CAREERS

REEF INSPECTOR Saving coral reefs and the sea life that depends on them **p.319**

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INSTITUTIONS

Small-school science

Researchers outside the big institutions face a unique mix of challenges and opportunities.

BY CHRIS WOOLSTON

Sometimes, downsizing pays off. After working as a postdoctoral researcher at large institutions including the University of California, Berkeley, and the University of Oregon in Eugene, evolutionary biologist Hélène Morlon now runs her own laboratory at the École Normale Supérieure (ENS), a small college tucked into central Paris.

Morlon is one of only seven principal investigators in the ecology and evolution section; Berkeley, by comparison, lists nearly 70 faculty members in its analogous integrative-biology department. Her section might be tiny, but Morlon maintains a global network of collaborators that keeps her connected. She also has no shortage of visitors, whether for a long stint in the lab or a quick conference talk. "It's easy," she says. "Even if we give them an economy ticket, they come because it's Paris."

The ENS is ranked by the London-based *Times Higher Education* as one of the best small universities (defined as having fewer than 5,000 students) in the world. But in common with all such institutions, its size is both a help and a hindrance. Researchers at small universities have fewer colleagues down the hall for conversation or collaboration, and this can lead to a sense of detachment in their field. On the other hand, it forces them out of their intellectual comfort zones. Morlon says that she has much more contact with colleagues in other disciplines than she ever had at a large university. "I've never before been to so many genomic and neurobiology talks," she says.

Scientists who are considering employment at small institutions will also need to modify their expectations when applying for large grants and setting timelines for producing publications. They must also take a highly focused, hands-on approach to building collaborations and dealing with lab and administrative tasks that researchers at larger institutions can usually delegate.

Still, for many (see 'Finding your niche'), small is the right fit. At Lincoln University in Christchurch — the smallest in New Zealand, with roughly 2,000 full-time students — environmental chemist Brett Robinson has learnt to rely on pluck and ingenuity to overcome a relative lack of resources. "At a small institution, we don't necessarily have all of the equipment or perhaps even the expertise that a large university would have," he says. "You have to find new ways of doing things instead of throwing up your hands and giving up. You need a can-do attitude."

That spirit became essential after an earthquake shook the campus in 2011, causing extensive damage to the university. "We operate under a tighter financial space because we have fewer students to support basic services," he says. "We don't have the economies of scale. That makes us more vulnerable in a crisis." After rounds of staff cuts in the aftermath of the quake, the university now seems to be financially stable enough to survive and move forward, Robinson says.

Where on-campus alliances or support are lacking, outside connections become crucial. Nic Bury, an aquatic toxicologist, recently moved from King's College London (where more than 27,600 students were enrolled in 2016) to the University of Suffolk (total enrolment about 5,000), in the small UK town of Ipswich. "I've had a lot of collaborations over the years, and I'll need to keep those alive," he says.

Robinson also relies on his networks to maintain connections with researchers at larger, more prominent organizations. "A lot of my collaborations are with European ▶

institutions, including ETH Zurich and the Institute of Soil Science in Vienna," he says. Some scientists at small institutions appreciate what they feel is a more laid-back culture than might prevail at a large university. Bury relocated to Suffolk partly for family reasons, but he is also comfortable with its environment. "

Yet the security of Suffolk comes with some sacrifice, particularly to his research programme. He anticipates teaching three or four courses every term, a load that will make it impossible to keep up the research schedule he's been used to. "At King's College, I had five projects running at a time," he says. "I'm going to have to cut that down to one or two."

Researchers at small institutions can also feel uneasy about their ability to win competitive grants. Karl Johnson, a neuroscientist at Pomona College in Claremont, California, says that his grants are consistently rejected. Pomona, a 4-year liberal-arts college, has an enrolment of about 1,600. "I keep getting turned down in the preliminary stages," he says. He suspects that the size of US liberal-arts colleges — enrolment is below 5,000 for each of the top 100 such institutions, as ranked by *US News and World Report* — puts them at a funding disadvantage. He acknowledges that his lab could never handle a big, complicated project, but he also feels that his ideas are worth funding. And without grant money, he can't afford the experiments that could validate his concepts and justify more funding. "Once you're out of the grant cycle, it's very hard to get back in," he says.

Bury shares these concerns. Scientists at larger institutions, which can support complex, high-profile projects, have an advantage when applying for European Research Council (ERC) grants, he thinks. He plans to seek money from other sources, but he's still thinking big. He has applied for a grant from the Biotechnology and Biological Sciences Research Council, a major governmental funding organization in the United Kingdom.

Researchers at small institutions devote a lot of time to teaching, both in and outside the classroom.

LINDA DAVIDSON/TWP/GETTY

But researchers from larger institutions don't necessarily have better luck winning ERC grants, according to the organization's most recently compiled data, covering 2007–13. The ERC doesn't track overall success rates for smaller institutions, but many such places have a strong record of winning grants.

The ENS won 15 grants out of 47 submissions over that period, a success rate of 31.9%. The Research Institute of Molecular Pathology in Vienna supports 200 scientists in 15 labs, but those scientists enjoyed a 71% success rate — the highest of any institution with at least 10 grant recipients. By comparison, the overall success rate for ERC applications was just over 10%. The council notes that it funds researchers at more than 600 universities and research centres of widely varying size. "The ERC is able to find excellence wherever it is and to offer opportunities to thousands of researchers regardless of the profile of their organizations," says Jean-Pierre Bourguignon, the council's president.

Researchers at small US universities have some specialized funding options. The US National Science Foundation (NSF), for instance, provides Research in Undergraduate Institutions grants to colleges that don't offer graduate degrees. The NSF funded 132 such grants in fiscal year 2015, at an average of roughly US$110,000 each. "NSF values the research and education proposals it receives from faculty at all types of academic institutions," says Suzi Iacono, head of the NSF Office of Integrative Activities. "The participation of researchers at different types of schools brings new perspectives, research approaches and ideas to the scientific community."

Still, scientists at smaller institutions don't always require a steady stream of grants to keep their labs running. Like many of his colleagues, Johnson operates his lab on a bare-bones budget. "I'm happy with my research productivity," he says. He works on *Drosophila* flies, which don't need a lot of expensive upkeep. And because Pomona is an undergraduate institution, he doesn't have to pay salaries to graduate students. Instead, he staffs his lab with undergraduates who, although short on experience, are long on enthusiasm.

But the absence of a larger lab team also means fewer hands to help out. Joshua Sandquist, a cellular biologist at Grinnell College, an undergraduate liberal-arts college in Iowa, says he's extremely busy, largely because he lacks people who can help him with mundane tasks such as performing statistical analyses or procuring lab supplies. "It's not everybody's priority to get your lab up and running," he says. He will have two undergraduate

HOT SPOT

Finding your niche

What does it take to win a position at a small institution? Karl Johnson, a neuroscientist at Pomona College in Claremont, California, offers some tips.

- **Hone your teaching skills.** If you can't teach, you can't thrive. Finding a postdoctoral programme that stresses teaching is a good early step in the right direction.
- **Work well with others.** Successful applicants must have several stellar letters of recommendation from supervisors. At a small institution, there's not much room for people who have trouble getting along.
- **Think small.** Your research subject can't be especially complicated or expensive — think fruit flies, not primates. And it must often be done during a 'summer break' of ten weeks or less. "We're looking for someone who can transfer their work to a small liberal-arts programme," Johnson says. "It has to be low-hanging fruit."
- **Go for grants now.** Even though winning funding isn't always a top priority at small institutions, a proven record of bringing it in is important for landing a job. C.W.

students in his lab this summer, and hopes that one will stick around once the autumn semester starts.

He has, however, been able to avoid one of the more odious aspect of scientific life: grant writing. "My institution doesn't require it," he says (although in 2014, he did win an NSF Major Research Instrumentation grant that allowed him to buy an infrared scanner to detect proteins). He thinks that his time is best spent on teaching and whatever research he can afford. "If you do win a grant, you're left with a bunch of work that you promised to do that you have to squeeze into your teaching," Sandquist says.

Indeed, small US liberal-arts colleges generally emphasize teaching above all else. "If you don't love teaching, you're going to be pretty miserable here," Johnson says. He spends 7–13 hours in class every week, and that's just a part of the load, which can include assembling a syllabus and selecting textbooks; developing lectures and lab sessions; and assigning and marking exams, papers and lab reports. "A lot of teaching takes place outside of the classroom," he says. And for Sandquist, even when he's in the lab, his highest priority is not necessarily churning out data and papers to further his own research career. "At a liberal-arts school, you're using your lab to train future scientists," he says.

Over the years, Johnson has given several presentations to early-career scientists about life as a small-school researcher, often as part of a panel on 'alternative' careers. "Some scientists see this as a non-traditional career," he says. "But it's funny. I'm more traditional than someone at an R1 [top research] school. I'm teaching, and I'm at the bench. A lot of people at major research institutions don't set foot in the lab any more."

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Some researchers might once have viewed small universities as a 'plan B' in case they couldn't land a job at a big-name institution. But that idea needs an update. "We get more than 200 applications for every faculty position," Johnson says. With so many applicants, Pomona and similar institutions can afford to be picky. Increasingly, they are looking for people who fit the small-school mould. It's another example of specialization in science. Young researchers should already be thinking about what size workplace would suit them best. ■

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TURNING POINT
Reef inspector

Since 2015, Terry Hughes has monitored coral bleaching — a result of rising ocean temperatures — at Australia's Great Barrier Reef. When reefs bleach, they expel crucial algae and can die. Hughes describes how, as director of the Australian Research Council's Centre of Excellence for Coral Reef Studies in Townsville, he is trying to save the reef, vital for marine life.

ARC CENTRE OF EXCELLENCE FOR CORAL REEF STUDIES/ANDREW RANKIN

What have the past two years been like?
It's been a whirlwind. The US National Oceanic and Atmospheric Administration and the Australian Bureau of Meteorology have each developed near-real-time maps to forecast the likelihood of mass bleaching. We saw it in 1998 and 2002. We knew by May 2015 that there could be a third event. The National Coral Bleaching task force — consisting of 300 researchers from universities and government agencies — formed in November 2015 to coordinate research into a potential third mass bleaching. We booked research stations, vessels and aeroplanes. I spent March to April 2016 and this past March aerially surveying the bleaching along the Great Barrier Reef.

Was aerial surveillance a risky approach?
Yes. That's why we also put 100 divers in the water in March and April 2016, who confirmed that our scoring of the extent of bleaching was highly accurate. We published a paper on that data — featured on the cover of the 16 March *Nature* issue (T. P. Hughes *et al. Nature* **543,** 373–377; 2017) — and then, two days after its publication, we boarded an aeroplane to assess coral bleaching for the second year in a row.

Can you publish findings before the next field season?
No. The back-to-back bleaching we are now seeing has overtaken our capacity to keep up.

What is the most difficult part of the research?
The uncertainty. We hoped that a bleaching event wouldn't happen, and there was a period in 2015 when the forecast said that it was unlikely. But that was followed by a period of rapid heating, so we had warning of only 2–3 weeks before we needed to conduct reef-bleaching surveys. Luckily, I had kept the bookings for the boats, so it was easy to fire up again.

How do you have such flexibility?
I direct a Centre of Excellence, a consortium of four universities funded by the Australian Research Council, equivalent to the US National Science Foundation. Our graduate programme has 210 PhD students. Because we have a seven-year block of funding, we can set up ambitious projects.

What was your best move as director?
Since 2005, when we established the centre, I've hired more than 100 postdocs. And I've hired more social scientists and people who work on the dynamics of institutions, governance, legal frameworks and international treaties. Knowing everything about the biology of coral reefs won't improve their governance.

Does the dire situation affect student interest?
Most of our PhD students and postdocs come from abroad. People are galvanized by this problem and the urgent need to address it. Still, it has the potential to be overwhelming. Many PhD projects have been disrupted by the heavy reef mortality.

Is there an upside?
It is, dare I say it, a research opportunity. I don't want to come across as taking advantage of ecological disaster, but we are learning a lot. In Australia, we have a lot of science around bleaching events but lack science-based policy responses. The elephant in the room is climate change.

Do you focus more on outreach to the public or to policymakers?
Both. We routinely give government briefings. In addition, when the National Coral Bleaching task force that I formed began gathering data, we put out press releases and blogposts about bleaching. We've taken some flak over releasing findings that haven't yet been peer reviewed. But we will continue to put out important preliminary results that we feel the government or the public should know about. ■

INTERVIEW BY VIRGINIA GEWIN

This interview has been edited for length and clarity.