



## FOR LOVE AND MONEY

The self-reported contentment of researchers with their chosen profession depends on more than just salaries, according to the results of our international career survey. **Gene Russo** parses the data.

**P**ostdocs at the National Institutes of Health (NIH) campus in Bethesda, Maryland, often bring their many concerns to Lori Conlan, the NIH's director of the office of postdoctoral services. Sometimes they have already reflected on their prospects, and have made the decision to seek an academic position, delve into industry, or try a non-traditional career. Others are unsure. Almost always, they don't know what to expect. "Some postdocs do not have a good understanding of their worth," says Conlan. "Some have unreasonable expectations." They overestimate their potential starting salaries. They also express anxiety about finding an academic position with good mentoring and guidance, and they might wonder whether they will acclimatize to the 'team science' environment of industry. All of these considerations will affect how much they enjoy their chosen career path.

NIH postdocs are, of course, not alone in this respect. Worldwide, many scientists,

junior or senior, don't fully understand the landscape of salaries and job satisfaction. They know the career-stage timeline well — graduate school to postdoc to academia or industry — but it is difficult to track contentment with one's job by region or by job attributes such as health care, the degree of independence or mentoring potential.

This was a major aim of *Nature's* first-ever salary and career survey. We looked at overall career satisfaction and the factors that contribute to it by career stage, gender and geographical region. More than 10,500 scientists responded to the survey from dozens of countries worldwide. (Full details of the methodology behind the survey can be found at [go.nature.com/aSZqch](http://go.nature.com/aSZqch).)

Among the 16 countries for which we have considerable sample sizes, Denmark ranks as the one most likely to provide its scientists with an excellent all-round research experience. It scored best on a satisfaction ranking that included measures such as

salary, health care, pension and degree of independence (see 'Scientist satisfaction vs country happiness' and 'Satisfaction by country and job attribute'). Japan scored the lowest among these 16 countries, with only a very small percentage of respondents saying that they were "very satisfied" — ranging from 2% for satisfaction with their retirement plan to 10% for "degree of independence". The emerging scientific powers, India and China, also had low satisfaction ranking scores. But, in a separate question, a higher percentage of respondents from China and India reported increased overall job satisfaction in the past year as compared with respondents from most other countries.

Worldwide, many scientists seem satisfied with their jobs, and most are paid reasonably well. In academia, job satisfaction improves for most scientists throughout their career (see 'Satisfaction by academic career stage'). But our data also support studies showing that gender inequities in salaries persist (see

‘Salary gender bias’), and suggest that, country to country, some researchers are unhappy with the factors we asked about. Although such dissatisfaction can cause brain drain, the signs of improving satisfaction among scientists in countries such as China and India could stem the tide. As these once science-poor countries become well-supported research hot-spots, the brain drain may increasingly turn into ‘brain circulation’, as Mohamed Hassan of the African Academy of Sciences in Nairobi suggests (see Opinion, page 1006). Optimistic outlooks could reflect the growth of a scientific community and increases in science and technology investment. *Science and Engineering Indicators: 2010*, published by the US National Science Foundation in January, for example, reports that China now awards nearly as many doctoral degrees in the natural and engineering sciences as the United States, with the totals rising steeply since 2002. According to the latest (2007) data, China now has as many researchers (about 1.4 million) as either the European Union or the United States.

Of course, there are caveats. The countries ranked fourth to ninth in our ratings of overall satisfaction are separated by very little, meaning that France’s satisfaction score is not that much better than Australia’s, despite their disparate rankings. And, importantly, residents of particular countries and regions may be predisposed, for cultural or lifestyle reasons, to report lower satisfaction or happiness levels regardless of profession.

To clarify this potential bias, we compared our satisfaction results to a commonly cited ‘happiness index’, part of a continuously updated World Database of Happiness

## SALARY DISPARITIES

In general, our results comparing salaries by region did not account for the costs of living. To make the comparisons more meaningful, we used purchasing power parity (PPP) numbers. The PPP essentially enables a salary comparison in different regions by asking how much a basket of goods would cost in the given country. Our data are based on the University of Pennsylvania’s PPP data (see [go.nature.com/fu7xcy](http://go.nature.com/fu7xcy); note that to control for widespread currency fluctuations in recent months, we used three different exchange rates from three different time points over the past few months).

Using the PPP, the relative salaries in India get a huge boost; China less so (see ‘Purchasing power parity’). Our small sample showed that South Korea had the top average salary. According to the Organisation for Economic Co-operation and Development’s 2009 data, South Korea has sharply increased its research and development expenditures since the late 1990s, creating a strong demand for talent. Our numbers indicate

a big disparity in industry versus academic salaries. Average industry salaries exceeded average academic salaries by 50% in Asia and by 40% in Europe and North America (see ‘Salaries: academia vs industry’). In all of these regions, the average pay increases throughout the course of a career (see ‘Salaries after highest degree’). In Europe and Australasia, the trends flatten in late career stages compared with those in North America.

The trajectory is steepest within academia, where salaries rise at every career level (see ‘Salaries by academic career stage’). Postdocs in Europe have salaries comparable to those in North America. But when North Americans move to entry-level positions such as assistant professor, they get a much bigger increase. Europeans who identified themselves as assistant professors or lecturers (an entry-level academic position that is more common in Europe) do earn more, but they still fall short of the levels in North America.

Salaries in the past year

have generally held steady for nearly all regions, according to our respondents, with only a few per cent of respondents reporting a decrease. Japan was the one exception, where more than 20% of our respondents reported salary decreases in the past year. Australia, Switzerland and India had the highest percentage of respondents reporting a salary increase.

Compared with other professions, science salaries fare reasonably well, although the starting wages for academic postdoc positions remain low (something organizations such as the US National Postdoctoral Association are attempting to address). Taking just the United States, for example, lawyers of all types and experience levels have an average salary of US\$129,000, according to the US Bureau of Labor and Statistics. Physicians of various types and experience make roughly \$100,000–160,000 depending on the speciality. The top-level science positions are in these salary ranges, according to our data and those from the bureau.

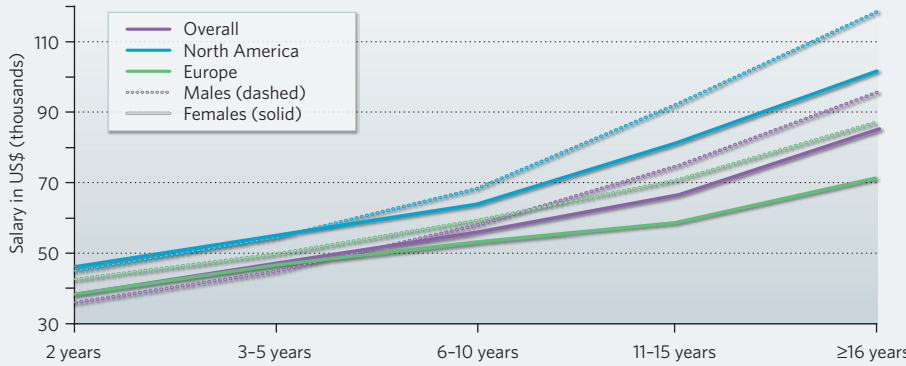
G.R.

SATISFACTION BY COUNTRY AND JOB ATTRIBUTE

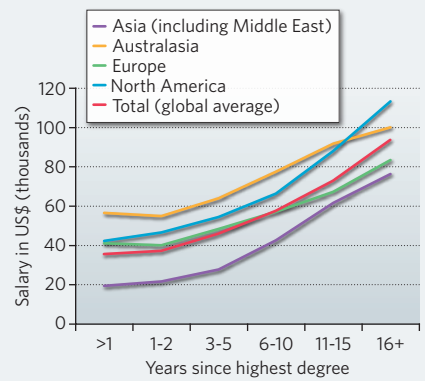
	China	India	Japan	South Korea	Australia	Denmark	France	Germany	Italy	Netherlands	Spain	Sweden	Switzerland	UK	Canada	US	Total
Salary	0.387	0.501	0.471	0.542	0.665	0.694	0.374	0.586	0.339	0.698	0.463	0.585	0.844	0.580	0.567	0.511	0.509
Holiday entitlement	0.517	0.521	0.424	0.504	0.724	0.870	0.850	0.837	0.719	0.854	0.754	0.861	0.759	0.831	0.691	0.682	0.690
Health-care benefits	0.491	0.442	0.546	0.592	0.562	0.840	0.851	0.747	0.528	0.746	0.664	0.758	0.575	0.580	0.707	0.731	0.623
Maternity or paternity leave	0.497	0.464	0.429	0.544	0.583	0.937	0.789	0.677	0.572	0.663	0.568	0.865	0.426	0.630	0.665	0.534	0.542
Pension or retirement plan	0.455	0.443	0.341	0.421	0.689	0.771	0.525	0.537	0.291	0.703	0.330	0.571	0.643	0.653	0.545	0.565	0.516
Total hours worked per week	0.542	0.644	0.448	0.581	0.513	0.665	0.604	0.547	0.585	0.626	0.549	0.620	0.644	0.584	0.612	0.625	0.589
My degree of independence	0.657	0.632	0.567	0.754	0.797	0.841	0.793	0.782	0.764	0.858	0.740	0.831	0.803	0.754	0.814	0.784	0.753
Guidance received from superiors or coworkers	0.466	0.466	0.442	0.523	0.584	0.598	0.580	0.520	0.456	0.600	0.459	0.594	0.576	0.532	0.592	0.595	0.533
Composite of all 8	0.501	0.514	0.458	0.558	0.640	0.777	0.671	0.654	0.532	0.718	0.566	0.711	0.659	0.643	0.649	0.628	0.594

Satisfaction scores for each attribute were calculated by averaging all responses to survey question (satisfied = 1.0, neutral = 0.5, unsatisfied = 0).

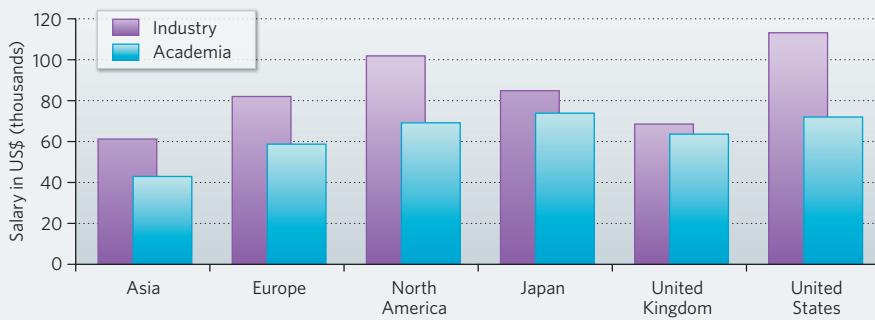
### SALARY TRENDS FOR MEN VS WOMEN



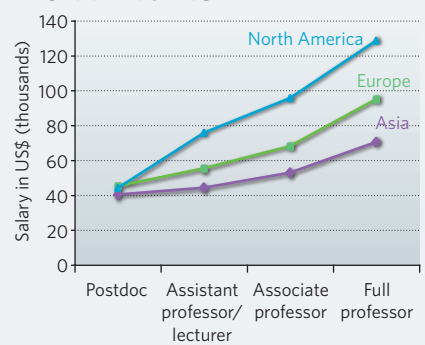
### SALARIES AFTER HIGHEST DEGREE



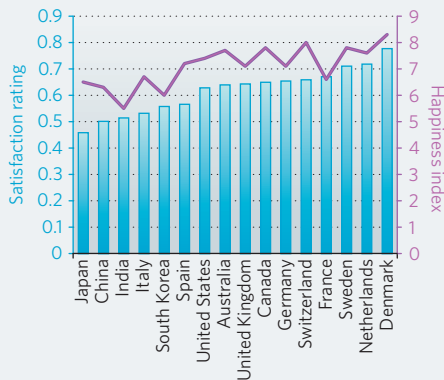
### SALARIES: ACADEMIA VS INDUSTRY



### SALARIES BY ACADEMIC CAREER STAGE

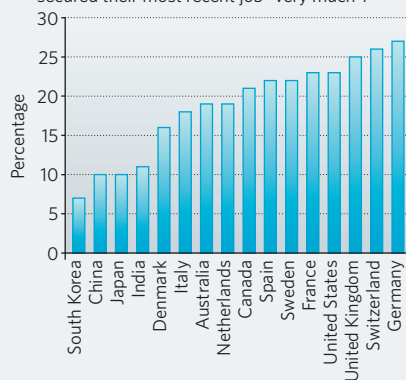


### SCIENTIST SATISFACTION VS COUNTRY HAPPINESS

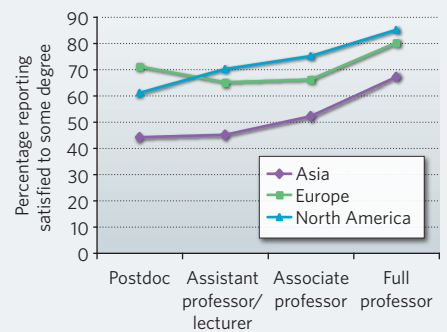


### TWO-BODY PROBLEM

Respondents who said the two-body problem (accommodating job needs of a partner who is also a scientist) influenced how and when they secured their most recent job "very much".

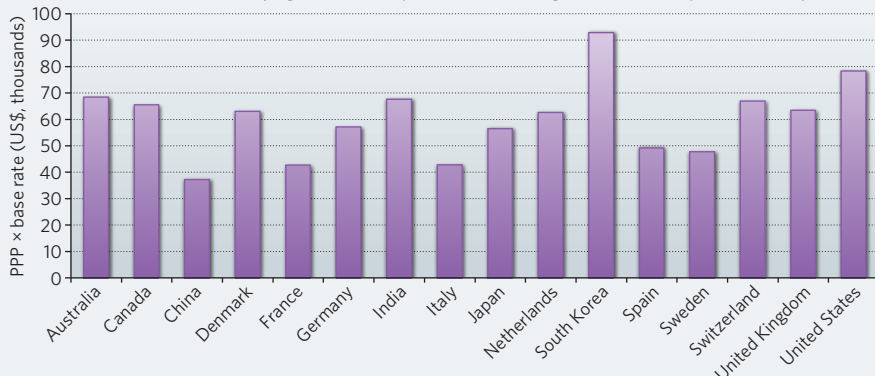


### SATISFACTION BY ACADEMIC CAREER STAGE



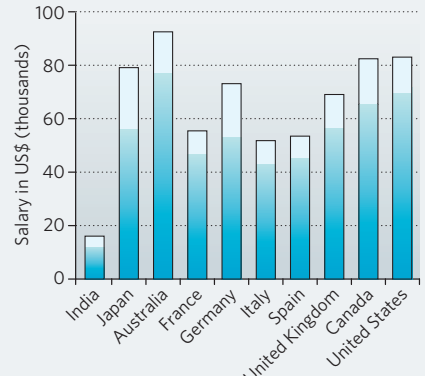
### PURCHASING POWER PARITY

By using a PPP index, salaries were normalized across countries to account for costs of living. The PPP calculation is based on the varying costs of an equivalent 'basket of goods' in each respective country.



### SALARY GENDER BIAS

Total bar denotes average male salaries; coloured area represents average female salary.



Salaries not adjusted for costs of living (except for PPP). SOURCE: (Happiness index) World Database of Happiness, Erasmus Univ. Rotterdam; (PPP data) Penn World Table, Univ. Pennsylvania.

## GENDER DIFFERENCES — AND SIMILARITIES

Although universities continue to try to close the gender gap (see *Nature* **465**, 832–833; 2010), it clearly persists in science, and perhaps nowhere is this gap more pervasive than with regard to income.

Men's salaries were 18% to 40% higher than women's in the countries for which we had significant sample sizes — Australia, Germany, Italy, Spain, the United Kingdom,

India, Japan, Canada and the United States. By comparison, in the 2009 publication *OECD Science, Technology and Industry Scoreboard 2009*, the Organisation for Economic Co-operation and Development found that the salaries of women with tertiary education (generally a college degree) were typically between 50% and 60% of the earnings of men with tertiary education in several countries worldwide.

Our data comparing income to years from degree suggest that the disparities grow over the course of men and women's careers. In Europe, men's salaries start to increase noticeably in relation to women's in the 3–5-year range, and in the 6–10-year range in North America (see 'Salary trends for men vs women').

Despite such discrepancies, overall job satisfaction levels among male and female

researchers were remarkably similar. A potential exception was India, where 62% of men reported being very or somewhat satisfied, compared to 45% of women, although our sample of female Indian researchers was modest.

Levels of overall satisfaction for men and women were also comparable across industry and academia: about 65% of both men and women said that they were very or somewhat satisfied. **G.R.**

(see [go.nature.com/trnIeH](http://go.nature.com/trnIeH)) that reports, on the basis of surveys, subjective levels of happiness in 146 nations worldwide. Some of the rankings correlated well (see 'Scientist satisfaction vs country happiness'). Denmark not only has the most satisfied scientists of the countries with sizeable samples according to our poll, it also has the happiest citizenry. This suggests that the 'background' influences of location and culture can sometimes have an influence on life and career satisfaction — and science professions are no exception. In other countries, however, scientist satisfaction was high relative to background happiness — France being the biggest example (note the dip in the happiness index relative to scientist satisfaction in the graph).

Which job attributes were the biggest satisfaction drivers? By comparing the average satisfaction scores for each of our eight factors with respondents' total satisfaction score, we found that "guidance received from superiors or coworkers" was the biggest influence overall on satisfaction levels. One possible conclusion here is that scientists crave guidance and mentoring, seeking assurance from others that they are likely to learn and progress — and they may place a higher premium on mentoring as science careers become increasingly competitive.

Salary was the second-biggest driver of satisfaction (see 'Salary disparities'). "Degree of independence" was ranked third as a determinant of overall satisfaction, but in general most scientists seemed satisfied with their freedom. The percentage of respondents who said that they were "satisfied" or "somewhat satisfied" with their degree of independence was less than 60% for only three countries — China, India and Japan. Science as a profession may have its failings, but our results reinforce the notion that many science careers do offer a reasonable and agreeable degree of independence.

We also wished to address how these satisfaction levels vary throughout the course of a career. We isolated four academic categories — postdoc, assistant professor/lecturer, associate professor and full professor — to determine how levels of

satisfaction changed from one to the next. We then compared the data for continents with sufficient sample sizes: Asia, Europe and North America (see 'Satisfaction by academic career stage'). The results indicate that satisfaction levels generally increase as careers progress, although in Europe they dip after the postdoc before recovering. An examination of our satisfaction data for individual attributes hints at an explanation. Two attributes in particular show different trends from postdoc to assistant professor/lecturer in Europe versus North America: salary and "guidance received from superiors or coworkers". The entry-level academic positions in Europe often pay less and lack the job security and support of their North American counterparts (see 'Salaries by academic career stage'). These factors become less of an issue at the full-professor level.

### Two-body challenge

Even if salary isn't at the top of many scientists' concerns, other lifestyle factors can make a big difference in overall satisfaction. Most scientists in Europe were relatively satisfied with their holiday entitlement (71% of respondents were very or somewhat satisfied) and with maternity/paternity leave (51% were very or somewhat satisfied). In North America, in contrast, 56% were very or somewhat satisfied with vacation time, and 41% with maternity/paternity leave. And the 'two-body problem' — the challenge of finding positions for both members of a couple when they are both researchers — casts a shadow over many scientists' careers, across continents.

Respondents were asked to what extent the two-body problem influenced how and/or when they had secured their most recent position. In several European countries, as well as in the United States, Canada and Australia, 20% or more of the respondents answered "very much" (see 'Two-body problem'). The numbers were lower for the Asian countries for which we had substantial sample sizes — China, India, Japan and South Korea. However, when we combine the numbers of respondents

who thought that the two-body problem was either "very much" or "somewhat" of a challenge for scientists generally, the results from the United States, Europe and Japan converge — a total of 48% of respondents in Europe responded "very much" or "somewhat", compared with 43% of US respondents and 54% of respondents in Japan.

The results may point to a worldwide need for more explicit institutional policies for easing the hiring of dual-career couples. A 2008 report, *Managing Academic Careers Survey*, from the Stanford University-based Clayman Institute in California, found that the main reason that women in academia (in this case, scientists and others) refused a job offer was because their academic partners were not also offered employment at the same location. The authors of that survey, which received more than 9,000 responses from full-time faculty members at 13 US research universities, urge institutions to develop a dual-career academic-couple hiring protocol to increase transparency, speed and fairness in hiring potential candidates.

But with the two-body problem and other trends, the data present as many questions as insights. For example, will the two-body problem worsen in regions with growing mobility and countries with growing scientific enterprises? What are the specific causes of changes in satisfaction, region to region, as scientists climb the academic career ladder? Stacy Gelhaus, chair of the US National Postdoctoral Association board of directors, wonders whether the gender disparity in salaries narrows if women without families are compared with men (see page 1006; see also 'Gender differences — and similarities'). These are among the many questions that will help determine the changing career patterns of scientists and the changing attitudes towards the science profession. ■

**Gene Russo is the editor of Naturejobs. Sara Grimme contributed to the study design and data analysis.**

**See Nature's commentary on salaries, page 1006. Coming soon: an online-only salary search box based on region, discipline and other survey data. Check [go.nature.com/RVvqWe](http://go.nature.com/RVvqWe) for more information.**