Letters

Saving Science Education

Elizabeth Culotta's article "Can science education be saved?" (News & Comment, 7 Dec., p. 1327) left me feeling angry and disgusted. For the last 20 years, it has been obvious that U.S. education, not only in math and science, but in most subjects, has become more and more dismal. Perhaps only in athletics have our children been exposed to competent instructors.

The problem is not what should we teach, or how should we teach, but rather who should do the teaching. No one would suggest that to teach children to play good tennis, we should use a person who has never held a racket; and if we want our children to play basketball, we would not hire a coach who has never played the game. Yet we have teachers who have never studied science or math teaching our children in these subjects.

Unless we approximately double the salaries we pay to teachers in our pre-college schools, we are lost. All of the proposed improvements and changes in curricula, methods of teaching, changes in books, and rearrangement of schools will not solve the basic problems. Such changes will help partly because changes, in themselves, stir things up and often cause improvements. But such changes can, at best, only improve the situation by small amounts.

When the Russians put up Sputnik, the research and development groups that were asked to meet the challenge did one simple thing: they doubled salaries to attract the best scientists and engineers. This did the trick. When we saw that we might have to enter World War II, the government and the industrial research labs that were set up to produce new weapons "drafted" the best people they could find. They appointed the best man or woman to lead these teams. No one told these people how to do research, development, or preproduction. I was lucky enough to be put into one of these teams. We had no rules and no advice on how to do what we had to do. Money was not a restraint. We did well.

We are now in an economic and intellectual war. We must produce an army of highly educated people in all fields of knowledge. But as I read the proposals about how to accomplish this, there is no mention of the basic problem of economics. We want cheap help to do something that even with the best intentions they cannot do. (I realize full well that a small number of teachers work simply for love.)

I would not, for a moment, suggest that all we need to do is "pour money" into the educational system. What I suggest is this: Decide what level of education and expertise we need in a teacher for a particular phase of education. Write the specs to be much higher than the minimum required. Set up procedures such as written and oral examinations and trial periods before a man or woman can qualify to be a teacher. A teacher of physics should know physics, not be chosen for the number of courses he or she has taken in "education." Finally, we should raise the salaries to get those who can meet our very strict requirements in each discipline.

Raising our standards and paying for the people who meet them would not result in any short-term solutions. It would take time to clear out the dead wood by retirement and pressure of competition, but we must start now. If we don't, the United States will continue to slip economically, technically, and socially.

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Biology Textbooks

A 7 December News briefing (p. 1335) reported that the Texas State Board of Education (TSBE) voted 11 to 4 in November "to approve a new generation of eight major [high school] biology texts [that] give extensive coverage to evolution and none to creationism." Two of the books are hardly new with respect to the treatment of evolution: they are the sixth editions of textbooks first published in 1963. *Biological Science: An Ecological Approach* (Green Version) and *Biological Science: A Molecular Approach* (Blue Version), were developed by the Biological Sciences Curriculum Study (BSCS), a nonprofit organization founded in 1958 with financial support from the National Science Foundation.

The first editions of these books, written by practicing scientists and teachers and published by the commercial sector after extensive field testing, treated evolution as the central organizing theme of biology. BSCS texts have remained solidly evolution-based in their subsequent editions. Both books had been excluded from Texas for the last two decades because of the TSBE's capitulation to creationist pressure, notwithstanding the books' consistently high marks from teachers and scientists.

Of the nine books submitted during the 1990 adoption process, the BSCS books were rated first and second by the science textbook committee, which proposed eight books for final adoption by TSBE. The creationists found all of the books objectionable, itself an indication of the progress the science education community is making in defense of scientific integrity. Textbook publishers, justly criticized in the past for their failure to place good science ahead of profits, should be commended for the stand they have taken in Texas. There is still considerable room for improvement in the quality of high school biology textbooks, but the Texas decision clearly is a step in the right direction.

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Carcinogens and Human Health: Part 3

Bruce N. Ames and Lois Swirsky Gold (Perspective, 31 Aug., p. 970) and Philip H. Abelson (Editorial, 21 Sept., p. 1357) raise questions about the interpretation and application of cancer information in regulating chemicals. They seem to suggest that (i) the rodent bioassay is misleading, (ii) risk assessment is too cautious, and (iii) these factors distort the regulatory process, creating public anxiety about phantom hazards while real risks are ignored. These suggestions involve a mix of science and politics. We wish to respond, point out alternative scientific perspectives, and discuss the appropriateness of the Environmental Protection Agency's (EPA's) approach.

In their statements about rodent bioassays, Ames and Gold and Abelson take a few often cited examples and generalize to other bioassays in ways that are contradicted by much of the accumulated scientific evidence. First, carcinogenicity is not necessarily a consequence of high-dose toxicity. Many bioassays have shown either toxicity without carcinogenicity or carcinogenicity without toxicity. D. G. Hoel *et al.* (*1*) have analyzed results from National Toxicology Program bioassays of 99 chemicals, of which 53 were positive. For only seven could target organ toxicity be the cause of all observed carcinogenic effects. Second, carcinogenicity has generally been confirmed at less than maximally tolerated doses. Of the 99 chemicals in the analysis by Hoel *et al.*, just three caused cancer at the highest dose only. Third, rodent bioassays are indicative of human cancer risks. Allen *et al.* (*2*) have analyzed results