Letters

Discordant Observations

Eliot Marshall's discussion of controversy in science (News & Comment, 6 July, p. 14) will, I expect, stimulate a lively response. So let me make my position clear. Theoretical interpretation should be an open, progressive activity able to make small or big changes in response to observations. The only theoretical verity we can be really certain of in astronomy right now, however, is that there exists strong evidence that contradicts the fundamental assumption in the field. A small number of influential astronomers, for a variety of reasons, have denied the validity of this evidence. They simply state that the "ideas" are not proved or they are "harebrained" or "screwy." They certainly have not tested the evidence; for example, a NASA committee did not allow even a few thousanths of a part of the U.S. time on the x-ray telescope for elucidation of the connection between the quasar Markarian 205 and the low redshift galaxy NGC 4319.

Nevertheless, I would estimate that a majority of my colleagues believe there is "something" in the discordant observations that should be followed up. At the same time many would not welcome any direct competition with their own programs. Hence my suggestion that 10% of public resources be set aside for testing evidence in new directions (or 5% or even 1%, on a trial basis). The problem is to persuade the strong personalities in the field who feel it necessary that *they* decide what is right and wrong for everyone else. This is where the pressure must come from outside the field. There must be enough people of general education and conscience to say it is neither wise nor legally nor morally permissable to censor opinion or research in any human activity.

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Ph.D. Supply and Demand

In his AAAS presidential address "Supply and demand for scientists and engineers: A national crisis in the making" (27 Apr., p. 425), Richard Atkinson analyzes a number of projections, almost all of which appear dire. The major hopes, he believes, are (i) to encourage high school students who are qualified, but are not choosing science, to do so and (ii) to cut back on the numbers of students who drop out of science and engineering majors in college. These are worthy recommendations and should be vigorously pursued.

However, as someone who has spent more than a decade as an undergraduate adviser to talented freshmen students, I can attest to the onerousness of the task of trying to interest nonscience students in the field, or of convincing those who have discovered the joys of the Gothic novel or 19th-century philosophy that they should not shift out of their science concentrations. The former use their considerable intellects to devise excuses for why they should be allowed to substitute "soft" science for a "hard" science requirement. The latter, rightfully, explain that they had never encountered sophisticated thinking in literature or philosophy in high school, where the science teaching had been first rate. They were simply enlarging their horizons. The many "physics-for-poets" and now the largely nonscientific environmental courses that have sprung up in recent years have allowed many students to satisfy their science requirements, but rarely convert them.

The most promising opportunity to alleviate the predicted shortage is not mentioned by Atkinson, namely, the Immigration and Naturalization Service. Were every foreign science and engineering student in the United States, whether in a baccalaureate, masters, or Ph.D. program, awarded a green card at graduation, the immediate problem would be solved. At present, the rules and regulations are so complicated, and the procedures for granting resident status so confusing, that prospective employers attempt to avoid becoming enmeshed in the red tape and often negative results. This solution would provide the country with some of the best scientific talent in the world.

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Atkinson rightly identifies the indifference of research universities toward secondary education as a factor in the declining number of high school graduates who seek scientific careers. This will change. Research universities and colleges with strong baccalaureate programs in science will increasingly be called upon to structure curricula for those seeking careers in secondary education, as states drop school of education requirements for teacher certification. Those who would become science teachers must major in science, not education.

Science policy-makers must heed Atkinson's warnings about the looming crisis in science and engineering and take the remedial courses he recommends. Research universities must do all they can to see that those who would teach science will displace mediocrity with excellence through caring, competence, and creativity.

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Atkinson decries the fact that "few research professors pay much attention to teacher training programs at their university. . . ." Little wonder, considering that most research universities have established a reward structure that severely penalizes the few idiosyncratic professors who work to improve undergraduate education. The problems delineated by Atkinson might be diminished in the long-term if universities would instead heed the recommendations of the AAAS Project 2061 (*1*): (i) Presidents should "establish scientific literacy as an institution-wide priority" and ensure that all graduates, including K–12 teachers, "leave with an understanding of science, mathematics, and technology that surpasses what this report recommends for all high school graduates"; (ii) departments should design courses "for future elementary teachers and high school science teachers that go beyond, but are in the spirit of, the recommendations of this report, and create "in-service workshops and institutes tailored to the needs of teachers who wish to attain the standard of excellence implicit . . . in this report."

In addition, as suggested 16 years ago by F. Reif (*2*) to an evidently uncomprehending audience, universities "must be willing to face the challenge, worthy of the role of a university, of devoting to education the kind of searching thought commonly bestowed on scientific and engineering fields, and of promoting the translation of new ideas into practice." There now appears to be hope (*3*) that a much needed increase in federal funding for such research and development will soon be made available, especially if Congress is wise enough to reallocate some of the $307-billion military budget request (*4*) for fiscal year 1991 to programs of more crucial national interest.

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REFERENCES

1. Project 2061, *Science for All Americans* (American Association for the Advancement of Science, Washington, DC, 1989), p. 165.