

## letters

that may be derived from an informed involvement by physicists and the scientific community at large. Indeed, education should be central to the role played by the citizen physicist.

I must say, however, that one sentence in the article by Dietrich Schroer simply confounded me. "A good measure of the success of arms-race education may well be its ability to institutionalize itself." The author was clearly decrying the ravages of on-again/off-again funding. But allow me to offer a contrary view: A good measure of the success of arms-race education will certainly be its demise at the hands of its own success. (A circular argument is an offense in science, but not necessarily in politics.) When these courses move from the current-events curriculum to history, we will all be able to rest easier.

ELTON N. KAUFMANN

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## Value of a physics education

I want to discuss an issue concerning "displaced physicists" that seems to be prevalent today because of the employment situation (June, page 107). Many people who are educated in physics who do not pursue a career in physics (perhaps for no reason of their own) need to resolve any inconsistencies between their education and their present career objectives. A physics education instructs one to obtain understanding and solve problems through fundamental principles. This type of educational experience usually leads one into a career of research. A non-physics environment has the reputation of applying to problems solutions derived from other working systems, without a total understanding of the fundamentals involved. This may be due to time constraints or necessity. In this type of environment, a contradiction would arise between the skills of someone educated as a physicist and the immediate requirements of the task at hand.

Does this make the displaced physicist bitter that he may not have the opportunity to use in his future endeavors the many hours of arduous study he spent in such subject areas as quantum mechanics and mathematical physics? The physicist can resolve this dilemma by forcing application of his esoteric skills to the tasks at hand. He must realize that his education was meant to train his mind and prepare him for advanced problem solving that may be beyond the scope of specialized engineering. A sincere effort must be made by the physicist to apply his talents to

the problem at hand, whether called for or not. Perhaps this would be the greatest challenge of all. For example, a physicist friend of mine, who is now employed as a design engineer, told me he uses S-matrix scattering theory to design surface acoustic wave devices.

A physics education does not have to be put aside when one is engaged in a non-physics career. In fact, the physicist will have more than his share of tools necessary for producing good work, including analytical thinking and cogent expression that he gained from studies of quantum mechanics, and so on. The application of his talents and fundamental approach will put him in a position of versatility and much visibility relative to his colleagues. I, for one, now have a job that does not directly use most of my physics talents (naval mine engineering), but it gives me much pleasure to employ them whenever possible. For this reason, I continue to belong to the American Physical Society, take advantage of its many opportunities to be involved with physics, and faithfully read PHYSICS TODAY.

MARK VEDDER

Naval Weapons Station  
Yorktown, Virginia

7/83

## Saturday-morning physics

A number of recent letters have spoken glowingly of physicists' Saturday-morning or other lectures to high-school students or to elementary and high-school teachers. While I think it is fine that physicists are doing this, I would like to note that such programs are nothing new and, moreover, that such extracurricular after-school classes are likely to have extremely little positive *national* effect on our educational system. Indeed, they may have a bad effect if they convince scientists that they are thereby doing their bit for improving science education and need do nothing else.

I know of no careful studies that show programs of this kind to be of value. The evaluations of the many teachers' training programs conducted with NSF and other funds in the 1960s and 1970s tended to be negative.

Education certainly suffers severe problems at present, both in school systems and in universities. University professors, often unaware of their own problems, tend to focus on the problems of others. It seems very unlikely that with the major problems confronting American education today, a limited number of faculty lectures given in very few locations around the country will make much difference in the total picture. If we consider that only one-third of our high schools now

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offer more than one year of mathematics and more than one year of science, the few people who hear such lectures and the even smaller group influenced by the lectures are only a drop in the bucket. We need a serious effort to improve education in this country, not just the Saturday lectures.

ALFRED BORK

University of California, Irvine

5/83

Irvine, California

AN AUTHOR COMMENTS: Alfred Bork notes that the initiatives to improve high-school physics on the part of Fermilab, Caltech and so on may be of little value and do not address the "total picture." We need "a serious effort..." and so on. Bork is dead wrong! Such programs are certainly not new. Indeed, I trace my own interest in physics to a Saturday course given at NYU in 1936.

However, in our own local experience, we have, so far, "graduated" 800 science-oriented, selected, bright students out of a candidate population of 80 000, that is, the upper one percent. We don't know what will become of our students, but we have some measure of how much they were moved and stimulated by contact with living, working scientists. Statistically, we have already reached—and perhaps saved—some fraction of about 100 future PhDs. Statistically, we have talked to 0.2 of a genius whose work might cure senility, cancer or educational decay. If we had fifty institutions willing to bestir themselves for something less than the total picture, in ten years we may well have rescued 100 geniuses from drowning in the tide of mediocrity decried by national commissions. Finally, rather than diverting us from addressing the big picture, it has given us a much more detailed appreciation of the many sides of our educational dilemma. Why not Saturday Morning Science at Irvine, Professor Bork?

LEON M. LEDERMAN

Fermi National Accelerator Laboratory

6/83

Batavia, Illinois

AN AUTHOR COMMENTS: Alfred Bork is attacking a straw man when he denounces the various Saturday lecture programs as having little value in correcting the nationwide inadequacies in science education. We have never proposed that such programs could do more than reach a limited number of motivated students in just a few locations. For those we do reach, I submit we have made a significant impact on career choice and on science awareness. We have never pretended that these lectures could in any way be a substitute for regular school programs. As for Bork knowing of no careful studies to document the value of these

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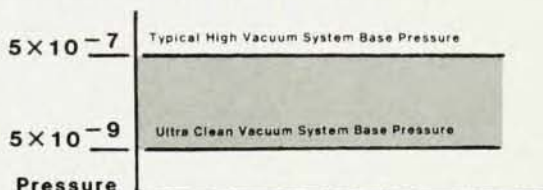
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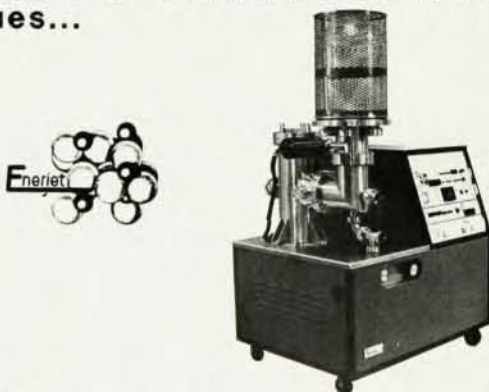


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## letters

programs, neither do I. However, I am convinced by personal contacts with many of our alumni, some years after we have had them, that we were a strong, positive influence in their lives. Of course we are only a drop in the bucket, but my colleagues and I feel this to be a most worthwhile drop.

MILTON GOTTLIEB

Westinghouse Electric Corporation

8/83

Pittsburgh, Pennsylvania

## High-school sabbatical

The June editorial (page 128) suggests that people in academia and industry may contribute, by active participation, to the goal of excellence in science and math education.

I have met my part of this obligation by taking a year sabbatical from teaching high-school physics and joining the corporate R&D staff of Pitney Bowes in Norwalk, Connecticut; I worked as a consultant and participant in the physics and chemistry laboratory there for the past academic year. My earlier experience in industry (25 years ago) was updated by contact with today's technology.

I shall return to the classroom this year with a greater appreciation for the "real world"; I now believe that both my physics and career-counseling skills will have improved.

I hope that more high-school science and math teachers will apply for sabbaticals; I also hope that industry will support this concept in a way that will cover as many disciplines as possible.

NICHOLAS J. GEORGIS

Staples High School

8/83

Westport, Connecticut

## Origins of great scientists

With reference to the letter by Tung Tsang (June, page 101), I agree with him that it is not correct to say that before the 20th century "most scientists were independently wealthy gentlemen"—although Robert Boyle, Henry Cavendish, James Prescott Joule and Benjamin Franklin fall in that category. Stephen Gray, who discovered electrical conductivity, was a pensioner with no income; Johannes Kepler was a poorly paid calculator; Nicolaus Copernicus was a bishop's clerical assistant. Many great physicists were professional physicians—Thomas Young, William Wollaston, William Gilbert, Georg Ohm, among others. I would call all of these men amateur scientists, in the sense that their work was done for the love of it, not for a living. On the other hand, I would call a man who makes a success-