

# Cost Cuts Should Come From Research, Not Just Education

*By ROALD HOFFMANN*

Even though we are part of a major research university, we agonize, in meeting after meeting, over the 5 to 10-percent yearly cuts we need to make in our chemistry department's budget. By and large, those end up coming from education, not research, especially in faculty replacements and teaching assistants. The same decisions are being made at most other universities.

The research budget we can't touch, for it is federal money that flows through our university but is not under our control. But even if we could tap into research support, would we? We're in love with our research, as we should be.

No rules dictate, however, how many teaching positions we can cut. So we do. The consequences are that the education of undergraduates will suffer — by our own standards, in the experience of our students, and in the perception of their bill-paying parents. It is only a matter of time before they will simply conclude that our actions are selfish.

Something's got to give, and I think that change should be in the organization of graduate education and research.

In America, Ph.D.'s in science and engineering probably haven't paid a cent for their graduate educations. Neither have their future employers. In chemistry, on the way to a typical five-year Ph.D., a graduate student is initially supported as a teaching assistant, working about 15 hours a week for the first two years. There follows a three-year period as a research assistant, paid by the professor's research grants. In addition the student typically gets an annual stipend of \$25,000 to \$30,000 — not luxurious, but enough to live on. That pattern holds for both American doctoral students, who make up about 53 percent (in chemistry, although fewer in engineering fields) of the group, and for foreign doctoral students, who make up about 47 percent.

I know I court the disapproval of many of my colleagues when I say that we have fallen into this system as a result of a strategy by American industry to get the most highly trained component of its work force, the Ph.D., practically free of charge. Contributions by industry to universities are small (4 percent of research funds at Cornell). And as for taxes paid by industry — well, I think they are ... minimized.

We give the young people who work with us a work ethic, approaches to wisdom, sound professional training, and the joy of taking part in exploring the universe. But the current system exploits us — to work off our addiction to research, we must write proposal after proposal to find the means of supporting our students.

Yes, we would write those proposals anyway, even if the graduate-student support were not our responsibility. For we need equipment, materials, and other hands — for instance, postdoctoral researchers. But approximately 30 percent

of our budgets goes to graduate-student support. Raising those funds is a major source of pressure for academics in science and engineering.

The university acquiesces in this process enthusiastically, institutionally addicted to the flow of money for research and overhead, and to the reputation that accrues from that research.

And Congress is moved by lobbying more than by any national research strategy. So when there are too few American doctorates for industrial demand, rather than have market forces work to increase the salaries for American Ph.D.'s, industry lobbies effectively to lower immigration barriers for the most highly trained.

But it's not as though there were a national referendum in which Americans agreed that a Ph.D. student in physics or chemistry should pay nothing for his or her education, while future physicians and doctorates in Spanish literature should pay. There is no question that the current system is part of a remarkably successful American social apparatus for innovation. Yet other countries (Japan and Germany, for instance) arrange support of graduate study and research differently. Their universities generally receive money from the central or provincial government, so effectively the greatest part of tuition comes from the state. And graduate-student stipends are awarded in competition directly to the student. Such study and research systems have also been successful if measured by, say, patent production. I think that in America we have just fallen into a comfortable system, steered by shortsighted industrial interests that take advantage of our addiction to research as well as the universities' concerns with finance and prestige.

I would propose that government granting agencies eliminate research-assistant salaries from research budgets. Instead, those funds, which are substantial, should be used for a system of competitive fellowships, to be carried by the graduate students to the schools of their choice. Those fellowships should, of course, have a tuition component as well as a living allowance. Universities should charge science graduate students tuition and not pay them stipends, except for teaching services.

Such radical policy changes would need to be done in stages. The net outcome, if the student does not hold a government fellowship, would be that Ph.D. students may have to take out loans — just as law, medical, and business students do. Our goals for research would need to become more humble, for sure. I imagine that, all else equal, we would keep our American graduate students, their support now derived centrally, not from research grants. But there is a good chance that we would lose some of the incredible talent from Asia that has been attracted to our graduate programs, for the American fellowships of the future might not be open to them. That won't be easy on us, but it's a lesser evil than gutting the quality of undergraduate education.

If government can resist industry lobbying to expand immigration, the changes could lead in the long run to an increase in pay for American science Ph.D.'s. That economic incentive would be a powerful draw to the profession.

Perhaps someday, we'll find a way to deal with budgetary constraints in a manner equitable to both research and education. But at a research university, it is unconscionable that most of those cuts now come from the latter.

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