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LAB BUDGETS

A numbers game

With careful planning, new faculty hires can stretch their start-up funds to launch successful research programmes.

BY HANNAH HOAG

When biologist Emily Standen was negotiating her start-up package for a post at the University of Ottawa in Canada, she retreated to her backyard to pace out the dimensions for her desired laboratory. Standen studies fish to understand the evolution of animal biomechanics. Her work demands large equipment, including a 700-litre flow tank, and she hoped to staff her lab with graduate students, postdocs and a technician. In her view, her potential for success was tied directly to having enough room for equipment, staff and bench space.

Standen's planning paid off. She got the lab that she wanted — at present, it is under renovation to make the floors impermeable to water. Now, she is spending her start-up funds to equip the space. In addition to the tank, her lab needs glassware, computers, software, furniture, hot plates, lab chemicals and more. She has looked for ways to stretch her budget wherever possible. "You're never going to get everything you ask for in a start-up," she says. "You'll get some of it, and then you have to be very careful about what you decide to spend it on."

Junior faculty members must work out how much funding they will need to get their labs under way and how to make the money last long enough to launch a successful career. Yet often, these researchers get little or no guidance on how to draw up a lab budget. Scientists who are aiming for the tenure track need to take a detailed look at the equipment their research plan requires — and find ways to economize. University start-up packages are meant to give newly hired faculty members the means to settle in, produce data and publish until they secure their first big grant. But the size of those packages varies widely across fields and between public and private institutions. In the United States, a tenure-track assistant professor in the biomedical sciences could receive around US$1 million; scientists in other fields can expect between $300,000 and $800,000. In other countries, packages tend to be smaller.

These funds must sometimes cover a broad swathe of outlays: materials and equipment, compensation for lab staff and graduate students, costs of conference travel and, occasionally, the scientist's summer salary. "It's an investment the institution is making in a young faculty member to help get them started," says Jim Kellner, a tropical-forest ecologist at Brown University in Providence, Rhode Island.

Making sense of what a lab needs — and how much it will cost — can be a bewildering process. "It required a lot of skills outside the set that I had developed as a postdoctoral researcher," says Lizzie Wolkovich, a global-change ecologist at Harvard University in Cambridge, Massachusetts, who runs a lab at the Arnold Arboretum in nearby Boston. She knew little about the tangible goods or the human-resources support that she would need to build a productive lab. "I was extremely adept at doing research, publishing and communicating some of my research, but I was not adept at determining how much money and resources it would take." But she learned from experience. "It's a fascinating new skill set. You get better at it, and I found it kind of fun," she says.

How does a job-hunting scientist know what to include in start-up negotiations? In Wolkovich's case, she asked her peers for lists of the items, funding and support that they had requested in their own packages. "The most important thing is to get example budgets," agrees David Kent, a stem-cell biologist at the University of Cambridge, UK. Next, he advises scientists to ask colleagues what they forgot to include. "They'll make the comment that if you don't build in conference travel, then you won't travel to conferences."

Although it can feel awkward to broach the topic of money, these kinds of questions pay ▶

off. "Two-thirds of the people I asked were willing to share, and a third were a little more cagey," says Stephanie Pau, a biogeographer at Florida State University in Tallahassee. She had never seen a start-up package until she reached out to contacts who had recently begun faculty positions. Seeing someone else's spending plan helped Pau to divide her own budget between equipment, computing, travel and graduate-student and postdoc support.

WHAT A LAB NEEDS

Advice from others goes only so far. The next step is to establish research priorities and 'must-haves' for the next few years. Standen walked through each of her planned experiments from beginning to end and listed every necessary sample, reagent, material and piece of equipment, down to the plastic basins that she uses for anaesthetic. Wolkovich's highest priority was to staff her lab, but a close second was to own a car dedicated to the research. "I had a good time asking people about the cars they would buy," she says. "Most own a really big truck. We bought a diesel station wagon and saved a lot of money."

To prepare themselves, scientists can monitor research costs and outlays long before they apply for an academic position. Alex Gagnon, a chemical oceanographer at the University of Washington in Seattle, did just that. During the last few years of his graduate programme, he made a spreadsheet to track the equipment, reagents and consumables that he used in the lab. Then, he researched the costs.

Human resources — not equipment or expendables — are often the biggest outlay. "You have to pay for qualified people," says Steve Prescott, a neuroscientist at the Hospital for Sick Children in Toronto, Canada. He previously held a junior faculty position at the University of Pittsburgh in Pennsylvania. In that job, he had earmarked part of his funding to hire a research associate who could help him to launch his programme quickly. Salaries for research assistants in the United States run upwards of $35,000 a year; in California's university system, a mid-level associate research professional can earn around $80,000.

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Prescott could have cut corners here, but it might have cost him. Skilled lab staff can help principal investigators (PIs) to chase down deals on equipment and reagents and complete time-consuming paperwork, thus freeing up time for the PI to apply for grants and do research. "Grant reviewers want to see that you are being independent and publishing on your own, and that's hard to do if you don't have enough people in the lab," says microbiologist Sunny Shin at the University of Pennsylvania's Perelman School of Medicine in Philadelphia. "Right off the bat, I was thinking about personnel."

EM STANDEN

Emily Standen with her new racks for housing fish.

Start-up packages are not always large. That is fine if the essential equipment is already in place. During his interview for a position at the University of Western Sydney in Australia, stem-cell biologist Michael O'Connor discovered that the job came with a dedicated cell-culture lab and brand-new equipment. "There was no need to spend any money there," he says. Other universities have core labs, which can help to eliminate the need for expensive purchases (see *Nature* **519,** 495–496; 2015). Kent, for instance, relies on flow cytometers to count and sort cells and to detect biomarkers, so he made sure that his job offer guaranteed access to local institutes with cytometry cores.

Newly hired faculty members can also economize by sharing equipment. Standen chatted with PIs in her department to find out what equipment they owned and might allow her to use. Lori Ziolkowski, a biogeochemist at the University of South Carolina in Columbia, talked to another new hire whose work overlapped with hers. They identified equipment that they both could use and that one or the other could buy.

COMPROMISE TO SUCCEED

Sometimes, difficult choices must be made. Kellner received a robust start-up package, but quickly realized that if he bought the helicopter drone and sensors that were required to establish a remote-sensing programme for his department, it would consume most of his budget. Ultimately, he spent his start-up funds on the aircraft equipment and used grants to hire lab staff. Similarly, when Ziolkowski realized that soaring lab-renovation and personnel costs would keep her from buying an expensive gas chromatograph, she revised her research plan and chose to purchase only some components at the outset. She will seek funding for the rest in another grant application.

And, of course, there is the time-honoured way to save money. Recycling, repurposing, scavenging — whatever you call it, finding second-hand equipment can help new faculty members to stretch their budgets. Patrick Osei-Owusu, a hypertension researcher at Drexel University in Philadelphia, Pennsylvania, grabbed equipment from a campus lab that was slated to close. His haul included an anaesthesia machine, a couple of microscopes and a dated DNA-copying machine — the same model that he had used during his postdoc. "These dinosaurs work really well," he says. He estimates that he saved more than $30,000 by scavenging. Two years into his job, he still has money to spend.

Established labs often have unused equipment gathering dust in a corner or squirrelled away into storerooms. Although he had budgeted $40,000 in his start-up package for a petrographic microscope to analyse minerals, Gagnon found one valued at a higher price — and with more features than the one he had planned to buy — sitting unused in a colleague's lab. He spent $8,000 to replace the cameras and bring it up to date, essentially getting a better machine for a lower price. Shin inherited two second-hand tissue-culture hoods, along with other equipment. She saved $50,000 overall, although she had to pay to fix some broken components. Asking around for small items, such as glassware or hot plates, can also prolong start-up funding. "People say, 'Oh, that's not much'—but $1,000 here and $2,000 there add up really quickly," says Standen. Many universities also have reuse facilities in which labs leave outdated equipment.

Ultimately, outfitting a lab is a balancing act. Newly hired PIs stand to learn much from those who have been through it before. "Talk to the silverbacks in the department, the folks who have been around and know how things work," says Standen. They might, among other things, be willing to share their own mistakes. Osei-Owusu, for his part, wishes that he had known more about the costs of animal care, which quickly consumed his operating budget. "Sometimes we're shy about talking to people because we don't want to appear ignorant," Standen says. "But the bottom line is that you are ignorant when you're just starting out." ■

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CORRECTION

The Careers feature 'The power of a pastime' (*Nature* **523,** 117–119; 2015) erroneously stated that one of Ryan Raver's thesis-committee members was reluctant to sign off on Raver's PhD. In fact, the comment about how Raver spent his leisure time was made long after signing off on the doctorate.