

Science for All Americans: Seeking a Common Knowledge Core Across Disciplines

It is not difficult to see why K–12 science education is in trouble. In his letter, Art Hobson (PHYSICS TODAY, December 2002, page 12) approvingly quotes the authors of *Science for All Americans* for their view that, “without a scientifically literate population, the outlook for a better world is not promising.”¹ However the authors of that document promote obsolete and incorrect information about the foundations of physics. On page 47, for example, they write, “Scientists continue to investigate atoms and have discovered even smaller constituents of which electrons . . . are made.” That same sentence is repeated in *Benchmarks for Science Literacy*,² which is currently used as the foundation for curriculum reform across the US.

Much more serious than any specific erroneous statement is the document’s almost grotesque failure at the foundation of physics. You probably thought that the basic premise of the modern theory of matter was quantum mechanics, or at least that it was the standard model, right? Well, *Science for All Americans* says, “The basic premise of the modern theory of matter is that the elements consist of a few different kinds of atoms—particles far too tiny to see in a microscope—that join together in different configurations to form substances. There are one or more—but never many—kinds of these atoms for each of the approximately 100 elements.” The first sentence indicates that the way you form “substances” is by combining different isotopes of a single element!

Is it any wonder that our K–12 education system is in such bad shape when such an illiterate, anti-

quoted report has been circulated and used for more than a decade?

NASA’s Maryland Space Grant Consortium has been trying for the past decade to bring university-level science professionalism into Maryland’s K–12 school system. It is an uphill task.

References

1. F. J. Rutherford, A. Ahlgren, *Science for All Americans*, Oxford U. Press, New York (1990). Available online at <http://www.project2061.org/tools/sfaaol/sfaatoc.htm>.
2. American Association for the Advancement of Science, *Benchmarks for Science Literacy*, Oxford U. Press, New York (1993), p. 80.

Richard Conn Henry
(henry@jhu.edu)

Maryland Space Grant Consortium
Baltimore

The director of Project 2061 replies: Richard Conn Henry makes two points in his letter, one identifying awkward language and one criticizing the exclusion of advanced physics topics from *Science for All Americans*. We will certainly fix the awkward language, as we have done in the past, and thank him for pointing it out. However, we stand by our choice of learning goals.

Our authors attempted to define a common core of knowledge, across science, mathematics, and technology, that would be optimally useful and enlightening (given constraints of students’ time, interests, and abilities) for every high-school graduate, not just for those who aspire to scientific or technical careers. Difficult decisions about what was both important and possible included input from numerous chemistry and physics faculty, who have found that few college students understand the particulate nature of matter and the significance of the periodic table, let alone the significance of the standard model.

Science for All Americans does not claim to be a ceiling, but a floor; high-school and college faculty consider it quite ambitious. Perhaps with better materials and teaching we can achieve universal science lit-

eracy on which to build understanding of more sophisticated ideas such as quantum mechanics and biological signal transduction.

Project 2061 views *Science for All Americans* and *Benchmarks for Science Literacy* as living documents, subject to ongoing review and suggested revisions by scientists and educators. We welcome criticism and take it seriously. Interested readers can compare sections on cells, structure of matter, and energy transformations in their original 1989 print version with those in the current online version at our Web site, <http://www.project2061.org>.

Jo Ellen Roseman
(roseman@aaa.org)

Project 2061
American Association for the
Advancement of Science
Washington, DC

In the continuing discussion about K–12 physics education, one or two sentences in Leon Lederman’s response (PHYSICS TODAY, August 2002, page 74) caught my eye. Lederman says, “Here I only insist that the design be for *all* children.” That got my attention, because I have been working for 25 years at that goal of science for all Americans. It was also the goal of F. James Rutherford, former assistant director of NSF and former assistant secretary of the US Department of Education, perhaps the most knowledgeable physicist in science education that the country has ever produced.

From plenary lectures on science education that I have presented at major scientific and teachers’ society meetings, I summarize some questions that I do not see answered in the writers’ comments in the August 2002 Letters. For scientists interested in having all Americans learn science, I pose the following:

► For whom are you designing your reform? All students? Including the urban poor? The science able? The nonscientist/engineer (NSE) population? Future physicists?

► If you are concerned about all students, can you demonstrate to yourself even some knowledge of their

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