

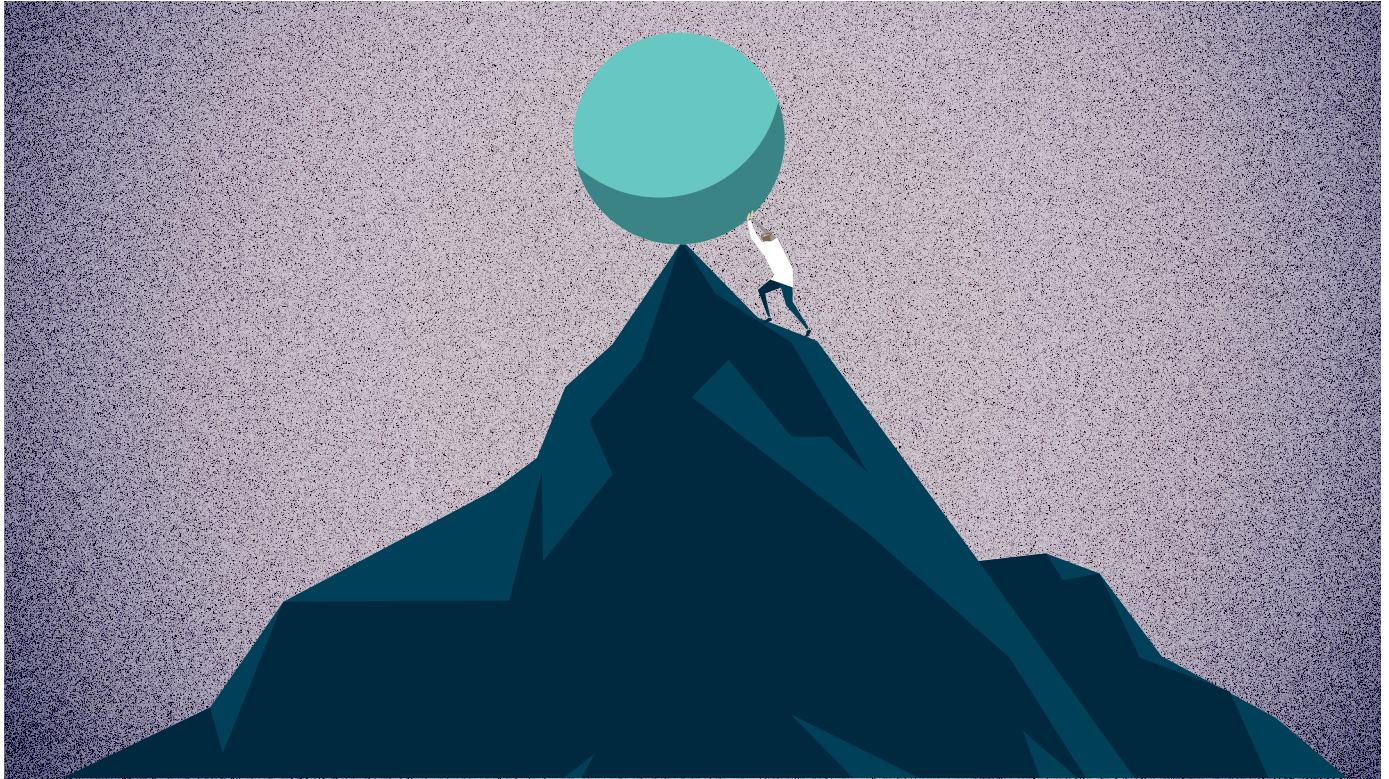
# CAREERS

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GRADUATE SURVEY

## A love–hurt relationship

*Nature's 2017 PhD survey reveals that, despite many problems with doctoral programmes, PhD students are as committed as ever to pursuing research careers.*

BY CHRIS WOOLSTON

Science PhD students love what they do — but many also suffer for it. That's one of the top findings from *Nature's* survey of more than 5,700 doctoral students worldwide.

The survey is the latest in a biennial series that aims to explore all aspects of PhD students' lives and career aspirations. Respondents indicated high levels of satisfaction with PhD programmes overall, but also revealed significant levels of worry and uncertainty: more than one-quarter listed mental health as an area of concern, and 45% of those (or 12% of all respondents) said that they had sought help for anxiety or depression caused by their

PhD studies (see 'A challenging road'). Many said that they find their work stressful, worry about their futures and wonder whether their efforts will pay off in earning them a satisfying and well-compensated career. For some, it's almost too much to handle. "Every university should have a special room reserved for graduate students to get some crying time in when they are feeling overwhelmed," said an ecology student at a US university, in the survey's comment section.

Responses also uncovered a strong, perhaps crucial, connection between a well-matched PhD adviser and the student's success. Good mentorship was the main factor driving satisfaction levels. Most respondents were happy with their adviser, but nearly one-quarter

said they would switch advisers if they could. Students can survive and thrive during a PhD programme — challenges and all — but they generally can't do it alone. "I'm a happy PhD student," a genetics student from South Africa wrote in the comments. "This life is difficult but it's what I've wanted to do my whole life, so it's worth it. I also have a fantastic supervisor who is understanding, helpful and ready to push me to the next level."

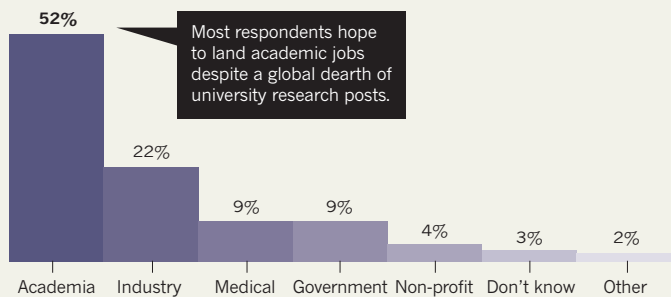
### WIDESPREAD STRUGGLES

The respondents to the 2017 survey came from diverse scientific fields and from most parts of the world. Asia, Europe and North America were all strongly and equally represented. The survey was advertised through ►

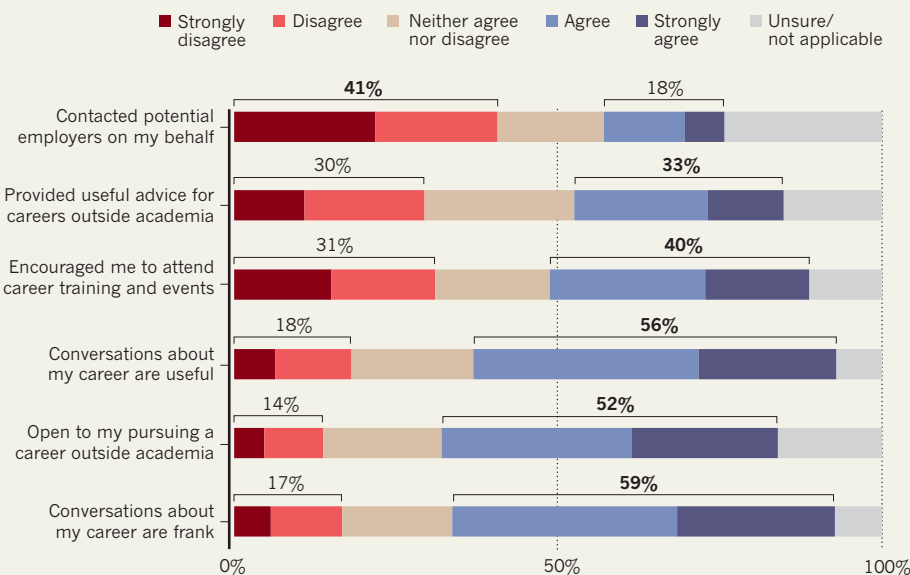
# A challenging road

Nature's 2017 graduate-student survey drew responses from more than 5,700 students — enough to capture both the challenges and rewards of PhD life around the world. Most are glad that they decided to pursue a PhD, even if many have second thoughts about their supervisors. But the journey is far from easy. Respondents worried about their responsibilities and the uncertain futures that await.

**Q** Which of these sectors would you most like to work in?

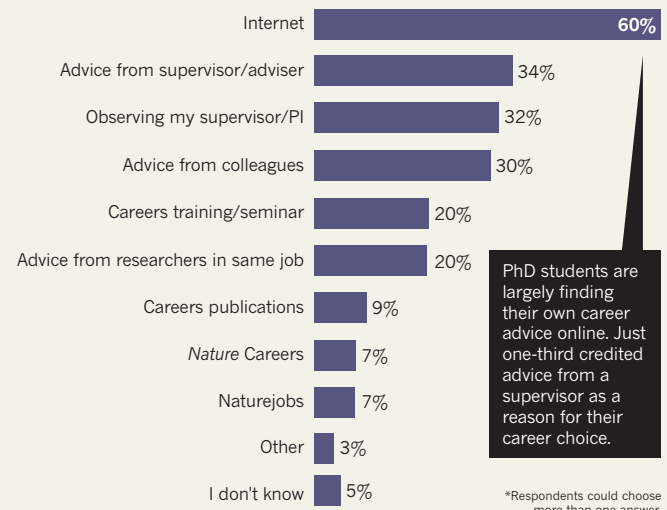


**Q** To what extent do you agree or disagree with the following statements regarding your current supervisor?



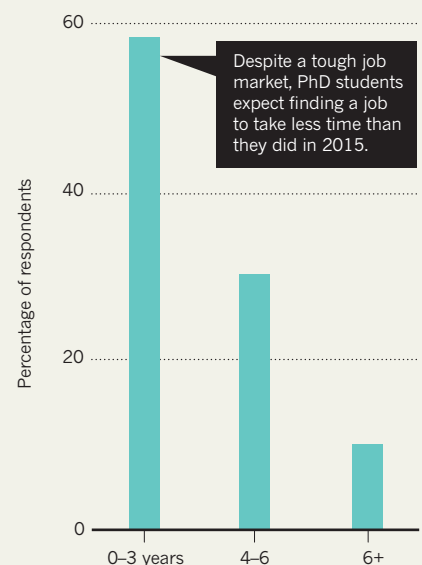
Some data have been rounded to the nearest per cent. Data-analysis services were provided by educational-research agency Shift Learning.

**Q** How did you arrive at your current career decision?\*



\*Respondents could choose more than one answer.

**Q** How long do you think it will take to find a permanent job?



► links on nature.com, in Springer Nature digital products and through e-mail campaigns. The data (which are available in full at [go.nature.com/2kzo89o](http://go.nature.com/2kzo89o)) were fleshed out by interviews with a small group of respondents who had indicated that they were willing to be contacted.

There were many positives. Overall, more than three-quarters of respondents were at least somewhat satisfied with their decision to do a PhD, a strong endorsement for such a massive commitment. That result closely mirrors those from other surveys of PhD students, says Katia Levecque, an industrial-relations specialist at Ghent University in Belgium. “About 80% of PhD students are satisfied

or very satisfied,” she says. “It’s a consistent finding in most universities.”

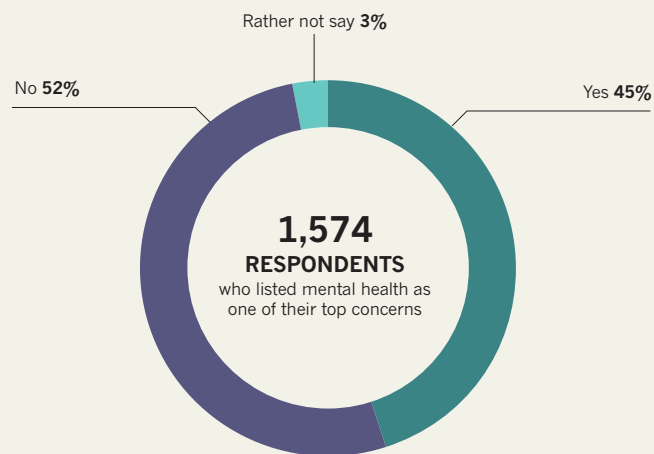
The fact that 12% of respondents sought help for anxiety or depression caused by their PhD underscores the stresses of the graduate student life, Levecque says. “You’re expected to take responsibility, but you aren’t given control over a lot of issues,” she points out. And because the 12% includes only people who sought help for their distress, it almost certainly understates the prevalence of anxiety and depression among all respondents to the survey.

The Nature survey also found that students with anxiety don’t always have an easy time getting help. Of those who sought assistance, only 35% said that they found helpful

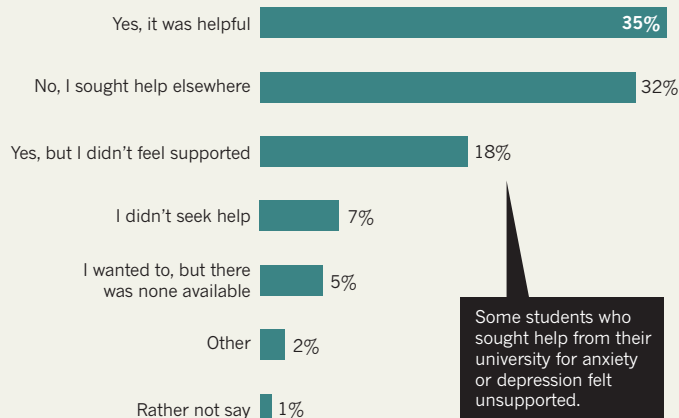
resources at their own institution. Nearly 20% said they tried to find help at their home institution but didn’t feel supported. “There are so many cultural and financial barriers to seeking help,” says Levecque.

In the Nature survey, nearly 50% of students who reported seeking help for anxiety or depression said that they were still satisfied or very satisfied with their doctoral programme. Kate Samardzic, who studies pharmacology at the University of Technology Sydney in Australia, was one of the hundreds of respondents who live with that apparent paradox. She’s satisfied with her programme, but she is also under considerable stress. “There’s a lot of uncertainty in becoming a researcher,” she says. “You’re under pressure to please your

**Q** Have you ever sought help for anxiety or depression caused by PhD study?



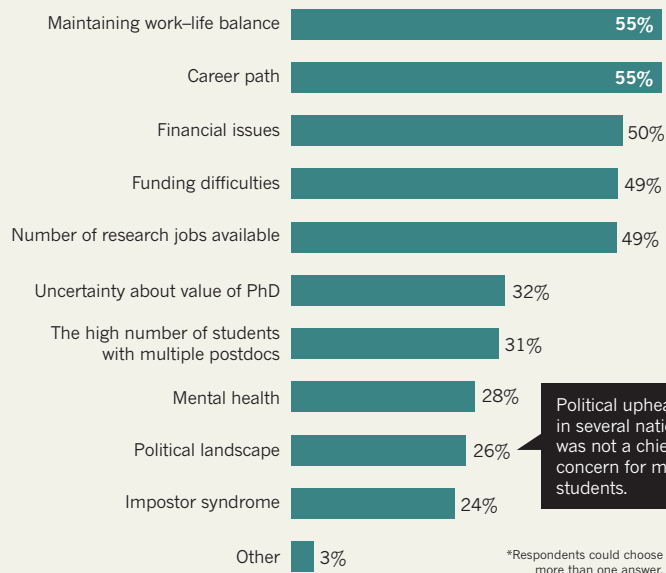
**Q** Did you seek help for anxiety or depression within your institution?\*



Some students who sought help from their university for anxiety or depression felt unsupported.

\*n = 709, this question was put only to those who had sought help.

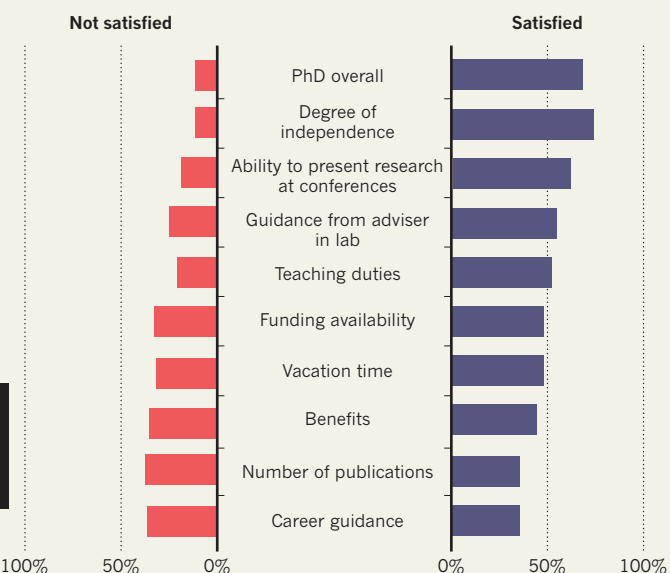
**Q** What are you most concerned about since starting your PhD?\*



Political upheaval in several nations was not a chief concern for most students.

\*Respondents could choose more than one answer.

**Q** How satisfied are you with the following:



adviser and do everything in a certain time frame. And you don't know what kind of job you'll get at the end of the day. I'm halfway through and I still don't know where it's going to lead."

Samardzic knows that she isn't the only one going through this. She had read a study published in March by Levecque and colleagues (K. Levecque *et al. Res. Pol.* **46**, 868–879; 2017) showing that PhD students were about 2.5 times more likely than highly educated people in the general population to be at risk of depression and other common psychiatric disorders. To tackle this problem, Samardzic, a student representative who serves as liaison to the university board, helped to form Research Resilience, a university group that holds

regular seminars designed to help students cope with the emotional toll of PhD studies. "I sensed that there wasn't enough support for people who are feeling anxious or upset about their PhD programmes," she says. "That should be more of a priority."

Research Resilience holds monthly seminars that draw 30–40 students. Recent topics have included tips on mindfulness and the pitfalls of impostor syndrome — the pervasive feeling that one doesn't really belong with the rest of the PhD crowd ([go.nature.com/2gtuftg](http://go.nature.com/2gtuftg)). "We're all high-achieving individuals, which makes us even more prone to those sorts of feelings," Samardzic says. Indeed, nearly one in four respondents to the survey listed impostor syndrome as one of the difficulties they face.

Among them was Andrew Proppe, who studies physical chemistry at the University of Toronto in Canada. Like Samardzic, he is satisfied with his PhD, despite hefty doses of anxiety. For him, feelings of alienation were exacerbated by the fact that, for a while, he also felt physically out of place.

Proppe had started a PhD programme at Princeton University in New Jersey, but left after about a year and a half because, despite having an excellent adviser, he didn't feel fully prepared for the programme or the town. He had grown up in culture-rich, populous Montreal, and felt disoriented in the relatively small town of Princeton. "It was no fun at all," he says. "I hadn't factored in how important the environment would be to me.

I gave up everything I had back at home to go out there, and it didn't seem worth it. I was unhappy."

Proppe's current adviser, Ted Sargent at the University of Toronto, was eager to add Proppe to his team. "He was working with one of the world's best physical chemists at Princeton, so he had some skills that were a clear benefit to my group." Proppe was also able to provide some insight into how his previous adviser ran his lab. "I asked him to engage in academic espionage," Sargent jokes. "You might think that after 20 years I have this completely figured out, but it's still an evolving process."

Returning to Canada helped Proppe to regain his footing, but it didn't completely remove the anxiety of PhD work. "I was running the day through my head," he says. "At three in the morning, I'd be thinking about data sets." Having never had to deal with much stress or anxiety before in his life, it took him a while to recognize the problem. Once he realized how much his PhD worries were affecting his life, he started to make changes. "I stopped trying to stay at work until 11, to instead make more time to play guitar, exercise and be with my girlfriend," he says.

#### AWORTHWHILE COMMITMENT

PhD anxiety can have a variety of causes. Among other issues, the survey uncovered widespread concerns about future employment. Only 31% of respondents said that their programme was preparing them well or very well for a satisfying career. But more than three-quarters agreed or strongly agreed that it was preparing them well for a research career, suggesting that many see a significant distinction between a research career and a "satisfying" career. And although two-thirds of respondents said that a doctoral degree would "substantially" or "dramatically" improve their future job prospects, one-third had a more tepid outlook.

Not all respondents are certain that the labour and stress of their programme will pay off. Hannah Brewer, a data scientist at the Institute for Cancer Research in London, says that she second-guesses herself whenever she Googles job openings in her field. "A lot of those jobs only require a master's degree, so I don't know if a PhD is going to help in any way," she says. Still, she's happy with her decision to get a doctorate. "I wouldn't do it differently if I could go back," she says. "I appreciate the level of skill that I'm working at, and I'm excited about my research."

#### IMPORTANT ADVICE

Mentorship contributed more to respondents' overall satisfaction with their PhD programme than did any other factor. Specifically, guidance from, and recognition by, an adviser proved to be the top determinant.

Yet, a sizeable proportion of survey respondents are unhappy with the mentoring

they receive. Beyond the 23% who said they would swap advisers if they could, nearly one-fifth of respondents, or 18%, said that they do not have useful conversations about careers with their advisers — the person who is uniquely well positioned to help doctoral students to identify their ideal career path and learn how to pursue it.

Respondents said that conversations with their supervisor about non-academic careers are notably absent. "My adviser looks down on non-academic jobs and thinks they're only suitable for people who aren't very motivated," wrote a chemistry student in the United States in the comments. Around 30% disagreed or strongly disagreed with the statement that their supervisor has useful advice for non-academic careers, about the same proportion as in *Nature's* 2015 survey of graduate students. Slightly more than half of respondents in this year's survey agreed that their supervisor was open to their pursuing a degree outside of academia, which also echoes findings from the 2015 survey.

Sensing an institutional indifference towards career development, Samardzic and other students have started organizing careers events in which graduates and other experts talk about their options. She helped to arrange a recent talk by a PhD student who had gone overseas for a workshop on entrepreneurship and biomedical innovation. "There needs to be more of that," she says. "I feel like I don't know about half of the jobs that exist out there."

The survey responses suggest that many PhD students lack a clear vision of their future. Nearly 75% of respondents said that they would like a job in academia as an option after they graduate, whereas 55% said that they would like to work in industry. That might partly be down to indecision: nearly half of respondents indicated that they were likely or very likely to pursue a career in either sector.

The strong interest in academia echoes findings from the 2015 survey in which 78% of respondents said that they were likely or very likely to pursue a career in academia despite a lack of job opportunities. The dearth was highlighted in an analysis published in 2015 (N. Ghaffarzadegan *et al. Syst. Res. Behav. Sci.* **23**, 402–405; 2015), which estimated that in the United States, there are on average 6.3 PhD graduates in biomedical sciences for every tenure-track academic job opening.

Doctoral studies don't seem to be prompting large numbers of students to rethink their commitment to research. Nearly 80% said that

the likelihood that they will pursue a research career has grown or remained unchanged since they launched their PhD programme — up from 67% in the 2015 survey.

With an already tough academic job market getting tougher, many hopefuls will need guidance. But that's not always easy to come by. Only 15% of respondents said that they found useful career resources at their institution, down from 18% in the 2015 survey.

To a large extent, students are serving as their own career counsellors. When asked how they arrived at their current career decision, almost two-thirds chalked it up at least in part to their own research on the topic. Just 34% credited advice from their adviser.

Laying some groundwork with an adviser early on can go a long way towards improving the PhD experience, Proppe says. After leaving Princeton for Toronto, he immediately had a direct talk with Sargent, his new adviser. "I asked all of the questions I wished I had asked when I first started graduate school," he says. By the end of the conversation, he had a good idea about how the lab operated, how often he'd see his adviser and how much supervision he could expect.

Alberto Brandl, a student in aerospace engineering at the Polytechnic Institute of Turin in Italy, knew his co-supervisors before he started his PhD programme. "I hoped they would be great mentors, and I'm very satisfied," he says. It helped that his advisers were very accommodating when his daughter was born, early in the PhD process. "They said it was a beautiful thing," he says. "I didn't take much time off, but they told me to take as much as I needed." He feels that his advisers give him just enough guidance to make his own decisions, instead of dictating every step. "It's the difference between a boss and a leader," he says. Brandl counts himself fortunate. "I know people who have abandoned their PhDs because of their mentors."

Survey responses can only go so far, and sometimes there's a deeper story beneath the data. Yissue Woo, a microbiologist at the Singapore Centre for Environmental Life Sciences Engineering, gave his adviser high marks, but says that he and his supervisor have had no career-related discussions. For now, Woo is too preoccupied with his studies and research to broach the subject with his adviser.

He also rated his PhD experience highly, but that's partly because he's learnt to take failures in stride. "I'm not new to research," he says, "so I'm not surprised by setbacks. When things don't work, I know that's just how it is."

Perhaps one student, who studies medicine in Israel, summarized it best. "Doing a PhD is hard and frustrating," wrote the student in the comment section. "But the small successes are worth it all." ■ [SEE EDITORIAL P.429](#)

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