# MIND THE GENDER GAP

*Despite improvements, female scientists continue to face discrimination, unequal pay and funding disparities.*

BY HELEN SHEN

As an aspiring engineer in the early 1970s, Lynne Kiorpes was easy to spot in her undergraduate classes. Among a sea of men, she and a handful of other women made easy targets for a particular professor at Northeastern University in Boston, Massachusetts. On the first day of class, "he looked around and said 'I see women in the classroom. I don't believe women have any business in engineering, and I'm going to personally see to it that you all fail."

He wasn't bluffing. All but one of the women in the class ultimately left engineering; Kiorpes went on to major in psychology.

Such blatant sexism is almost unthinkable today, says Kiorpes, now a neuroscientist at New York University. But Kiorpes, who runs several mentoring programmes for female students and postdoctoral fellows, says that subtle bias persists at most universities. And it drives some women out of science careers.

By almost any metric, women have made great gains in closing the scientific gender gap, but female scientists around the world continue to face major challenges. According to the US National Science Foundation, women earn about half the doctorates in science and engineering in the United States but comprise only 21% of full science professors and 5% of full engineering professors. And on average, they earn just 82% of what male scientists make in the United States — even less in Europe.

Scientific leaders say that they continue to struggle with ways to level the playing field and entice more women to enter and stay in science. "We are not drawing from our entire intellectual capital," says Hannah Valantine, dean of leadership and diversity at the Stanford School of Medicine in California. "We've got to put on the accelerator to evoke social change."

One of the most persistent problems is that a disproportionate fraction of qualified women drop out of science careers in the very early stages (see 'Women in science'). A 2006 survey of chemistry doctoral students by the Royal Society of Chemistry in London, for example, found that more than 70% of first-year female students said that they planned a career in research; by their third year, only 37% had that goal, compared with 59% of males[1].

Many experts say that a big factor driving this trend is the lack of role models in the upper divisions of academia, which have been slow to change. The Royal Society of Chemistry has found, for instance, that female chemistry students are more likely than males to express low self-confidence and to report dissatisfaction with mentorship[2]. Female students "conclude consciously and unconsciously that these careers are not for them because they don't see people like them", suggests Valantine. "That effect is very, very powerful — this sense of not belonging."

The attrition continues at later stages. In biology, for example, women comprised 36% of assistant professors and only 27% of tenure candidates in a 2010 study by the US National Research Council[3]. "We're not talking about a lack of talent here. Part of the story is that women leave earlier. In a sense, they give up on an academic career," says Curt Rice, vice-president of research and development at the University of Tromsø in Norway, who has studied gender equality in US and European universities.

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The gender gap and how to close it
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## FAMILY VALUES

Many of the UK chemistry students viewed research as an all-consuming endeavour that was incompatible with raising a family. Meeting the demanding schedule of academic research can seem daunting for both mothers and fathers. But family choices seem to weigh more heavily on the career goals of women.

Law professor Mary Ann Mason at the University of California, Berkeley, and her colleagues have found[4] that male and female postdocs without children are equally likely to decide against research careers, each leaving at a rate of about 20%. But female postdocs who become parents or plan to have children abandon research careers up to twice as often as men in similar circumstances.

"The plan to have children in the future, or already having them, is responsible for an enormous drop-off in the women who apply for tenure-track jobs," says Wendy Williams, a psychologist at Cornell University in Ithaca, New York. Furthermore, women who do become faculty members in astronomy, physics and biology tend to have fewer children than their male colleagues — 1.2 versus 1.5, on average — and also have fewer children than they desire[5].

In response to these concerns, many universities have taken steps to establish family-friendly policies such as providing child-care assistance and extending tenure clocks for new

# WOMEN IN SCIENCE: MANY HURDLES AHEAD

The number of women studying and practising science has risen sharply, but women are disproportionately driven away from scientific careers.

KEY

MEN WOMEN

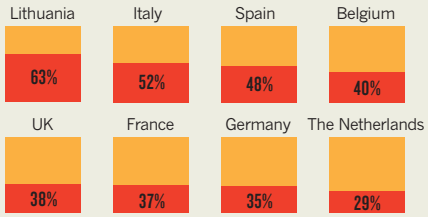
## GRADUATE SCHOOL

SOURCE: NSF/REF. 12

The fraction of women gaining doctorates in science has more than doubled in the United States since 1980 and is now nearing equity. In some European countries, women outnumber men in science degrees but there is significant variation between nations and fields.

### US FEMALE DOCTORAL RECIPIENTS IN SCIENCE AND ENGINEERING


### FEMALE DOCTORAL RECIPIENTS IN SCIENCE IN EUROPE (2006)

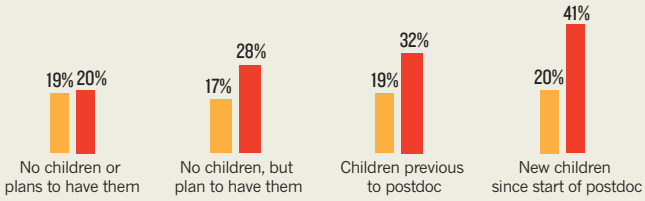



## POSTGRADUATE POSITIONS

SOURCE: REF. 4

A 2009 survey of postdoctoral fellows at the University of California showed that women who had children or planned to have them were more likely to consider leaving research.

### POSTDOCS WHO DECIDED AGAINST CAREERS AS RESEARCH FACULTY MEMBERS (2009)

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Wendy Williams, Cornell University

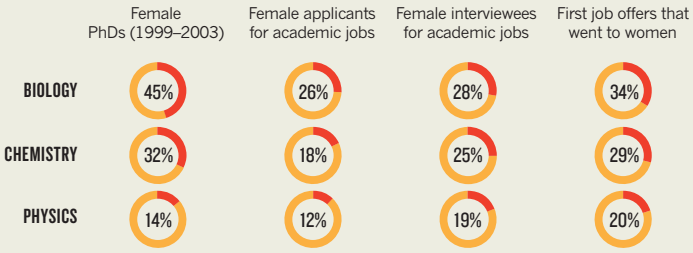
## EARLY CAREER

SOURCE: NSF/WEBCASPAR

Female representation among science and engineering faculty members in the United States has lagged behind gains in graduate education, in part because many women do not apply for tenure-track jobs. But women who do apply are more likely than men to receive interviews and offers.

**"At least part of the lack of applications is due to the fact that women look at these careers and don't see people like themselves."**

Hannah Valantine, Stanford University

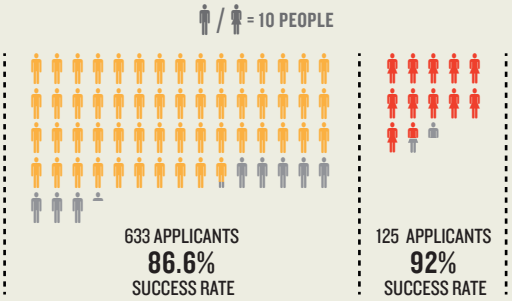



## RISING IN THE RANKS

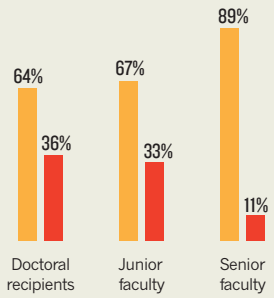
SOURCE: REF. 3/REF. 12

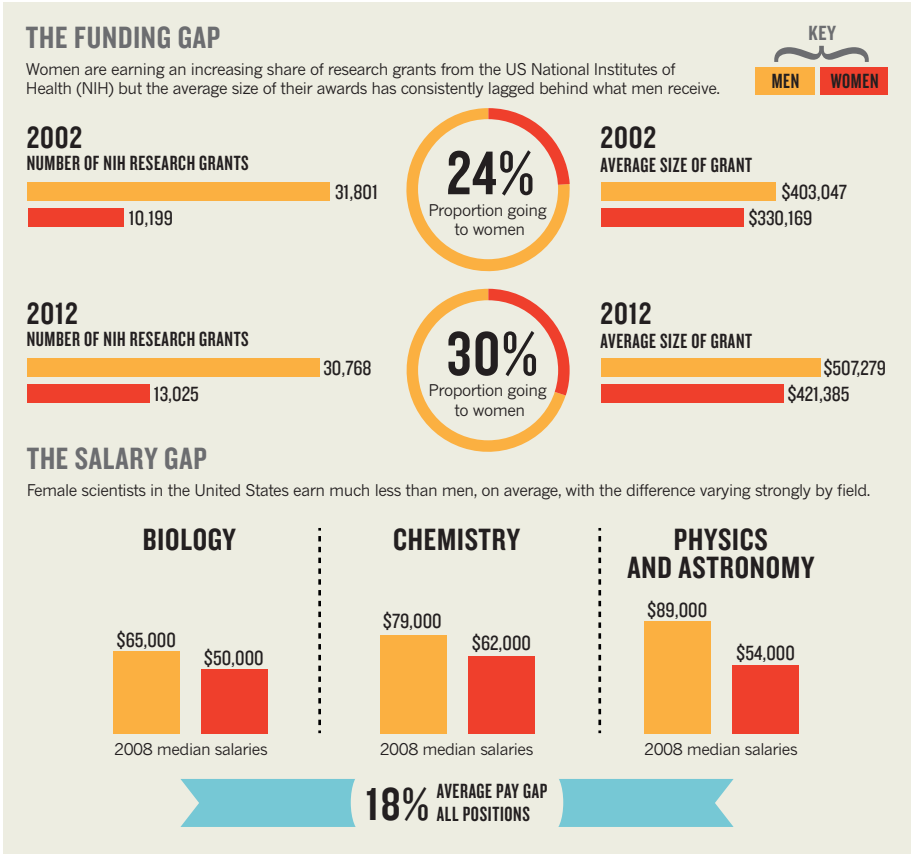
A study of US science departments showed that women were more successful than men in gaining tenure between 2002 and 2004. In Europe as in the United States, the gender gap is greater among senior than among junior faculty members.

### US TENURE DECISIONS 2002–04




### GENDER GAP AMONG SCIENTISTS IN EUROPEAN UNIVERSITIES (2006)






parents. Shirley Tilghman, president of Princeton University in New Jersey, believes that such initiatives provide crucial support for women, but that other solutions are still needed. "I don't think there's a single obstacle," she says. "I think there's a whole series of phenomena that add up."

## LIVE ISSUE

At Yale University in New Haven, Connecticut, microbiologist Jo Handelsman is one of many researchers who think that gender discrimination continues to be a significant part of the problem. In a much-talked-about experiment last year[6], her team showed that science faculty members of both sexes exhibit unconscious biases against women. Handelsman's group asked 127 professors of biology, chemistry and physics at 6 US universities to evaluate the CVs of two fictitious college students for a job as a laboratory manager. The professors said they would offer the student named Jennifer US$3,730 less per year than the one named John, even though the CVs were identical. The scientists also reported a greater willingness to mentor John than Jennifer. "If you extrapolate that to all the interactions that faculty have with students, it becomes very frightening," says Handelsman.

Her findings match well with the results of a survey[7] done in 2010 by the American Association for the Advancement of Science. Of the 1,300 or so people who responded, 52% of women said that they had encountered gender bias during their careers, compared with just 2% of men.

Still, other concrete evidence of bias is hard to find. Some measures show female scientists outperforming male rivals in landing interviews and job offers early in their careers. The National Research Council study[3] showed that women accounted for 19% of the interview pool and received 32% of job offers for tenure-track electrical-engineering positions. Women fared just as well as men in tenure evaluations, but female assistant professors in many disciplines seemed less likely to reach tenure consideration compared with men.

Women face even more daunting odds in Spain. Men are 2.5 times more likely to rise to the rank of full professor than female colleagues with comparable age, experience and publication records[8].

Disparities can also be found in grant funding in some countries. In one frequently cited study[9], Christine Wennerås and Agnes Wold at the University of Gothenburg in Sweden found in 1997 that female applicants for postdoctoral fellowships had to score 2.5 times higher on an index of publication impact to be judged the same as men.

Several groups, such as the UK Medical Research Council and biomedical research charity the Wellcome Trust, have since investigated their grant programmes and found negligible or very subtle effects of gender[10]. The Canadian Medical Research Council found no differences in success rate in most of its research grant programmes, but reported lower success rates for women in some training grants[11]. In the United States, women are slightly more successful than men in obtaining grants from the National Science Foundation, but the trend is reversed for the National Institutes of Health (NIH). The NIH also gives women smaller awards on average (see 'The funding gap').

Information provided to *Nature* by the NIH through a Freedom of Information Act request indicates that the percentage of women on review panels has improved marginally over the past decade, from 25% in 2003 to 30% in 2012. Those figures roughly parallel the percentage of women applying for and receiving grants in that time.

## PAY PROBLEMS

The inequalities also extend to salaries. In the European Union, female scientists earned on average between 25% and 40% less than male scientists in the public sector in 2006 (ref. 12). Although the average pay gap is smaller in the United States, the disparity is particularly large in physics and astronomy, where women earn 40% less than men.

For young academic scientists, however, those differences may be fading. The National Research Council found an 8% pay gap at the level of full science and engineering professors but no significant differences among junior faculty members[3]. Some experts argue, however, that the salary gap may reflect other continued trends, such as the fact that a disproportionate share of women move into non-tenure positions or faculty jobs at lower-status universities.

Tilghman says that Princeton and many other universities have grown increasingly conscious of the need to track and rectify gender gaps in salary and other institutional support. "Absolutely, it needs eternal vigilance," she says. "But we're in a much better place." ■

**Helen Shen** *is an intern with* Nature *in Washington DC.*

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