



ILLUSTRATION BY MIGUEL MONCK

## THE PRECARIETY OF POSTDOCS

The second article in a series on *Nature's* survey of postdocs worldwide uncovers a sense of instability and disenchantment. **By Chris Woolston**

**U**neasy and insecure, postdoctoral researchers worldwide are experiencing great distress around their career prospects, workload and workplace culture, among other issues, finds *Nature's* first-ever survey of postdocs.

The survey, which drew self-selecting

responses from 7,670 postdoctoral researchers representing 93 nations, sought to capture the major concerns facing these scientists. Respondents' chief issues are not new. For at least 20 years, postdocs have been identified by the US National Academies, the Organisation for Economic Co-operation and Development and others

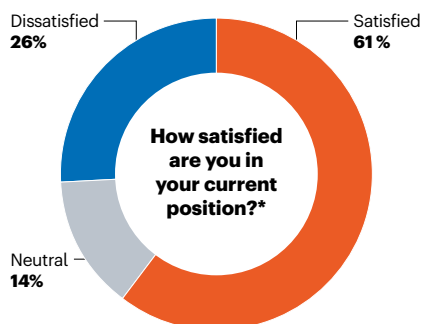
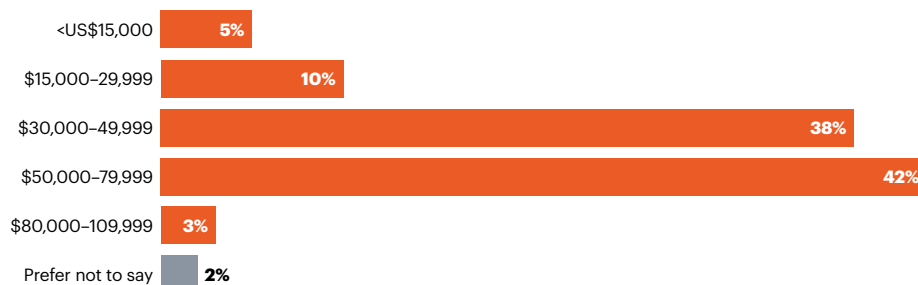
as part of the research precariat – those who work in positions with little job security, poor compensation and an unclear path to a permanent post.

Despite that uncertainty, postdocs continue to show up and put in their work. Six out of ten say that they are satisfied with their positions. They also tend to hold on to their

## ROOM FOR IMPROVEMENT

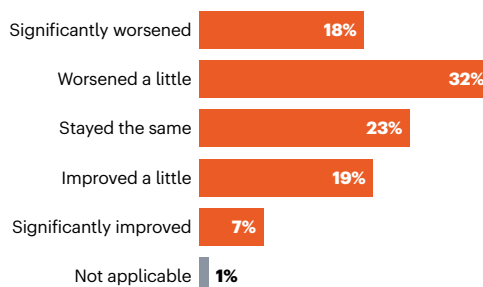
Most postdocs who responded to *Nature's* survey reported salaries in the range set by major funders. Yet overall, more than one-quarter are dissatisfied in their current role, and around half report that their level of satisfaction has worsened in the past year.

**What is your current gross annual salary/compensation (earnings before tax or other deductions) of your primary job?**



\*Percentages do not add up to 100% because of rounding.

**In the past year, would you say your level of satisfaction has...**



aspirations. Even in the face of a pandemic that is forcing universities around the world to cut positions or put a freeze on hiring, about two-thirds of respondents – and 80% of those who currently work in North America or Europe – still see academia as their preferred career destination.

The survey uncovered widespread concerns about the present and future: when asked whether their postdoctoral stint met expectations, 32% of respondents said it was worse than they expected, and just 12% said it was better. More than half, or 56%, have a negative view of their career outlook, and fewer than half would recommend a scientific career to their younger self. “There is a disappearance of options,” wrote one respondent in free-text comments.

The past year has been especially tough on postdocs. Half of survey respondents report that their job satisfaction declined in the past 12 months, a period that saw the emergence and spread of COVID-19 worldwide (for survey results on the wide-ranging impacts of the pandemic on postdocs, see *Nature* 585, 309–312; 2020).

This week, *Nature* gives an overview of the survey results. Two subsequent articles will explore respondents’ opinions on their quality of life – including their mental health and encounters with discrimination and harassment – and thoughts on their career prospects, a crucial issue for postdocs as they look ahead (see ‘*Nature's* postdoc survey’). The full

survey data sets are available at [go.nature.com/3tmckuq](https://go.nature.com/3tmckuq).

### ‘Nobody knows what postdocs are’

The survey shed light on fundamental questions: who are the postdocs of the world, and what do they think about their position? For this survey, responses were limited to postdocs in academia; *Nature* plans to look at postdocs in industry and other sectors in future surveys. Respondents came from across the scientific spectrum. More than

### “Postdocs are the most valuable component of a lab because of what they can produce.”

half, or 52%, work in biomedical science, a field that deeply depends on the postdoctoral workforce. “Postdocs are the most valuable component of a [biomedical] lab because of what they can produce,” says Anna Cousens, an immunologist at WEHI in Parkville, Australia (formerly the Walter and Eliza Hall Institute of Medical Research), and a former member of the executive committee of the Global Young Academy, a science-advocacy group based in Halle, Germany. “They are the hands-on researchers.”

In some fields, the concept of a postdoc can still feel nebulous. “Is it a path to

academia? Is it a research position?” asks Petra Hermankova, a postdoctoral archaeologist at Aarhus University in Denmark. “Nobody knows what postdocs are, so we have to struggle on our own.”

### Unsatisfying science

Struggles, in fact, are common among survey participants. More than one-quarter, or 26%, said that they were dissatisfied with their position. Half said that their level of satisfaction had worsened in the past year (see ‘Room for improvement’).

There were some bright spots: eight out of ten respondents said they found satisfaction through interest in their work, and three-quarters were satisfied with their level of independence.

Satisfaction varied by field. Sixty-nine per cent of respondents in ecology and evolution (who represent just 8% of all respondents) said that they were satisfied with their positions, the highest of any group. But when it comes to dissatisfaction, biomedical postdocs and physicists led the pack, at 28% each. Among biomedical scientists, 57% of respondents said they were satisfied and 14% felt neutral.

Biomedical research can be an especially demanding and pressure-packed field, says Natalie Sirisaengtaksin, a postdoctoral cancer researcher at the University of Texas Health Sciences Center in Houston. “In the biomedical field, you have to be in the lab, away from your family and whatever else you might want to be doing,” she says. “There’s only so much you can do from your desk, so every minute that you’re not in your lab is a minute that you’re not productive.”

The survey results suggest that satisfaction with postdoc life tends to dwindle with time. Younger postdocs aged 26–30 had the highest satisfaction rate, at 66%. Satisfaction was also relatively high (64%) for respondents who had been working as a postdoc for less than two years, but declined for those with more experience under their belts.

Postdocs are highly mobile. Sixty-one per cent of respondents said they were currently working outside their home country. Postdocs are often encouraged to pursue experiences in other countries, but the move can be challenging.

“People don’t understand the sacrifices we have made,” wrote a geneticist who moved from France to the United States. She added that she is especially worried about maintaining her visa at a time of great political uncertainty in the United States.

Such concerns are widespread, but the survey suggests that postdocs working overseas generally fare about as well as their peers working in their home countries. When asked to rate their level of satisfaction with their position, postdocs working outside

their home nations weren't any more or less content than others.

## Holding pattern

Postdocs usually work on short-term contracts – typically two or three years at a time – but many find themselves in a long-term holding pattern as they look for permanent work. In the survey, 48% of respondents said they had been working for more than three years as a postdoc. Thirty per cent said they had already completed two or three positions, a few reported having more than four or five, and some had done as many as six or seven.

Postdoctoral work is meant to be a temporary stepping stone towards a permanent position, says Rory Duncan, director of talent and skills at UK Research and Innovation (UKRI), Britain's research-funding agency. Duncan estimates that UKRI indirectly supports some 40,000 postdocs through its funding of labs and universities in the United Kingdom. "It should be clear to everybody, including postdocs and supervisors, that these roles are temporary and developmental," he says.

Kate Buckeridge, an ecologist at the University of Edinburgh, UK, started her first post-doctoral stint in 2010, and she's now wrapping up her fourth position. Her work on Arctic tundras has taken her to Canada, Greenland and Sweden, among other regions, but she has struggled to find a route to a permanent job. "I feel lucky to have worked on the projects that I have," she says. "I have more research experience than most starting faculty members." Yet, so far, her attempts to land a faculty position haven't panned out. "I wish I would have had the opportunity," she says. "I think I would have been an excellent colleague as a faculty member."

As a postdoc for a decade and counting, Buckeridge says that she has missed out on a sense of stability and continuity. She notes that it sometimes takes a couple of years to settle into a project, and by then it's almost time to leave. She has also observed that postdocs' options can be constrained. When she worked in Canada, she wasn't allowed to formally supervise PhD students who could help with her research, and, in the United Kingdom, she isn't allowed to apply directly for large grants that are reserved for principal investigators (PIs). "Wherever you are, there are limitations to being a postdoc that feel like a constant ceiling," she says.

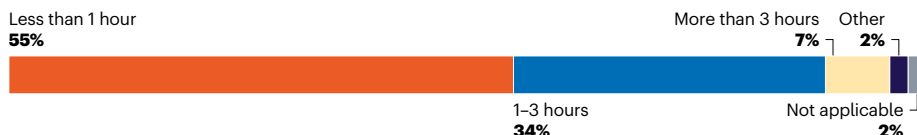
## Following the funds

Postdocs are in some ways defined by their sources of funding. Only 13% work directly for their institution; the rest occupy a grey zone between students and faculty or staff members. Forty per cent of respondents received fellowships from a funding agency,

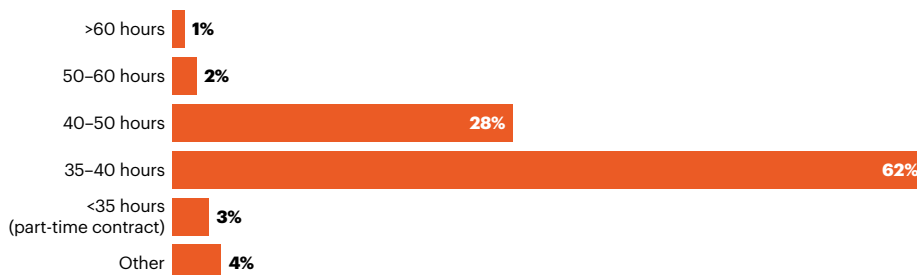
## TIME WELL SPENT?

More than half of postdoctoral researchers surveyed said they had little guidance from their supervisors. The majority reported working beyond their contracted hours, often at weekends, chiming with the 47% who feel their institution has a long-hours culture.

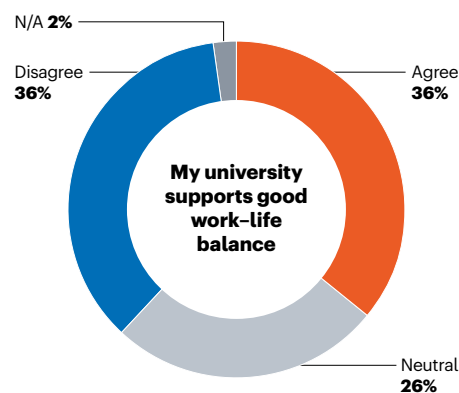
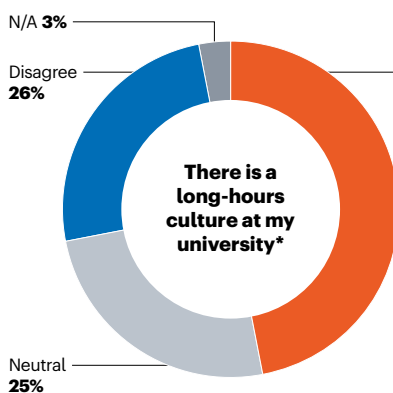
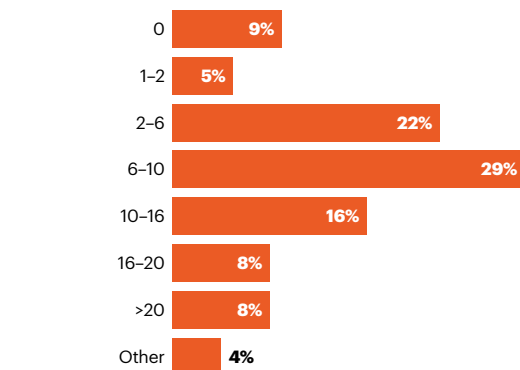
### On average, how much one-on-one contact time do you have with your supervisor/PI each week?



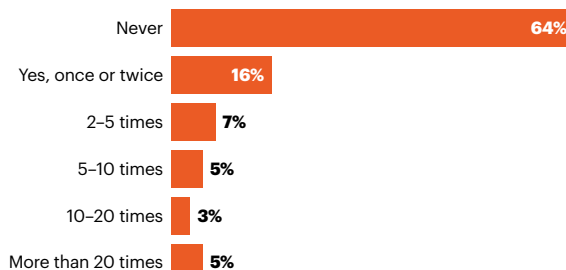
### How many hours a week are you contracted to work?



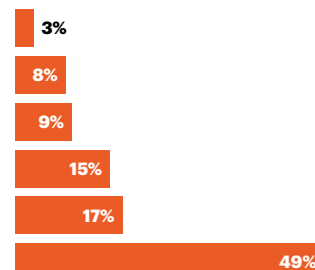
### How many hours per week, if any, do you typically work beyond those contracted?\*



### In the past year, have you ever worked: ...overnight in the lab?



### ...on weekends or on days off?\*



\*Percentages do not add up to 100% because of rounding.



and about the same proportion are paid from grants earned by their PI. Postdocs who have their own funding have already established a degree of autonomy, but they often aren't completely on their own. Postdocs in the hard sciences generally depend on their supervisors and institutions for supplies and workspace, Coussens notes. The arrangement can have important consequences for independence and ownership of the work and intellectual property. "You've built up your project and your skills base, but there's still a tension about whose project it is," she says.

Many postdocs don't feel true ownership of their work. Only 18% of respondents who have their own grants or fellowships reported that they could take their project with them if they changed institutions, and 29% weren't sure (figures based on further analysis of raw data). Responses varied by field: 31% of self-funded social scientists felt they could move with their work, significantly more than postdocs in biomedicine (17%) or chemistry (11%). Sirisaengtaksin says that she has at least partial ownership of her work, but that it took some negotiation. "I was hired with the understanding that I work on lab projects, but I could always spend time developing my own projects that I could carry somewhere else," she says.

Respondents reported little guidance or direction from their PI or supervisor. More than half (55%) said they spent less than an hour of one-to-one time each week with their lab head, and one-third said they had just 1–3 hours weekly (see 'Time well spent?'). "I worked at my postdoc for 1.5 years and met

with my PI face to face in person 3 times," wrote one respondent in free-text comments.

### Salaries and benefits

Postdocs are not always well compensated for their work. "You are expected to work for less than half the pay of an assistant professor, usually only a few thousand dollars more than the graduate students," wrote a US chemistry postdoc in free-text comments. "At the same time, we are held responsible for much more than any graduate student."

### "In some ways, it's more of a financial burden to be a postdoc than to be a student."

Fewer than half (42%) of respondents reported earning between US\$50,000 and \$80,000 annually, and just 3% reported greater earnings. Those numbers are in line with salary guidelines set by major funding organizations. For example, new postdocs with Intramural Research Training Awards from the US National Institutes of Health get annual stipends of at least \$52,850 a year. The survey found few differences between men's and women's salaries. Likewise, respondents who identify as members of minority ethnic groups did not report an income disadvantage.

At the lower end of the income ladder, 38% reported earning between \$30,000 and \$49,000 annually, and 15% of respondents said they earn less than \$30,000 a year. Income varied widely by region. At the top end, 84% of respondents in Australasia and 70% of respondents in North and Central America reported making more than \$50,000 a year. By contrast, only 29% of respondents in Europe and 13% of respondents in Asia reached that mark. The results from Europe echo a 2019 survey by the European Network of Postdoctoral Associations in Coimbra, Portugal, which showed wide disparities in postdoctoral income, with a median around \$38,000.

Some fields are better compensated than others. Sixty-three per cent of researchers in astronomy and planetary science – who accounted for 3% of all respondents – reported earning more than \$50,000 each year, the highest proportion of any field. A slight majority of all biomedical researchers – 51% – reported making more than \$50,000 a year. By contrast, 43% of researchers in social sciences and 36% in ecology and evolution made that much.

More than half of respondents (51%) said that they received no increase to their compensation in the past year, and 5% earn less than they did a year ago. In free-text comments, several respondents mentioned funding cuts related to the pandemic.

Biomedical postdocs aren't just working for

themselves – they also tend to bring in money for labs and institutions, says Sirisaengtaksin. "You put in the hours, you do the hard work to get publications that ultimately result in grants for your mentor," she says. The compensation still might not be enough to avoid financial hardship. She notes that, in the United States, many researchers have to start paying off student loans as soon as they earn a PhD. As she explains, biomedical postdocs get a modest bump in pay compared with graduate students, but they also face more costs as they try to establish their lives. "In some ways, it's more of a financial burden to be a postdoc than to be a student," she says. In the survey, 22% of respondents said they were unable to save any of their postdoc earnings. Another 48% said they could put aside some money, but not as much as they would like.

Benefits such as health-care coverage, retirement contributions and paid time off also vary widely – a reflection of postdocs' sometimes poorly defined position between student and full-time staff member. Eighty-four per cent of respondents said they received paid holidays, and 79% said they were eligible for paid sick leave. Slightly more than half said they had access to paid parental leave, but only 14% had the option of subsidized child care, an especially important issue for the 13% of respondents who said they had had a child during their current postdoc. Fewer than half (46%) of respondents said that they were satisfied with their pay and benefits.

At the University of Cape Town (UCT) in South Africa, postdocs are "treated the same as PhD students, even though they have a PhD", says postdoc Tara Edwards, a geologist. She explains that postdocs are not hired directly by the university, so they aren't entitled to the benefits that faculty and staff members enjoy. She says that she had more benefits – including four weeks of paid leave – as a PhD student in her home country of Australia.

A spokesperson for UCT confirms that postdocs are considered "academics in training", not staff members. They add that the university provides postdocs with "relevant academic privileges", such as access to libraries and computing services. Individual PIs might sometimes be able to provide benefits such as maternity leave on a case-by-case basis, according to the UCT spokesperson. "Issues persist, but the tide may be changing," Edwards says.

Whatever their job title, postdocs rarely receive the recognition and support that they deserve. "Postdocs do a whole lot of the work, but the PIs get the credit," Hermankova says. "Future postdocs ought to be recognized as a vital group that has opinions. I would love for their voice to be heard by the upper parts of academia."

**Chris Woolston** is a freelance writer in Billings, Montana.

## NATURE'S POSTDOC SURVEY

A series of four articles gives a snapshot of the workday lives of postdocs in academia.

In September, *Nature* reported survey results about how COVID-19 has affected postdocs and their views of the future. The second article in the series offers an overview of their circumstances worldwide. The third explores postdocs' quality of life, including mental health and experiences of discrimination and harassment. The final article examines respondents' sense of their career prospects, a crucial issue for postdocs as they look ahead. The survey, created together with Shift Learning, a market-research company in London, was advertised on nature.com, in Springer Nature digital products and through e-mail campaigns. It was offered in English, Mandarin Chinese, Spanish, French and Portuguese. The full survey data sets are available at [go.nature.com/3tmckuq](https://go.nature.com/3tmckuq).