Cell

Learning to Lead

A successful research career requires not only an aptitude for science but also the mastering of other skills including communication, management, and grant writing. A growing number of programs at universities and research institutes aim to teach these crucial skills to graduate students, postdoctoral fellows, and junior faculty.

Graduate students spend years developing the research capabilities they need to conduct good science, but when they finally arrive at a laboratory of their own, they can quickly discover that heading a lab also demands know-how beyond the bench. "It's daunting," says Hopi Hoekstra, an assistant professor at the University of California, San Diego. "You're thrown into this situation where all of a sudden you have to manage people and money and your time and you haven't been trained for that." Management skills are just the beginning—research ethics, peer review, and communication are other aspects of a principal investigator's job that have rarely received formal attention in graduate and postgraduate programs.

In Europe and the US alike, there is a growing recognition that budding scientists could benefit from more training in the broad career skills they will need to excel. Peter J. Peters, dean of postdoctoral affairs at the Netherlands Cancer Institute (NKI) in Amsterdam, surveyed attendees of the NKI's 2005 retreat for postdoctoral fellows. He found that a mere 33% of the 135 postdocs surveyed reported receiving helpful training from their mentors in grant writing. Only 50% of respondents were happy with their principal investigator's efforts to teach them how to succeed as a scientist. Indeed, the NKI postdoctoral retreat was designed in part to provide some of the professional development workshops that postdocs crave.

Programs to address long-neglected career skills are springing up on both sides of the Atlantic. The last few years have brought a strong push in the UK to incorporate into graduate training programs courses on topics such as management, writing scientific papers, entrepreneurship, and scientific presentations, says Claudio Stern, head of the department of anatomy and developmental biology at University College London, where students now have the opportunity to take courses in these areas and more. "Almost all funding bodies these days insist that training grants can only be given on the condition that these things are taught in formal way," says Stern.

In 2002, the Burroughs Wellcome Fund (BWF) and Howard Hughes Medical Institute (HHMI) partnered to offer a course in scientific management designed to teach junior scientists how to run a successful laboratory. The three and a half day course covered everything from negotiating a faculty position to hiring lab personnel, project management, funding, publishing, and technology transfer. The course was held again in 2005, and in an effort to make this training more widely accessible, the course's creators developed a manual, *Making the Right Moves: A Practical Guide to Scientific Management for Postdocs and New Faculty*, available for free on the HHMI website. Faculty members from diverse institutions were invited to attend the 2005 course at HHMI headquarters in Chevy Chase, Maryland as observers so that they could create similar programs back home.

John Galland at the University of California-Davis was one such observer, and he used ideas drawn from the BWF-HHMI course to spearhead his university's new Laboratory Management Institute (LMI). The institute accepted 22 postdoctoral fellows into its year-long certification program last October, and those who complete all five courses—which cover health/safety, compliance, leadership, management, and ethics—receive a certificate and 14 hours of university credit. This summer, LMI will offer a three-week certification program for postdocs, faculty, graduate students, and anyone else with an interest in lab management, and the summer program will be open to people from outside California. Galland is currently seeking additional funding and hopes to expand the program, with the eventual goal of making LMI a national resource for researchers in academia, industry, and government.

Ideally, scientists-to-be should start their professional training during graduate school, says J. Charles Eldridge of Wake Forest University School of Medicine. With a grant from the National Science Foundation (NSF), Eldridge and his colleagues are developing a course to introduce graduate students to ethical dilemmas they could face as research scientists. The course is not just about cheating or plagiarism, "This is about the culture of science, and ethics is a big part of this culture," Eldridge says. For example, "If I have a clone or antibody, do I have to give it to everyone who asks? If I do give it to someone, do they have to put me on their paper? This is not part of classroom learning, yet this is as important for their professional success as is the book learning," says Eldridge. Beginning this summer, graduate students will meet in groups to discuss case studies that touch on issues such as stem cells, conflicts of interest, working with industry, patents, and the peer review process.

At North Carolina State University in Raleigh, ethicist Gary Comstock

leads an NSF-funded program called Land Grant University Research Ethics (LANGURE), a coalition of eight public universities that have teamed up to develop interactive modules for teaching research ethics to doctoral students. Over the course of the three-year NSF grant, Comstock and his colleagues will develop texts, case studies, and reference materials that smaller universities can deliver to their graduate students online. Another online course has been developed by the University of Pennsylvania. Postdoctoral fellows are able to explore difficult ethical situations by participating in this mandatory online course that covers issues ranging from the sharing of reagents to data confidentiality and the peer review process. "We had bioethicists write case examples with no black and white answer, then we ask individuals how to handle it, giving them five or six choices," says Trevor Penning, associate dean for postdoctoral research training at the University of Pennsylvania. Participants select a choice, and then they receive a histogram showing what other participants answered, along with a bioethicist's take on what the correct answer should be, Penning says. Postdoctoral fellow Ivonne Vidal Pizarro has taken both the online course and a classroom version and notes that whereas the online class covers similar content, "It's not as powerful as doing it with a live person where you can discuss the issues with other people." At the same time, she says, the online course has the advantage of being available around the clock, a serious plus for busy postdocs.

Across the Atlantic, graduate students at the European Molecular Biology Laboratory (EMBL) in Heidelberg take a one day module called Good Scientific Practice, which discusses plagiarism, co-publication, data sharing, and other ethical issues facing scientists. "This course is taught in the first year, when the students are fresh at the institution," says Anne Ephrussi, EMBL's dean of graduate studies. "We think it's important that they understand from the beginning what the standards are."

At the Watson School of Biological Sciences at Cold Spring Harbor Laboratory (CSHL), graduate students practice scientific writing and ethics in a single course, Scientific Exposition and Ethics (SEE). "A million ethical questions arise when you write a paper," says William P. Tansey, director of graduate studies at CSHL. "Who should be an author? What's preliminary data? What's a publishable unit? How much spin do you put on a particular angle?" Ethical issues are "something you're dealing with on a daily basis as a bench scientist and we focus on these day to day ethics," says Tansey. Second-year CSHL graduate student Galen Collins says the course taught him how to present data in an honest and effective way. Fellow second-year student David Simpson says the course gave him practical experience that he has already put to use. "Learning how to write a grant early in my graduate career was critical—it gave me the confidence to approach any topic and propose a series of hypotheses and experiments to answer the open questions in the field," he says. "To date, I have already written two grants and given several presentations and each time I find myself going back to the basic principles I learned in SEE. I even find myself enjoying the process," says Simpson. He points to guest lectures by journal editors, lawyers, and other experts as one of the course's most effective components. "Learning how the system really works from the perspective of the people within the system—what a journal editor does, how incredibly long the patent system takes, or just how subtle scientific misconduct can be—were eye-opening experiences," says Simpson.

Peer review is another facet of scientific life that may seem mysterious to the uninitiated. Most people learn about peer review by observing a mentor participate in the process, but students at Harvard Medical School may soon gain first-hand exposure to peer review in a new course being designed by cell biologist David L. Van Vactor. The course is still in the development stage, but Van Vactor's vision for the class involves two components. "The first half will be devoted to standard, lecture-style discussion about the process of reviewing from the time the paper reaches the reviewer to the rebuttal process," he says. This portion of the course will include guest appearances by journal editors who will explain the editorial process. A second, more ambitious, section of the class will, Van Vactor hopes, involve a small, team-based approach to reviewing actual manuscripts. "We're negotiating with a couple of journals, the idea being to get permission to review actual live manuscripts that are in review," he says. Students would be assigned a faculty mentor to guide them through the review process, and the student comments would be submitted to the paper's authors as supplemental reviews. "Students would be on call, waiting for re-submission and rebuttal, and then they would re-convene and provide final comments," says Van Vactor. The details are still being worked out, but Van Vactor is hopeful he can get permission to go ahead with the idea. "If we're successful in convincing journals and authors to be brave and let students do this, it could drive students to engage at the highest level and with the kind of responsibility that every reviewer takes on," he says.

Learning to handle such responsibilities early on can ease the transition to one's first faculty job, where challenges can quickly pile up. One of the first tasks facing a new principal investigator is hiring lab personnel. As a new lab head, "You just want to get started and find a group of people," says Peter Espenshade, an assistant professor at Johns Hopkins University School of Medicine who attended the BWT-HHMI scientific management course in 2002. He says the program helped him appreciate the importance of taking the time to ensure that the people he hired would mesh with the tone he wanted to create in the lab. "It's not a good decision to just add a new person to the lab," says Espenshade. "Things can be worse with an extra person. Harmony in the lab is key to productivity," he says.

As part of the management course, Espenshade took the Myers-Briggs personality test, which quantifies the taker's personality characteristics. He found the test so insightful that he asked his graduate students and lab technician to take it too. "They thought it was a little hokey, but the course showed me it could be important," he says. The Myers-Briggs test helped his lab members see that, "Some of the little annoying things were really the result of personality differences," Espenshade says. Though he has not used the test every year, he says doing it initially, "established a tone that has worked."

But even the best efforts cannot stave off every potential conflict, and when conflicts arise productivity can take a nosedive. "I'm starting to realize that doing good science depends on being able to manage different personalities in your lab," says Hanne Varmark, a postdoctoral fellow at the University of Massachusetts, Worcester. Yet like most postdocs, Varmark has never received any formal management training. She isn't complaining and says she has picked up quite a few ideas by observing her mentors and colleagues. "My situation reflects what most people experience," she says. But now some institutions are playing with more overt ways of teaching conflict management to scientists-in-training.

At LMI, Galland and his colleagues teach conflict resolution with a program called LabAct. Attendees anonymously scribble down descriptions of a conflict in the laboratory. A facilitator randomly draws the scenarios from a hat, then professional actors from the school's drama department act out the incident. "The scene will illustrate the issue, and then there is a discussion about how the issue could have been resolved differently," says Galland. The actors then re-enact the situation using the proposed solutions. "It's a way each forum participant can practice resolving issues, without having to get up and act, but often what happens is participants will want to get up and join in the fun," he says. "We're giving actual practice in identifying, minimizing and resolving laboratory issues, and what's unique is that the problems are coming from the participants, so they're real," says Galland.

At the University of Pittsburgh's new Scientific Management and Leadership course, attendees receive critiques of their interactions with others in the laboratory where they are currently working. The program's innovative 360° Skillscope evaluations are conducted electronically and confidentially, says Joan Lakoski, associate dean for postdoctoral education at the University of Pittsburgh School of Medicine. "Your peers, your supervisors and the people you supervise give confidential feedback on your perceived areas of strength and areas for improvement. It allows you to compare your own assessment of yourself with what others say," Lakoski points out. Working in break out groups, participants use the evaluations to develop a plan to improve their performance. "I learned a lot about myself," says Birgitte Wittschieben, a junior faculty member at the University of Pittsburgh Cancer Institute, who participated in the Scientific Management and Leadership course in March of this year. "It's a type of evaluation most faculty never get."

Sometimes faculty members do receive feedback on their mentoring skills, but few have any formal training in this area. Hoekstra says the BWT-HHMI course's discussion about advising styles gave her valuable insight into how to become a better mentor. "I thought all my students would be like me and need to be mentored in the way I needed to be mentored, but this course made it clear that that's not the case. You can't do it one way for everyone," she says.

Likewise, the BWT-HHMI course's section on time management proved so useful to Hoekstra that she returned as a panelist for this portion of the 2005 course. "Being able to manage your time wisely is crucial," she says. "All of a sudden you have 10 times more commitments, like committee work and faculty meetings, that you didn't have to face as a postdoc. You have to learn to carve out blocks of time," she says. "Learning to say no early is really important. As a new professor I was so enthusiastic that I wanted to do everything and saying no was a challenge." But she soon realized that managing her time was essential to keeping her productivity high. "I'm not afraid to shut my door anymore," she says.

Among the most valuable insights that participants of career management courses gain is the realization that success in science requires attention to details beyond the bench. Espenshade says the BWT-HHMI course helped him to see that managing a laboratory is akin to running a small business and going at it with that mindset, he says, has helped him do a better job. He didn't leave the course with solutions to every challenge but says he came away with "confidence that I'm doing things the right way."

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