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GRADUATE EDUCATION

Student Survey Highlights Mismatch of Training, Goals

Biochemist Timothy Dore is living his dream. After earning his Ph.D. from Stanford University in 1998 and doing a postdoc at the University of California, San Diego, Dore began a tenure-track job last fall at a major research university.

But fewer and fewer of his colleagues can say the same. A new report, based on a survey of U.S. graduate students, finds a "three-way mismatch between student goals, their training, and their actual careers." It recommends major changes to better prepare graduate students for today's economic realities, including a greater emphasis on teaching, more information about the job market, and support for those interested in nonacademic career paths. Educators hope it will spur efforts to reform a system that Dore, who is also a co-author, had to navigate largely on his own.

"I learned to be a faculty member despite the system," says Dore, a 33-year-old assistant professor of chemistry at the University of Georgia, Athens, who teamed with education policy analyst Chris Golde of the University of Wisconsin, Madison, on a survey of 4114 graduate students in 11 disciplines from 27 institutions. "I decided early on that I was interested both in good teaching and good research, and went looking for the help I needed. I had to make it happen."

The study, funded by Pew Charitable Trusts and released this week (www.phd-survey.org), feeds into a growing debate about doctoral education in the higher education community by adding the voice of students. The title delivers the message: "At Cross Purposes: What the experiences of today's doctoral students reveal about doctoral education." Citing other studies, it drives home the point that the path taken by Dore is no longer the norm: Almost half of U.S. faculty members are part-timers, nearly one-third work at 2-year colleges, and only one-quarter of full-time faculty members work at research universities. And it makes a number of recommendations, including providing more relevant information for students about their training and what happens to graduates, better mentoring by faculty, more emphasis on teaching, more courses outside one's field, and more discussion of the problem at professional meetings.

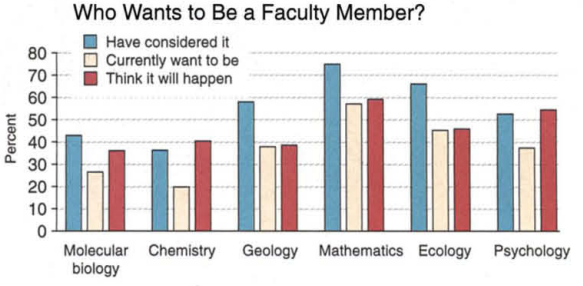
"This report not only provides a comprehensive overview of how students feel, but it also suggests what various groups can do," says George Walker, dean of the graduate school at Indiana University, Bloomington, who this month is beginning an initiative on graduate education as senior scholar at the Carnegie Foundation for the Advancement of Teaching. "We're going to pick a few disciplines and focus on leading universities, and this report will be a very valuable reference guide."

The mismatch between training and reality persists, says Golde, because of the "incredible conservatism of higher education" and the fact that professors who have thrived under the current system have little incentive to change it. Another obstacle to reform, says Jerry Gaff, vice president of the Association of American Colleges and Universities (AACU), is the fragmented structure of U.S. graduate education itself. "It's a cottage industry," he says, with most of the authority vested in individual faculty members and "with little consistency across departments and universities."

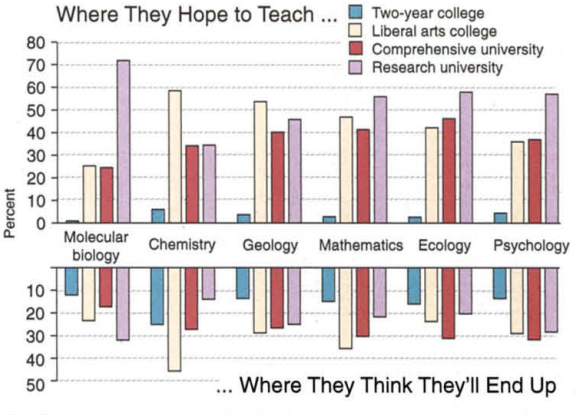
The survey, conducted by mail and over the Web with a 42% response rate, contains good news along with the warnings. Only 3% of the students regret their decision to attend graduate school, and some 91% say that they like their adviser. An even higher percentage, topped by chemistry students at 96%, say that they understand what's required of them for a Ph.D. And seven in 10 say that their program has prepared them well to become independent researchers. Dore says his experience supports those results: "In research I succeeded because of the system, thanks to an adviser telling me what I needed to know."

The problem, however, is that most graduates need more than that to compete in today's economy. "I don't think the old model of training researchers is sufficient anymore," says Gaff. "If students only learn topflight research skills, they won't get jobs when they graduate." Students say that they are not well prepared for classroom responsibilities, especially teaching higher level courses. They also would like to take more courses in related fields and outside their disciplines, such as languages and business. Their training in professional practices is also inadequate, the students report, with large numbers unclear about subjects ranging from assigning authorship on papers to avoiding financial and ethical conflicts of interest.

The authors admit that neither their findings nor their recommendations will surprise those who have followed the debate for



Confidence factor. More molecular biologists, chemists, and psychologists think they can snare an academic job than actually want one.



Making a wish. Molecular biologists aim for the top of the academic pecking order but aren't sure of making it, while chemists and mathematicians show greater interest in liberal arts colleges—and feel more likely to succeed.

CREDIT: "AT CROSS PURPOSES," 2001

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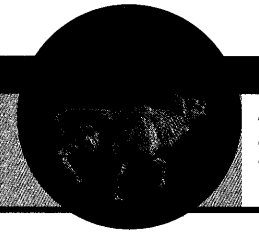

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the past decade, although they hope the data will arm reformers like Walker. In addition to putting up $350,000 for the study, Pew is a partner with AACU and the Council of Graduate Schools in the Preparing Future Faculty project, a national effort to improve graduate training (www.preparing-faculty.org). This summer, the National Association of Graduate-Professional Students hopes to present the results of a similar survey organized around departments. Its goal is to help "consumers" select the graduate program that's best for them.

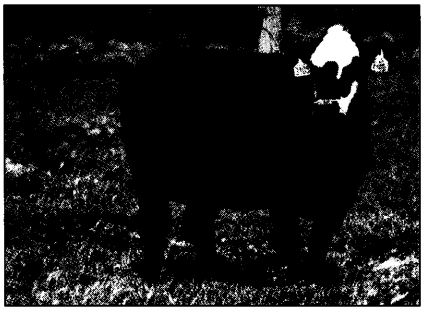
Students may indeed be the strongest force for change. This survey, for example, arose from a graduate course in academic ethics that Dore and Golde took at Stanford University. Dore has taken that interest with him to Georgia, where he is designing small organic molecules as probes to better understand the workings of the cell. "My future on the tenure track is tied to this project as well as to my research," he says about his plans to further analyze the survey's large database. "And my department chair and the graduate school dean are very interested in what I come up with." **–JEFFREY MERVIS**

ENDANGERED SPECIES

Cloned Gaur a Short-Lived Success

The first clone of an endangered species died last week, 2 days after its birth on 8 January. The baby gaur—a wild ox native to Southeast Asia—seemed healthy at birth but a day later developed a typically fatal bacterial infection that can plague young calves. The death "appears to be totally unrelated" to the cloning procedures, says Robert Lanza, vice president of Advanced Cell Technology (ACT) in Worcester, Massachusetts, the company that sponsored the project. ACT is ready to try again with gaur and other endangered animals, Lanza says.

Scientists at ACT produced the animal, named Noah, by fusing skin cells from a male gaur with cow eggs from which the nucleus had been removed. Forty-four embryos were then transferred into 32 surrogate mother cows at Trans Ova Genetics in Sioux Center, Iowa. Eight pregnancies resulted, five of which ended in miscarriage—common in cloning—and two fetuses were removed early for tissue examination. In October, the scientists reported that the fetuses seemed to be developing normally. That left Bessie with her calf, Noah, who was originally scheduled to be born by cesarean section in November. Shortly before the original due date the scientists learned that gaur gestation is longer than they thought and postponed the birth until last week.



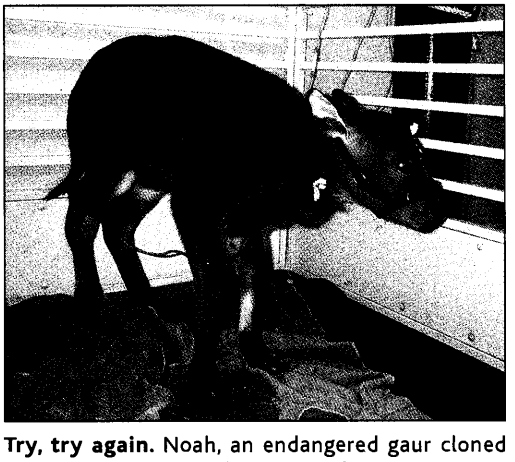
In a family way. Bessie, Noah's surrogate mother, is doing fine.

Many of the animals cloned to date have had serious health problems at or shortly after birth, including lung defects. Some have also been born abnormally large. But Noah, weighing in at 36 kg, initially received a clean bill of health. The C-section went smoothly, says Philip Damiani of ACT, and veterinarians who examined the newborn rated him in the top 3% of newborn cloned calves based on his alertness, eagerness to feed, and other factors. Within 12 hours, Damiani says, Noah was beginning to walk—a sign that he was strong and not oversized.

But about 24 hours after his birth, Noah developed diarrhea, often called scours. Doctors immediately suspected *Clostridium perfringens*, a bacterium that is normally found in the intestines of cattle. It can overgrow in young animals and produce a deadly toxin. Veterinarians treated Noah with antibiotics and an antitoxin. Despite these efforts, he died the next day. Clostridial infections are not uncommon in newborn calves, says veterinary infectious disease expert Robert Holland of Iowa State University in Ames, but are unusual in animals delivered by C-section. Damiani says the team is working to trace the source of the bacteria. A "control calf" fed the same colostrum and kept under the same conditions as Noah is doing fine, he says.

After such promising initial signs, "to lose him to scours is devastating," Damiani says. "When I left on Tuesday, he was walking around and even being a bit difficult to handle."

The death has not derailed the company's program to clone endangered animals. They plan to try again with a gaur, says Damiani. And Lanza says that within a few months the company will embark on a project to clone the bucardo, a Spanish mountain goat, from cells taken from the last living member of the species. The bucardo project should be both faster and easier than the gaur, as researchers have had more success with cloning goats and the animals' gestation period is only 5 months as opposed to 10 for a gaur. Predicts Lanza: "We could have live kids by end of summer or early fall." **–GRETCHEN VOGEL**



Try, try again. Noah, an endangered gaur cloned from an adult skin cell, lived just 2 days.

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ASTRONOMY

Weird New Exoplanets Leave Theory Behind

SAN DIEGO—Now that astronomers have found planets orbiting some 50 sunlike stars, you might think they have seen everything. Far from it. The latest pair of extrasolar systems, which a prolific U.S. team of planet hunters unveiled at a conference here last week,* jolted even the most jaded onlookers.

"After finding so many exoplanets, we thought we understood their masses and orbits," says team leader Geoffrey Marcy of the University of California (UC), Berkeley. "Maybe we became a little cocky. But the new systems, with two planets each, are unique and a little frightening. These systems stump us."

The first of the cosmic puzzlers belong to

* American Astronomical Society, 197th meeting, 7–11 January.