

himself among Judaism if he doesn't believe in its basic concepts? What does he consider the purpose of life? Could you have morals without religion? And I asked him why he advocated the atomic bomb production if he didn't believe in the ultimate good in man.

"I can't tell you any more about his ideas in this letter because I couldn't do them justice without stretching the letter to 19 or 20 pages, but was I thrilled when we left the meeting. A few of the fellows and I went to Nassau Tavern afterwards and filled ourselves full of beer. I felt so good when I went to bed that my roommates were sure that I was drunk."

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Give Grad Students a Good Talking, Too

As just about all American scientists are now aware, we live in times in which "strategic national needs" (whatever those are) are being held up as desirable funding criteria. (Consider, for example, Senator Barbara Mikulski's view of the NSF mission.) For better or worse, curiosity about the universe as a justification for scientific activity is under some attack.

At the same time, the employment outlook for new PhD physicists has been bleak for years, and some graduate physics departments seem to be responding by reevaluating their programs and by considering changing some of the emphases (for example, away from narrow specialization and toward flexibility). APS meetings now sometimes have special sessions concerning so-called alternative careers for physicists.

I herewith propose an activity that can potentially address many of the above concerns, plus others: *As a standard part of graduate training in physics, have graduate students present, annually, a talk about their work to students at public schools.* I have in mind elementary, middle and high schools. Whenever possible, such presentations should be videotaped. To ensure that the graduate student receives experience in addressing a wide variety of audiences, the audience should vary from year to year, so that, for example, he or she addresses kindergartners one year, middle school students the next year and so on.

There would be many benefits to such an activity:

▷ The aiding of public education by the scientific community would go

some way toward responding to the Mikulskiesque attitude that scientists should contribute directly to the national well-being. (I might add that I share that attitude.) The direct interaction of grad students with teachers and principals would be highly instructive for all parties, and some professional directions and contacts would likely develop. (For example, some grad students might decide that they want eventually to teach in public schools.) With such enormous visibility, the physics community would come to be viewed as directly participating in and contributing to the education of the nation's children.

▷ The exposure of many tens of thousands of students to thousands of highly trained scientists, on a regular basis, would be a healthy antidote to a culture in which athletes are worshipped (and paid) like gods. The students would get to meet real scientists and hear about real science in the making. The nature of science would be made more clear to the students as they came to understand that knowledge evolves incrementally as a result of hard work and that real science isn't something that pops magically out of a textbook.

▷ My proposed idea, if implemented, would force physics graduate students to *regularly* confront a problem every bit as real, and probably more important to their long-term professional success, as an eigenvalue problem, a coding problem, an optics problem or an electronics problem; namely, the problem of conveying one's ideas, and hence worth, interestingly, persuasively and accurately to an audience whose background is very different from that of the speaker. A scientist's career frequently hinges on her or his ability to persuade people such as corporate managers (some of whom have little technical background and view research expenditures as a necessary evil for generating cash later on), grant application evaluation committee members (some of whom may not be very familiar with the scientist's general field of work) or even a thesis committee. Why not include in graduate education regular training in real-world communication of ideas, especially when such communication can benefit the graduate student, the perception of the scientific community and the nation?

▷ The videotapes could be used by the public schools for further discussions after the scientist left the school; by the graduate student for detailed examination, evaluation and criticism of the quality of the presentation (preferably in the company of supportive fellow students and faculty *and* an abundant supply of coffee and donuts); and by the

graduate department for evaluating the student's communication skills. Perhaps such departmental evaluations should become as regular, and maybe even as important to the student's advancement through grad school, as the more traditional evaluations of prowess in theory and mathematical agility.

It is obvious that if the above proposal is good for physics, it is also good for chemistry, biology, engineering and perhaps other fields. There is nothing unique to physics in the proposal, and the proposal is hence immediately transferable to other graduate departments.

I confess that there is an ulterior motive at work in my proposal: As a scientist who dislikes coding and detests having to work with electronics but enjoys writing and giving talks, the proposal obviously suits my inclinations. A nationwide enactment of this proposal would then constitute a revenge of the articulate nerds.

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On Science Schooling, Seminar Style

George Greenstein's advocacy of a seminar format for teaching science (May 1994, page 69) has much to recommend it. Many of us who have been lucky enough to spend at least some part of our lives teaching physics at various levels appreciate the importance of continued classroom dialogue and know that we can readily maintain it even in the lecture format. If nothing else, it keeps the students and the professors awake! It provides instant feedback to the lecturer and permits him or her to continue with confidence. Indeed, the great entertainer Al Jolson, once finding himself spotlighted on stage, demanded that the auditorium lights also be turned up: He could not sing, dance or tell stories unless he saw the smiles on the audience's faces! A class (whether of 30 or 300 students) would be dull for me and even duller for the listeners if I did not stop to toss out questions, wait for some students to discuss their thoughts, and let everyone share in the process of responding (often by polling for yes or no answers and noting that nature's laws are not necessarily determined by majority rule). In my opinion a lecture format that does not permit, even demand, questions from the students is no class at all!

But I am deeply offended by Green-