

letters

than thirteen per thousand.

Nicholas Eberstadt, of the Harvard Institute of Population Studies, in his review of the work of Davis and Feshbach (The New York Review of Books, 19 February 1981, page 2) concludes: "Measured by the health of its people, the Soviet Union is no longer a developed nation."

We must stop fighting over dead issues and face the real ones of today, with a realistic perception of who are the friends of science and peace and who are their enemies.

References

1. W. S. Bainbridge and R. Stark, *Superpositions Old and New, The Skeptical Inquirer* 4 (4), 18 (1980).

LAWRENCE CRANBERG
8/81

Austin, Texas

Status of high-school teaching

I am disgusted by the physics community's attitude toward high-school physics teaching as demonstrated in two letters in April: "Librarians Beware" (page 76) and "University-School Cooperation" (page 11). In the first letter, Tamar Harari stated that the overpriced bibliography "must have been published by a local high school" as a way of emphasizing the poor quality of the publication he received. What is unfortunate is not merely did the editors of PHYSICS TODAY allow the slander against high schools to be published, but many educated readers of PHYSICS TODAY accepted this specious reasoning, linking the high school to a low-quality publication, even though the fact that there is no connection is clear. It may even be likely that the publication is produced by some college or college professor. I suggest that Harari and future critics be honest and place criticism in proper context. In Harari's case, it could have been stated, "Gate-keepers is not the professional informational publishing company it purports to be."

For the information of Harari and the rest of the physics community, many high schools have modern printing plants. Montebello High School, for example, has never had a Xerox copier machine in the printing shop, and the linotypes have long since given way to a computerized photoelectric typesetter that makes photograph-ready masters to produce plates for the big presses. Furthermore, the teachers do little dittoing, since the print shop, like the neighborhood instant printing service, supplies our needs within the hour.

The letter from Feshbach and Fuller, "University-School Cooperation," is a

further tragic example of the inability of both APS and AAPT to grasp the problem described as the "deterioration in both quality and quantity of secondary physics education in the US." They are treating only symptoms. The *main problem* is to *first* change the attitude of the physics community toward secondary school physics teaching—the attitude largely expressed in Harari's letter. Feshbach and Fuller appear to be condescending by trying to give the high schools a university "hand-out." I say *condescending* because of the unfortunate statement in their letter, "It may also serve as an effective recruitment tool for colleges seeking a wider pool of able potential majors . . ." This indicates to me, and most other high-school teachers, that it is *not* sufficient motivation for the colleges to want to establish ties with the high schools to end the "deterioration." It further indicates that the colleges have to be shown the advantages of a possible increased physics enrollment so that college instructors can keep their jobs, before the advantages of reversing "deterioration" can be appreciated.

For those seriously interested in university-school cooperation, I call your attention to the fine summer workshop for high-school teachers conducted by R. L. Wild at the University of California at Riverside. In addition, Robert Frost, Cal Poly, San Luis Obispo, has formed a joint committee of the Northern and Southern California Sections of AAPT to look into the problem.

So that I am not misunderstood—I think that *Feshbach and Fuller are right!* There should be university and high-school cooperation. I have enjoyed excellent cooperation with a number of institutions, most especially the physics staff at CSULA, and I am grateful for that cooperation. But the proposal by Feshbach and Fuller is weak, at best, and will prove ineffective.

If the physics community is serious about reversing this so-called "deterioration," I suggest, among other things being done, the following:

- That colleges and universities require high-school physics as a prerequisite to freshman standing with majors in mathematics, chemistry, physics, and engineering. If the colleges are interested in a "wider pool of potential majors," then establish a requirement that gives students the motivation to become a part of that pool.
- Since high-school physics programs vary greatly in quality, do not accept just any high school's physics credits. Find out which programs and teachers provide the preparation acceptable. Give that school recognition, and give its students preference in admissions

continued on page 100

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letters

continued from page 15

with majors in mathematics, chemistry, physics, and engineering. If the college is recruiting, nothing (save money) attracts students better than being preferred. Many college instructors will be pleased to find many fine high-school physics programs! Find them! What better way to establish university-school cooperation than to give some recognition to the high school?

► If the high schools do not offer the preparation expected, then follow up on Feshbach and Fuller's suggestions. Many high-school physics teachers are too aware of their inadequacies and are intimidated by university instructors. Use one or two good high-school physics teachers as co-instructors. These high-school teachers used as co-instructors do understand the problems and many are excellent physics teachers at their level of instruction.

► University instructors *must* stop overlooking and omitting high-school physics teaching as a career option when speaking to students. If necessary, to be completely honest, include the disadvantages of high-school physics teaching when mentioning career options, but *make sure* that high-school physics teaching is included as an option. The college teacher who does not include secondary physics teaching as a career option to able physics majors is contributing to the "deterioration" problem. Not all able physics majors are research-bound, and high-school teaching does have some advantages.

► Stop using the high school as a whipping post and as an example of lowliness. Many members of the physics community are illiterate outside their field of specialty. Many high-school teachers, by virtue of having to teach several subjects, are well-rounded people. Let us face a fact: there are boobs and nitwits as well as educated people in nearly every field of endeavor.

► Establish an award program that will recognize outstanding high-school physics teachers for the thing they do—teach physics! There are many excellent high-school physics teachers, and some of these people should be recognized. I can read in a year's time, in PHYSICS TODAY, where every physical society has given a medal to somebody for doing what he is paid to do. What about the physics teacher? Several ways are available to establish some sort of recognition. For example, AAPT can present some citation or medal with nominations coming from the local sections. An industry can give an award with nominations from physicists and staff members based on their own experiences or on the experiences

they know to be exceptional for their children. Universities can make an occasional presentation based upon the preparation of incoming science majors.

I have just completed a fourth term as vice-president of the Southern California Section of the American Association of Physics Teachers. I will be the first to admit that the quality of high-school physics teaching and physics programs varies widely—from non-existent to excellent. I have visited many high schools and have seen the good and the bad. The average high-school physics teacher teaches at least one other subject and may even coach in the afternoon; such teachers read their own papers, repair their own equipment, set up their own demonstrations, set up and run their own laboratories for student experiments, and they do this *alone*. I must not forget the adjunct duties of supervision and open-house nights.

I have twice helped new physics teachers, transplanted from other departments within a high school, by going through laboratory drawers and cupboards to tell these people what they have and how it can be used for demonstrations or student experiments. I have distributed new and used equipment that I could not use, but that was donated to me from various sources, to needy high-school physics teachers. I have provided books when there was a shortage of texts at a rival, neighboring high school. I worked hard to get, and I am now helping to implement a physics and mathematical analysis program at a high school where these subjects have not been taught for over ten years. There are many people all over the US, working hard to make high-school student preparation in physics the best possible. The average high-school physics program may not be one the physics community is proud of, but, while serving my four years as SC-AAPT vice president, I came into contact with many hard-working secondary-school physics teachers, most of them very good, if not superior, teachers. They, like me, are angered by a physics community that contributes to the deterioration of secondary-school physics and then blames the secondary-school physics teacher. We are angered by the degrading attitude of Harari and by the approach of Feshbach and Fuller. To continue berating high-school physics programs is driving good teachers from the profession and thus contributing to the problem. It is doing, to those of us who remain, a great *dis-service*.

HARRY MANOS

Montebello High School

Montebello, California

THE AUTHOR COMMENTS: The letter Robert Fuller and I sent to the chair-

men of physics departments was intended to stimulate interest of those departments in the problem of physics education. Obviously, in a one-page letter we could hardly discuss all aspects of this problem. There are many suggestions, some of which are listed by Harry Manos in his letter. The problem is to develop these so that they will become practical and useful. Manos would have been more constructive if he had considered that problem rather than the question of status. Of course, there was no "condescension" explicit or implicit, intended or unintended, in my letter with Fuller.

HERMAN FESHBACH

Massachusetts Institute of Technology
6/81 Cambridge, Massachusetts

Your April issue (page 11) carries a letter from the presidents of APS and AAPT urging increased cooperation between university and college physics departments and secondary-school teachers of physics. The hope is that more and better qualified students will take physics courses in college.

Their point is well made, and certainly such cooperation should be encouraged. I remember a similar effort in the mid-sixties that sponsored a Visiting Scientist program for secondary schools. Most of my visits seemed very helpful, although the variation between schools was great. Perhaps reinstituting that program would be the best general program.

There are two other facets of the problem which need to be recognized. The first is salaries for secondary-school teachers, particularly those outside the more affluent suburban areas. I have seen several well-trained and extremely effective secondary-school physics teachers take other jobs at more than twice their teaching salary. Other than supporting adequate compensation for all teachers and science teachers in particular, I do not see how APS and AAPT can effect any change.

The second concerns the teaching of science from the early grades through secondary school. I feel that many students are "turned off" from science in general and physics in particular by their earlier exposure. Many of the teachers have little background in any science and often have a distaste for the subject. The texts seem more glossary, a series of facts and definitions to be memorized. The whole approach is anti-science.

I suggest that APS and AAPT join with comparable groups in the other sciences to provide enough leverage to effect a change in the early instruction in science. Science is fun, science is ideas, and science is observation and experiment. In the early stages of learning and for the non-professional,

much can be learned about the school, the house, and the local environment that will increase general awareness and appreciation. Schools need not all do the same things; things suitable for urban Los Angeles might not be appropriate for rural Maine. But a constructive and interested attitude toward science should be the same.

ELROY O. LACASCE

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6/81

The Oregon Section of AAPT devoted most of its spring meeting to the problem of secondary physics education and covered much of the same ground that was covered by Feshbach and Fuller in April. In neither the meeting nor the letter was the root cause of the problem considered.

Any person capable of learning the physics necessary to do a good job of teaching is also capable of qualifying for any number of interesting and well-paying positions. Remuneration for teaching has always been less than for other jobs requiring comparable training, but the gap is widening at an alarming rate. Without other income or a working spouse, a person cannot support a family on a beginning high-school teacher's salary.

What is true in the high schools today could very well be true in college physics departments in a few years, and is already happening in the engineering colleges. Bachelor of science graduates are in many cases receiving salary offers which compare with their professors' salaries. There is little financial incentive to go on to graduate school, much less consider a teaching career. The information exchange section of PHYSICS TODAY regularly has listings where the salary offered for a position requiring a PhD (with an average of seven years of graduate school) is less than the starting wages of many two-year technical school graduates.

While university-school cooperation may be of some help, what is really needed to improve and maintain the quality of physics teaching are ways to help educational institutions at all levels compete successfully for technical manpower in the marketplace.

EARL KURTZ

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5/81

THE AUTHOR COMMENTS: I agree with Earl Kurtz that one cause of our problem which has become much worse in the past year, is the low salary level for many of the physics positions at educational institutions. I see no evidence of any national, state, or local resolve to address this extremely serious aspect of the problem. Perhaps the AIP Corporate Associates can show us some ways that the private sector of our economy

can help solve this problem.

I also agree with Harry Manos. Teaching physics is rewarded less highly than doing physics research. Further, in our society, the younger the child you teach the lower is your professional prestige and salary (probably an interesting inverse relationship to how much real influence you have on your students). Accepting those professional and cultural givens, then our call for closer cooperation between universities and high schools is a way to transfer a little prestige. Will it work? Ten years from now we will know if anything has happened. Meanwhile it looks as if the scientific leadership so long enjoyed by the US is in jeopardy.

ROBERT J. FULLER

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10/81

Preemptive strikes

I feel obligated to respond to the letter by Robert Yaes in May (page 107). Yaes attempts to shed "considerable light" on the vulnerability of our deterrent systems using a "very simple problem in high school mathematics." He then goes on to calculate the joint probability of kill for a Soviet attack and reaches the conclusion that the probability of all our nuclear weapons being destroyed is extremely small. He then makes remarks about the paranoia of military analysts for being so worried about such a small number. "Remember," he says, "(with) . . . a single nuclear warhead . . . we can still wipe out Moscow."

Yaes' logic is flawless, but grossly incomplete. I am reminded of the parable of the blind men and the elephant. One blind man, upon feeling the elephant's trunk, concluded that the elephant was much like a snake. Another, at the tail, concluded that the elephant was like a rope. The one at the leg knew that an elephant was like a tree, the one at the ear knew it was like a leaf, and the one at the side knew it was as a wall. But those of us that can see know that an elephant is none of these things. So, Mr. Yaes, let me open your eyes and show you some more of the elephant.

Consider the scenario; for whatever reason, the Soviets launch a nuclear first strike. We will assume that this strike is counterforce, that is, targeted against strategic military sites and not population centers. We will further assume that this preemptive strike destroys 80% of our ICBMs, 70% of our bombers, and 30% of our missile subs. I make no claims about the accuracy of these numbers, I simply made them up.

In the aftermath of this hypothetical strike, what is the strategic situation? The US nuclear capability is badly

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