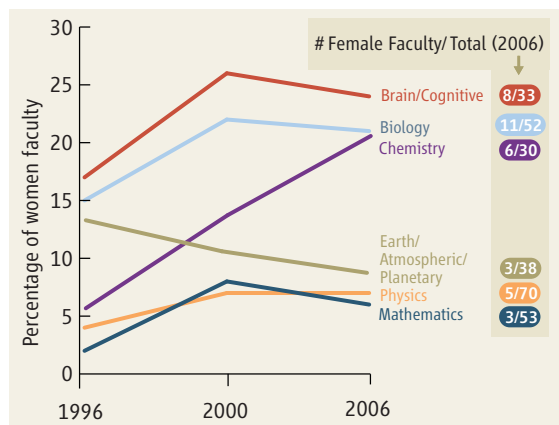
## Progress on Hiring Women Science Faculty Members Stalls at MIT

The number of women faculty members at the Massachusetts Institute of Technology (MIT) in Cambridge has declined or remained flat in five of its six science departments since 2000, whereas the number of women in other areas, such as engineering and architecture, increased significantly during the same period, according to a report released last week. The findings, say academics researching the issue, underscore the difficulty in removing obstacles for female scientists, despite high-level attention by some deans and administrators.

MIT kicked off a nationwide debate in 1999 following publication of a study highly critical of the university's treatment of women scientists (*Science*, 12 November 1999, p. 1272). That study prompted a host of personnel and policy changes at MIT and also led other research institutions across the country to examine their own policies. So when MIT biologist Nancy Hopkins, who chaired the committee that produced that initial report, compiled

the most recent statistics, "I couldn't believe my eyes; I dropped my pencil," she says.

In a paper in MIT's most recent faculty newsletter, Hopkins tracks a spike in the hiring of women scientists at MIT between 1996,



**Sliding scale.** After rising in the late 1990s, the number of women in most MIT science departments dropped.

when the initial findings of her committee were presented to then-dean of science Robert Birgeneau, and 2000, when Birgeneau resigned. From 2000 to 2006, however, the percentage of women increased only in the chemistry department. In biology, brain and cognitive sciences, and earth, atmospheric, and planetary sciences, the percentage decreased, although in physics it remained flat. The story is radically different, however, in the engineering department and in the school of architecture and planning, where the number of women nearly doubled in the past 5 years.

Birgeneau's successor, Robert Silbey, says he agrees with Hopkins that MIT has "failed to sustain that initial push," which brought 13 new faculty members into the sciences between 1996 and 2000. "And I'm not happy about it." But he notes that a dozen women scientists were hired between 2000 and 2005, only one less than during Birgeneau's watch. The decreases within departments, Silbey says, are largely due to female faculty members leaving after failing to win tenure or for ▶

## SCIENCE POLICY

## NSF Begins a Push to Measure Societal Impacts of Research

When politicians talk about getting a big bang for the buck out of public investments in research, they assume it's possible to measure the bang. Last year, U.S. presidential science adviser John Marburger disclosed a dirty little secret: We don't know nearly enough about the innovation process to measure the impact of past R&D investments, much less predict which areas of research will result in the largest payoff to society (*Science*, 29 April 2005, p. 617). He challenged social scientists to do better.

Next month, the National Science Foundation (NSF) will invite the community to pick up the gauntlet. A Dear Colleague letter from David Lightfoot, head of NSF's social, behavioral, and economic sciences (SBE) directorate, will describe an initiative tentatively dubbed "the science of science policy." NSF is also holding three workshops for researchers to lay the intellectual foundations for the initiative. By fall, NSF hopes to have \$6.8 million from Congress as a down payment on what Lightfoot envisions as "a significant program"

that would eventually support a half-dozen large research centers at U.S. universities and scores of individual grants.

In its 2007 budget request, released in February, NSF says the initiative will give policymakers the ability to "reliably evaluate returns received from past R&D investments and to forecast likely returns from future investments." Lightfoot cautions against expecting too much precision. "One shouldn't overstate this goal," he says. "Nobody is under the illusion that we're going to be able to hand these decisions over to the computers." But he believes that it should be possible to develop "a more evidence-based understanding of what happens to our R&D investments."

NSF officials have outlined a series of steps toward that goal. On 17 to 18 May, some two dozen cognitive scientists, social psychologists, and engineers will discuss the roots of individual and group creativity and innovation in science. On 1 to 2 June, a second workshop will explore the organizational components—how cultural, political, demo-

graphic, economic, and scientific patterns affect the creation and application of knowledge. In July, an international group of experts will suggest ways to improve existing surveys that measure various indicators of a nation's technological prowess, from publications to public understanding of science.

If the funding materializes, Lightfoot foresees a collection of interdisciplinary research centers, focused either on a particular discipline or an important technology. "To date, the criteria most commonly used—citation analysis or other bibliometrics—are science-neutral and field-independent," he says. "That strikes me as a mistake and a significant limitation. Chemistry and archaeology have different scientific cultures, and those differences affect innovation."

Lightfoot is in the process of hiring someone to coordinate the initiative within SBE and across NSF. The White House is also forming an interagency task force to oversee the initiative.

—JEFFREY MERVIS

other reasons. (Nearly half of all junior faculty members, male and female, do not receive MIT tenure.) “Department heads in science are committed to gender diversity, but sustained progress is difficult,” he adds. Silbey also notes that he has appointed women to various leadership positions, and that three of the 10 members of MIT’s science council are female.

But Hopkins argues that recruitment of distinguished women scientists needs to be more aggressive at the level of the individual science department. “The standard hiring process does not work,” she says. Indeed, the pattern found by Hopkins “is really not surprising,” says Alice Hogan, who heads a program at the National Science Foundation called Advance,

designed to increase women’s participation in science and engineering. “If you let the normal processes go their way, you get what happened at MIT.” The Advance program has given 19 awards averaging \$3 million to \$3.5 million during the past 5 years to encourage universities to devise strategies to recruit more women in science and engineering. At the University of Michigan, Ann Arbor, for example, search committees receive extensive briefings on diversity issues. At the University of California, Irvine, faculty members act as “equity advisers” to monitor and assist with searches. And at the University of Washington, Seattle, department chairs are trained to encourage diversity. Abigail Stewart, the prin-

icipal investigator on Michigan’s Advance grant, says there has been a “sharp upturn” in hiring women there since the grant began but adds that her analysis is not yet complete. Representatives from major research universities plan to meet in June in Ann Arbor to compare data and approaches.

Hogan and others say that for now, strong deans willing to push their department chairs may be the most effective tools for recruiting a new generation of female scientists. At MIT, Silbey says he will push harder to find young and excellent women for his departments. Of 10 new hires starting in July, he says four are women.

—ANDREW LAWLER

## COSMOLOGY

# Skewed Starlight Suggests Particle Masses Changed Over Eons

New measurements suggest that the ratio of the proton’s mass to the electron’s mass has increased by 0.002% over 12 billion years, a team of astronomers and physicists reports. If so, the ratio and other fundamental “constants” of nature may not be constant after all.

“If this small variation exists, it’s a revolution in science,” says Victor Flambaum, a theoretical physicist at the University of New South Wales in Sydney, Australia, and a member of a different team that 7 years ago reported that another constant may have changed. But some theorists say inconstant constants may clash with well-established physics.

To spot the change, two groups joined forces to compare starlight to laser light. Using the Very Large Telescope in Atacama, Chile, Alexandre Ivanchik, a theoretical physicist at the Ioffe Physico-Technical Institute in St. Petersburg, Russia, and Patrick Petitjean, an astronomer at the Institute for Astrophysics of Paris, France, and colleagues studied light from two quasars, the hearts of ancient galaxies. The light filtered through clouds of molecular hydrogen billions of light-years away when the universe was in its youth. Meanwhile, physicists Wim Ubachs and Elmar Reinhold of the Free University of Amsterdam, the Netherlands, and colleagues shined laser light through molecular hydrogen in the lab.

Molecular hydrogen absorbs light of distinct wavelengths, and the resulting spectrum of “absorption lines” creates a kind of bar code. The positions of the lines depend on the

ratio of the mass of the proton to the mass of the electron. So, by comparing the absorption spectrum from the clouds with the one measured in the lab, the researchers could tell whether the mass ratio had changed.

That’s easier said than done. Because of the expansion of the universe, the quasar

lengths—as the mass ratio changed.

The researchers found that the ratio has increased by about 20 parts per million over the past 12 billion years, they report this week in *Physical Review Letters*. The measurement is at the edge of statistical significance. “We have an *indication*,” Ubachs says. “I wouldn’t call it proof.”

The change is plausible, Flambaum says. Such variations arise naturally in “grand unified theories” that attempt to roll the electromagnetic force and the strong and weak nuclear forces into a single unified force, he says. Michael Dine, a theorist at the University of California, Santa Cruz, says that’s true in principle. But variable constants would require new particles that generally would either interfere with gravity or cause mind-boggling swings in the energy of the universe, Dine says: “It’s very hard to fit varying constants into our conventional notion of how nature works.”

Even so, other researchers have turned up occasional hints of inconstancy. In 1999, a team led by John Webb, an astrophysicist at the University of New South Wales, reported measurements of absorption of quasar light by various metal ions. The team found that the “fine-structure constant,” which determines the strength of the electromagnetic force, appears to have changed by about six parts in a million. Ironically, Petitjean and colleagues studied that constant and found no change.

To nail down whether the mass ratio has indeed changed, researchers need to study more quasars and clouds, Webb says. He is already working on the problem, so stay tuned for more weighty measurements.

—ADRIAN CHO



**Big diff.** Researchers compared the absorption of light by ancient hydrogen clouds to absorption in the lab.



light is stretched from ultraviolet to visible wavelengths, an effect for which researchers must correct. Measuring the ultraviolet absorption lines in the lab is also challenging. Also, to make a meaningful comparison, Reinhold and Ubachs had to calculate how much each line should shift and in which direction—toward longer or shorter wave-