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WORK EXPERIENCE

Stepping stones

Internships can help scientist job seekers to get a head start on the competition.

BY AMANDA MASCARELLI

In late 2009, Mark Brown was at the end of a six-year postdoctoral position in parasitology at the University of California, Los Angeles. Having completed a PhD in molecular and cellular pharmacology, he was primed for a position in academia. But he hungered to move into industry. “I really wanted to take what I’d learned and apply it, and I felt that academia really didn’t offer me that option whereas industry did,” says Brown.

But the economy was in trouble and industry jobs in research and development were disappearing. Prospects looked grim. Brown learned about the Postdoc Professional Masters (PPM) at the Keck Graduate Institute of Applied Life Sciences in Claremont, California, one of the growing number of programmes that aim to provide practical, hands-on business savvy to

graduates with PhDs and medical doctorates who want to enter the biosciences industry (see *Nature* **469**, 569; 2011).

Before he started the course, Brown was keenly aware that he faced stiff competition from more-experienced job seekers. “It was going to be a hurdle to make that jump,” he says. “I did have a lot of technical skills, but I felt I didn’t have the experience that industry might want.” The two-semester PPM programme encourages students to participate in industry-sponsored internships, and Brown landed a placement with Claremont BioSolutions, a small company that develops research tools for scientists, based in Upland, California. The internship taught him about marketing strategies, developing a product and the culture of a start-up company. After Brown graduated from Keck in 2010, Claremont BioSolutions hired him as a senior scientist.

US researchers trained on the academic track are increasingly pursuing job opportunities outside academia. The US National Science Foundation’s 2010 Survey of Earned Doctorates found that only just over half of new, employed US PhD recipients across all fields hold research positions at academic institutions.

Yet conventional science and engineering PhD programmes in the United States don’t always provide the practical experiences and skills needed to make a transition to industry. The flagging economy and increased competition for fewer jobs has made preparation for the job market even more crucial. Internships — whether offered as part of a graduate degree or pursued independently — can provide necessary skills, look good on a CV and offer a taste of the world outside academia.

More and more young US scientists are pursuing internships and cross-training opportunities that will give them an edge. Outside the United States, they are already common: in Germany, for example, internships and applied industry experience are often integral to graduate training (see ‘Part of the package’). Many employers and educational institutions in the United Kingdom recognize the value of internships or placements for graduate students, notes Janet Metcalfe, head of Vitae, a research-career advisory organization in Cambridge, UK.

NOT-SO-ACADEMIC HURDLES

Internships take various guises. But they generally last from two to six months, often over the summer. Graduate or postgraduate interns are usually paid salaries comparable to graduate stipends and postdoc wages.

Academic programmes are increasingly enabling students to gain practical work experience through fellowships, interdisciplinary collaborations, traineeships and other forms of professional development. And internships may be directly related to a student’s research, or serve as segues to opportunities in areas such as communications, venture capital, law, clinical-trial management or intellectual property.

But even as awareness grows about non-academic tracks, many institutions and faculty members have not adjusted. Graduate advisers might not support internships that take time away from the student’s primary research — grant money is limited, and PhDs already take a long time to complete. Doctoral programmes, especially in the life sciences, don’t typically encourage internships, says Jung Choi, director of the bioinformatics master’s programme at the Georgia Institute of Technology in ►

► Atlanta. “There are all kinds of disincentives for both faculty and students,” he adds.

Sudipto Guha, a chemical-engineering PhD student at the University of Illinois at Urbana-Champaign, found that there was little precedent among his peers for seeking an internship. “It’s a rare case that you would find an adviser who would let you do an internship in graduate school,” he says. Yet Guha struck lucky: his adviser did support him, helping him to seek out opportunities and putting him in touch with companies. Guha networked aggressively, introducing himself to company representatives regardless of whether their firm offered a formal internship programme. This summer, he completed an internship at Brady Corporation in Milwaukee, Wisconsin, which develops identification solutions such as barcode labels and safety markings.

ALL IN THE PLAN

Some US institutions have formally recognized the need for internships and other practical experience. In 2008, after collecting survey results suggesting that many students were interested in opportunities outside academia but lacked confidence in how to pursue them, the school of medicine at the University of California, San Francisco (UCSF), teamed up with other UCSF basic and biomedical science graduate departments to launch the Graduate Student Internships for Career Exploration Program (GSICE).

“Our strategy was to convey the realities of where our graduate students are going in terms of careers, what our graduate students are interested in, and to remember that UCSF has the responsibility to train our students for fulfilling careers,” says Alexandra Schnoes, GSICE coordinator and one of two people who spearheaded the effort. Between January and March each year, students complete a series of workshops

designed to help them to pinpoint the career choices most suitable for them. They can then pursue internships either during their graduate programmes (after passing the programmes’ qualifying exams and receiving approval from their advisers) or immediately after finishing.

Bethann Hromatka, one of the first graduate students to benefit from the internship programme, parlayed her placement into a full-time job. By the end of her PhD in biomedical sciences at UCSF, Hromatka knew that she was not interested in a postdoc or academia in general. “I was getting burnt out on the bench,” she recalls. “In my last year I had that conversation with my adviser, and at the end of the day she understood.” In 2011, after



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Terri O’Brien

defending her PhD, she wrapped up her lab work on a Sunday evening. The next morning, she began a two-month internship at 23andMe, a personal-genetics start-up based in Mountain View, California. Hromatka’s internship consisted mainly of researching and writing genetic health reports for the company’s website — and last November, 23andMe hired her as a full-time health-content scientist,

with the same core responsibilities.

For those, like Hromatka, who have grown weary of bench work, internships can provide inroads into various career paths outside research and development. The University of North Carolina at Chapel Hill offers

S. PARIS

GERMANY

Part of the package

Some US institutions are only now starting to incorporate non-academic career paths into graduate training, but at many German institutions, that emphasis is integral to doctoral training. In the past decade, such efforts have received an extra boost.

In 2005, the government launched the German Excellence Initiative to support new strategies for research and graduate training (see *Nature* **487**, 519–521; 2012). It invested around €2.1 billion (US\$2.8 billion) in the programme’s first five years, and has now renewed it with another €2.5 billion for the next five years. Both phases have funded ‘research clusters’ and graduate schools at select institutions to foster international collaborations and

internships across disciplines.

That is part of a tradition of practical science-career planning in Germany. At the Technical University of Munich, for example, international internships are mandatory for all doctoral candidates and are backed with financial support from the university. The emphasis is on training for careers both inside and outside academia, says Ernst Rank, director of the institution’s graduate school. He points to surveys showing that some 80% of PhD students in Germany do not end up in academic positions. “Not one of our PhD students who graduates from our university would consider him or herself failed if they don’t make an academic career,” says Rank. **A.M.**

a technology-transfer internship that gives graduate students and postdocs the opportunity to learn about intellectual property, patent filings, licence agreements and technology commercialization through eight-month internships in the university's Office of Technology Development. Interns commit 8–12 hours per week to the training programme, which is carried out during the academic year, alongside the students' main research.

Cato Research, a clinical-research organization in Durham, North Carolina, runs a fellows programme offering doctoral students a one-year, full-time internship in clinical research and drug development. It acts as a sort of alternative postdoc and is becoming a popular choice, says Patrick Brandt, director of the office of science, training and diversity at the University of North Carolina, noting that in the past two years, an increasing number of students have come to him asking about fellowships in clinical-trial management.

At Stanford University School of Medicine in California, an internship programme for life-sciences PhD students is set to begin in 2013. Career-centre advisers will help students to seek out 10-week placements in fields such as biopharmaceuticals, venture capital and finance, consulting, law and journalism.

Internships don't usually lead directly to full-time jobs at the host company or internship site, says Terri O'Brien, associate dean for research strategy at the UCSF school of medicine. GSICE coordinators warn their students not to expect an immediate job offer, but they also point out that internships greatly improve the overall odds of landing a job. On the basis of preliminary data, the coordinators have found that more than 90% of their students who have done an internship successfully move onto their chosen career path after graduation, compared with 60% of those who have not. But most important are the insights into potential career tracks — and the confidence to pursue them. "We don't define success in an internship as meaning they get a job in that field," says O'Brien. "They may go through the GSICE programme's career assessment and training and realize they want another field. We're really trying to impact the career-decision process and the point at which it happens."

ANOTHER DEGREE?

Pursuing a further degree may help students to build the practical experience needed to move into industry or other non-academic career paths. This is the explicit purpose of the Professional Science Master's (PSM) and PPM programmes. Increasingly popular, these degrees generally involve up to two years of academic training and a professional component such as an internship or other type of cross-training opportunity in business, communications or regulatory affairs. The effect is "dramatic", says James Sterling, vice-president

for academic affairs at Keck. "PSM graduates have a foot in the door at these companies," he says, noting that each year, some interns do go on to get jobs at the same firm. Sterling says that 95% of graduates from Keck's PSM and PPM programmes find employment in industry within eight months of graduation — although sample sizes are small for the PPM, which is much newer. Keck PSM graduates usually have starting salaries of about US\$70,000, and Keck PPM graduates about \$80,000.



"Professional Science Master's graduates have a foot in the door at companies."

James Sterling

before if I wanted to go into a PhD programme or get a job. But after the internship I decided I definitely wanted to work in industry first," she says. The Venter institute hired Gupta last year.

Internships and other unconventional training opportunities complement, rather than detract from, students' research, says Richard Linton, National Science Foundation dean-in-residence at the Council of Graduate Schools in Washington DC, a national organization that promotes graduate education and research. Students who build industry connections will often create valuable collaborations, bring new expertise to their academic labs and gain access to facilities that reinforce their projects, he says. "Data suggest that these non-traditional tracks actually elevate student productivity and give them more motivation to complete their degrees and move forward into careers," says Linton. "There's much evidence that this is an enhancement, not a barrier, to degree completion." ■

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CLARIFICATION

In the article 'Turbulent times' (*Nature* **488**, 685–688; 2012), we referred to research conducted by Ruth Müller. The work was done while she was at the Department of Social Studies of Science at the University of Vienna, in a team headed by Ulrike Felt.

EMERGING NATIONS

Scientists wanted

Researchers are in demand in east Asia, Latin America and southern Africa — regions not considered traditional scientific powerhouses — where doctoral-degree holders tend to leave academia for government or the private sector, says a report. *CODOC — Cooperation on Doctoral Education Between Africa, Asia, Latin America and Europe*, published on 4 October by the European University Association (EUA) in Brussels, examined international collaboration across fields at universities to assess efforts to build research capacity. It documents ample international collaboration at universities in east Asia and an increasing number in Brazil and Mexico, but notes the need for more research investment in southern Africa to expand such efforts. Thomas Jørgensen, head of the EUAs council for doctoral education and author of the report, says that increasing collaboration hasn't made it any easier to retain academic faculty members at universities in the three emerging regions. But early-career scientists who are willing to leave their home countries can find posts that match their research specialities, he says. "The need for early-stage researchers is desperately there," adds Jørgensen.

EUROPE

Misconduct policy

The European Research Council (ERC) has issued a strategy for identifying and addressing scientific misconduct — the first such policy on the European level. Under the strategy, released on 9 October, host institutions are responsible for detecting, investigating and adjudicating on suspected breaches of research integrity or misconduct by ERC-funded researchers or applicants for ERC grants. But the research council, based in Brussels, will also take action once institutions confirm cases of misconduct or questionable research practices: among other steps, it may notify the European Commission and the commission's anti-fraud office, hold a hearing, suspend or terminate grants or refuse further grant proposals. Since the ERC was launched in 2007, it has issued some 3,000 grants and handled between 10 and 20 allegations of misconduct, says ERC vice-president Pavel Exner. On 17 October, the InterAcademy Council in Amsterdam and the InterAcademy Panel in Trieste, Italy, released *Responsible Conduct in the Global Research Enterprise: A Policy Report* to promote research integrity.