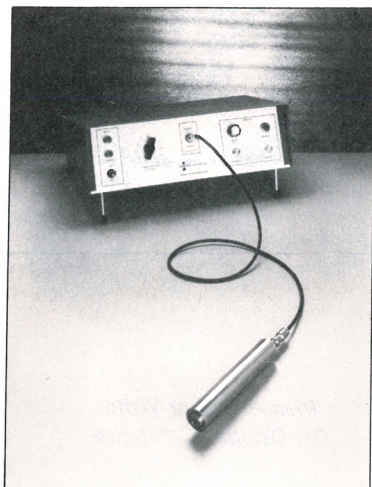


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legislation in 1980 permitting universities to hold the patents to technologies resulting from government-funded research. The intent was to speed the transfer of new technologies to the private sector, but as universities become involved in marketing the products of research, their prime function as creators and transmitters of new knowledge is compromised. The remedy, Bell says, is full disclosure.

The book is weakest when it attempts to deal with political influence. Congressional earmarking of projects that have not been subjected to impartial review by qualified experts—pork-barrel funding—is a serious threat to American science. But technical excellence is not the only factor Congress should consider in appropriating funds; Congress is also responsible for such matters as affirmative action and economic development. Indeed, the popularity of earmarking is a recognition of the importance of a strong university research program within the local economy. The problem comes when relative scientific merit is ignored or misrepresented.

When scientists seek Congressional support for their research, exaggerated claims for the potential benefits of the proposed research and "low-balling" cost estimates do a disservice to science and the nation. But willful misrepresentation in such cases can be hard to distinguish from self-deception. Self-deception in a scientist is a very bad trait—but it's not a crime. There is, I think, far more incompetence and far less conspiracy in some of the cases Bell analyzes than he imagines.

In the end, the examples in *Impure Science* give us plenty to worry about. But Bell's charge that the scientific community has chosen to ignore misconduct does not stand up.

ROBERT L. PARK
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Great Ideas in Physics

Alan Lightman
McGraw-Hill, New York, 1992.
250 pp. \$22.39 pb
ISBN 0-07-037937-8

It's no secret that science education in the US is in deep trouble. You only have to look at the graduate students at your own institution to be convinced that too few Americans are entering science to provide the force to drive our economy into the next century. There is, however, another area in which science education is in trouble, and that is in the education of

people who have no intention of ever becoming scientists. This problem comes under the general rubric of "scientific literacy."

There are many different approaches to the problem of scientific literacy. One approach is to look at the kinds of science that an ordinary person is called upon to use in daily life and to ask whether our high schools and universities are in fact supplying training in these areas. The answer to this question, for reasons too complex and lengthy to go into in a short review, is clearly "no." Courses based on this approach to scientific literacy try to span the sciences, providing the student with a general background, but not trying to get them to "do science" or to think the way scientists think.

The other approach to scientific literacy is to examine in great detail one or two examples of scientific thinking. One hopes that by exposing the students to the scientific method and the scientific view of the world, one might encourage them to learn more on their own and incorporate the scientific mode of thought into their lives and work.

I have always been an advocate of the first approach to scientific literacy, but I am aware that many of my colleagues prefer the second. Alan Lightman, a prominent astrophysicist and author, has taken the second road in *Great Ideas in Physics*. Lightman looks at four general areas of science: conservation of energy, the second law of thermodynamics, relativity (particularly special relativity), and quantum mechanics (particularly the problem of wave-particle duality). Based on a series of lectures he gave to Princeton University undergraduates, this book looks at these four questions in some detail and depth. Lightman's hope is that the student who is exposed to these ideas will be able to understand better the world in which he or she lives.

Experienced teachers will recognize that Lightman has chosen some of the most difficult topics to explain to nonscientists. He does an excellent job dealing with the hard physics: He presents each topic without apology and with the expectation that the student will be able to follow mathematical arguments at the level of elementary algebra. For example, he explains the second law of thermodynamics in the context of the allowed states of a system. This is a fairly sophisticated notion, but Lightman makes it seem reasonable that the abstract counting that goes into his arguments is relevant to deep questions such as the direction of time and

the progressive disordering of the universe.

It often happens that the best reference books for a working physicist are freshman lectures by a gifted teacher: Witness the great success of the Feynman lectures. I think Lightman's book is very much in that same tradition, though less comprehensive. If you're going to take the "narrow but deep" approach to scientific literacy, you'd have a hard time finding a better exposition than that given by Lightman in this book. I recommend it highly both for scientific literacy classes and for physicists. Anyone who found Feynman's lectures helpful will probably get a great deal out of this book.

JAMES TREFIL
George Mason University

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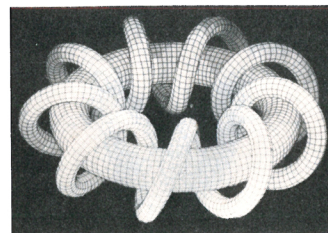
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