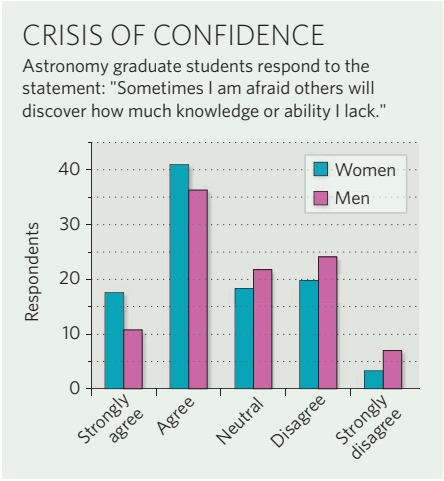
NEWS

Self-doubt plagues female astronomers

Women in US astronomy graduate programmes are considerably more likely than men to fear being exposed for a lack of astronomy knowledge or ability, according to the American Institute of Physics (AIP) in College Park, Maryland, and the American Astronomical Association (AAS). The results, part of the first ever longitudinal study of astronomy graduate students in the United States, raise concerns that these fears have been driving women to leave the field in large numbers. Initial study results were released at a 4 January AAS meeting session in Washington DC.

These report that almost 60% of female respondents agreed or strongly agreed with the statement "Sometimes I am afraid others will discover how much knowledge or ability I lack". Only 47% of male respondents agreed or strongly agreed (see graph). Figures compiled by the AIP show that female astronomers held only 17% of all US astronomy faculty positions as of 2006, the most recent data available. Attrition is hard to determine, but in 1992, according to the AAS, around 23% of US astronomy graduate students were women. According to the recently released National Science Foundation indicators, 34% of astronomy graduate students were women in 2006.

Study co-lead researcher Patricia Knezek, an associate scientist at the National Optical Astronomy Observatory and deputy director of the WIYN Observatory, both based in Tucson, Arizona, wonders whether the 'impostor syndrome' is forcing women to drop out of astronomy prematurely. First described in 1978 by two clinical psychologists, the impostor syndrome — in which the sufferer believes himself or herself to be inadequate in his or her field despite evidence to the contrary — has been documented across scientific fields in both women and men (see *Nature* **459,** 468–469; 2009). Knezek hopes that subsequent data sets will indicate whether the incidence of impostor syndrome correlates with the number of women and men who drop out of astronomy.



SOURCE: AIP/AAS

The findings also underscore the importance of effective mentoring at all career stages. "The people who feel that they have knowledgeable and helpful mentors tend to be much happier and much more likely to take chances, maybe to apply for a job that they might not necessarily think they're qualified for," Knezek says, adding that this information could be used to combat the impostor syndrome and possibly help keep more women in astronomy beyond PhD level. "This is one of the things that we hope will come out of the data," she says. "Then we will feed all of it back into the system and use it to try to improve how we train, promote and retain."

The longitudinal study also seeks to identify the ultimate occupations of postgraduate astronomers, including those outside of the traditional destinations of academia and national observatories. The initial survey has 1,143 respondents, and about 800 of these have agreed to participate in the full-length project, which will follow the astronomers for 15 years, from 2008. The next data collection will begin in 2011 and collections will continue every three years after that. "We have no long-term data of this type," says co-lead researcher Rachel Ivie, assistant director of the AIP Statistical Research Center. "We need to learn who goes where and what kind of job they're going to get." ■

Karen Kaplan

Q&A

Chemist **Richard Zare** is winner of the 2010 Priestley Medal and the 2009 Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring.

Your father tried to dissuade you from following a career in science. Was this what attracted you to the field?

Absolutely. Science was 'forbidden fruit' in our house. My father failed graduate school in chemistry and he told me to leave his chemistry books alone because they would only bring me unhappiness. Being a rebellious child, I quickly discovered I was good at science and chemistry. I spent my youth making gun powder, explosives and fireworks.

How did you get into laser chemistry?

When I got to the University of California, Berkeley as a graduate student, lasers had just been discovered. The physicists were saying it was a solution in search of a problem, but I thought it was the most exciting device. I was immediately struck by the many potential chemical applications of lasers and at once had ideas about using photons to break down chemical compounds — which I have worked on throughout my career.

What is your favourite piece of advice from a mentor?

At an American Chemical Society meeting early in my career, theoretical chemist Joe Hirschfelder received an award and in his address shared the fact that his equation for success was the integral of ability over time. He made it clear that even the most talented scientists have to work hard too.

Which of your scientific achievements has had the most impact?

It's hard to know, and always scary to sum up your life in one thing, but the discovery of laser-induced fluorescence, whereby we used lasers to excite molecules and then measure the light they emit, had a remarkable effect. First, we used it to look at the structure of molecules. Later, we used it to look at reaction dynamics because we were able to see the internal states of chemical products directly. Soon, we began to apply the technique in conjunction with chromatography, which led to a single-molecule fluorescence approach — a development that paved the way to using lasers to help sequence the human genome.

Of the two high-profile awards you've recently won, which are you the more proud of?

They are different types of award — one, the lifetime achievement award, is scary because I plan on living, and working, much longer. But in terms of lifetime achievement, it's easy to measure one's scientific success by the number of papers, patents and applications or discussions of your research. The impact of mentoring is less easy to measure. I've mentored more than 100 PhDs and postdocs and taught numerous courses, but no matter how much you try, you simply can't affect that many people, and

NEWS

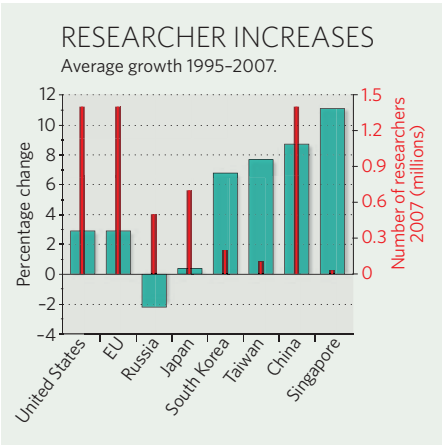
China's research rise

China has approximately as many researchers as either the United States or the European Union (EU), according to the US National Science Foundation (NSF) *Science and Engineering Indicators 2010* report.

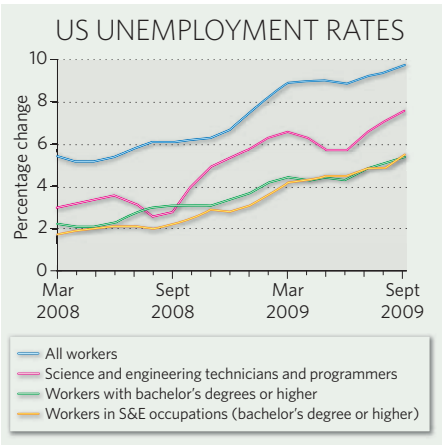
The biennial report found that each of the three had about 1.4 million researchers as of 2007, but the annual growth in the number of researchers is much higher in China (see graph, top right). That growth includes a continued steep increase in the number China's science and engineering doctorates, up to 21,000 in 2006, the latest data available. The relentless rate of growth over the past decade is unusual, says Rolf Lehming, programme director of the indicators project. "When we see this kind of strong increase in numbers, we usually expect a flattening out after several years," he says.

Although most of the NSF indicators are based on statistics collected before the global recession took hold in 2008, the NSF did track more recent unemployment figures for US scientists. Unemployment rates for scientists and engineers remain lower than for the general population. However, the estimated recent rate of unemployment increase was much higher for scientists and engineers (see graph, right). From March 2008 to September 2009, the rate increased from 5.4% to 9.8% for the general population, less than a twofold change. For scientists and engineers, it tripled, jumping from 1.8% to 5.4%. ■

Gene Russo



SOURCE: NSF *SCIENCE AND ENGINEERING INDICATORS 2010*



SOURCE: US CURRENT POPULATION SURVEY, PUBLIC USE MICRODATA SAMPLE

the people you mentor often realize the effect much later. That makes this award a very special, humbling thing. I'm delighted to be recognized.

What motivated you to create some of the most progressive graduate maternity policies in the country?

I grew up in Cleveland, Ohio, in a family in which the stereotyped roles for men and women were very much alive. Going to an all-boys school didn't help. But my wife, who regards herself as a feminist, and my three daughters, who all have professional careers, made me much more sensitive to women's issues. I strongly believe that the wealth of a country is tied up in its skilled, educated people, not in its resources. Therefore, it is incumbent on society to make use of the whole human talent pool, not just half of it. We need more policies, such as 12 weeks' paid leave for late-stage pregnancy, childbirth and newborn care, that can help keep women in science.

What is the secret to successful mentoring?

Confidence building. Understanding people's strengths even when they don't realize them themselves. The other thing is giving people the freedom to do what they want. It is helping people find a delicate balance between passion and persistence.

Do you enjoy teaching?

Teaching is the researcher's secret weapon. You never question how well you know something as keenly as when you are responsible for explaining it to others. Teaching forces you to question what's known, or whether there could be another way — which is exactly the attitude a researcher should have. Every time I teach a course, I learn something from the process.

What's next for your research career?

Oh, I'm not done. I'm not satisfied yet. I have various projects left to solve. In fact, I'm quite interested in pursuing whether some of my research could have a medical pay-off. For example, I'm exploring a way to use isotopes to study disease states. ■

Interview by Virginia Gewin

IN BRIEF

From lab to laundry

Female US scientists do nearly twice as much housework as their male counterparts, according to a study in *Academe*, the online publication of the American Association of University Professors. Science historian Londa Schiebinger of Stanford University in Palo Alto, California, and analyst Shannon K. Gilmartin found that partnered women scientists at 13 top US institutions do some 54% of household tasks, requiring more than 10 hours a week on top of the 60 hours they work. Partnered male scientists, however, do just 28%. The remainder is done by hired help. The authors propose that university benefits could be made more flexible to include support for housework help.

Responsible work plans

Three non-profit agencies have published a booklet to clarify US animal researchers' responsibilities under the Freedom of Information Act (FOIA) in light of escalating threats by animal-rights activists. *Responding to FOIA Requests: Facts and Resources* gives advice on how to deal with information requests under the act, which activists are increasingly using to target scientists. The publication, by the National Association for Biomedical Research, the Federation of American Societies for Experimental Biology and the Society for Neuroscience, gives such tips as not posting personal data online.

India offers foreign grant

For the first time, an Indian educational institution is launching a paid fellowship programme for international science students. The Indian Institute of Science (IISc) in Bangalore will support some international students admitted to its doctoral or master's degree programmes in science or engineering. The fellowship will pay 15,000 rupees (US$325) a month. One-third of this covers accommodation, food and tuition; the rest is for miscellaneous expenses. The IISc hopes that the influx of international students will boost campus diversity and that fellows will pass on positive reviews to potential students in their home countries. The IISc admits about 600 students annually, and expects to bring in 5–10 fellows for autumn 2010, with an eventual goal of 60 per year.