PERSPECTIVE

Teaching Scientists to Teach

We should train graduate students to be educators as well as researchers.

By Jo Handelsman

Imagine if music schools trained pianists to play with only the right hand, leaving them on their own to figure out the left hand's responsibility. Ridiculous? Yes. But that is not unlike the way research universities train scientists.

On the one hand, so to speak, research-university graduates excel at doing science, given their institutions' focus on rigor, intensity and high standards in the practice of scientific research; on the other hand, they emerge largely untrained to teach science—to the public, to students generally and even to the next generation in their own fields—simply because graduate programs pay little attention to teaching scientists to teach.

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The future scientist's teacher training, such as it is, is a casual and ad hoc affair with little design in the process or passion in the delivery. Some students serve as teaching assistants or mentors for undergraduates; others don't. Some receive supervision while engaged in teaching activities; others are left to learn—or flounder—on their own. It is unimaginable that students would complete the nation's best graduate science programs unable to deliver a compelling research seminar, defend an experimental design or write a scientific paper. Likewise, we ought to require that our graduate students also know how to craft a lecture, design a pedagogically sound learning exercise, successfully mentor an undergraduate student and communicate science to broad audiences.

In short, as we train the next generation of scientists, we should help students develop skills as educators—and expect that in that pursuit they would aspire to the same levels of knowledge, creativity and spirit of experimentation that we require of their research.

Whether they formally teach or not, scientists need to explain and make science compelling to nonscientists—industrial managers, government policymakers, patent examiners, the world. Every researcher has a responsibility to share his or her results with the public that supports the research and uses its products. With sound instruction in the art of teaching, scientists will be much better equipped to meet this responsibility. And those who enter the professoriate, where teaching is an explicit job requirement, will do so with skill and grace, having developed a theoretical framework about learning, cognition and the objectives of science education as well as a toolbox of teaching techniques to draw upon. Thus, strong teaching skills strengthen a Ph.D. scientist's career, whatever direction it may take.

Jo Handelsman *is an HHMI Professor at the University of Wisconsin–Madison. Her research focuses on the structure, function and networks of microbial communities.*

Scaffolding for Growth

Some might say there is no spare time in graduate education—for graduate students to master their discipline's rapidly expanding knowledge base is challenge enough. But training students to teach will not add years to their degree programs. Just a single semester of learning and practicing teaching as part of an intense, supportive and critical community, can build ample scaffolding for a student's future growth as a teacher. And for graduate students who are flagging or unfocused, successful teaching may renew a love of science. Their teaching can stimulate them to spend more time in the lab, plan their work with greater care and effectively direct the resources available, including the undergraduates they mentor.

Graduates of U.S. research universities become faculty at both undergraduate education institutions and research universities. Thus, if their own mentors embrace the goal of training graduate students in the art and science of teaching, the effect will cascade through the higher-education system. Such reform would improve the education of undergraduates at all institutions of higher learning, leading to a citizenry that not only has an enhanced sense of the power and limits of scientific inquiry but can also profit from the intellectual and experimental foundations of that inquiry. Programs by public and private agencies, including the HHMI Professors Program, help stimulate such important reforms.

We need to adjust our priorities and correct this historic imbalance of learning how to practice science but not how to teach it. In so doing, we will educate an entirely new generation of scientists who offer improved classroom teaching and more accessible public communication about science. That, in turn, will foster more informed discussion about the myriad science-rich issues that are unfolding before us at an ever-escalating pace, and wiser use of our country's resources, both material and human.

Research universities should raise a generation of future scientists who, like pianists who play with both hands, practice their art with a dynamic complement of skills, to the great benefit of society.