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PRESIDENT'S Column

The Real "Science for Society"

Recently, Shirin Ebadi, the Iranian lawyer who won the Nobel Peace Prize in 2003 for her human rights efforts, raised an important question. How, she wondered, can the U.S. be so shortsighted and unwise in its foreign policies when it is so accomplished in its science? This is a disturbing question: Why do we not apply a scientific way of viewing the world to a broader range of human problems? More narrowly, why do we not even apply scientific thinking to the question of how to teach science?

Bruce Alberts

Using the Tools of Science

My 12 years at the National Academy of Sciences convinced me that the future success of our complex human societies depends on using the tools of science much more broadly to create a knowledge base—resembling the one that we have in cell biology—that can be used to guide decision-making in many areas of human endeavor. Thus the National Academies have repeatedly addressed questions such as "How can we make a science out of education?" and "How can we make a science out of sustainable development?" The answer is to embed research and researchers of the highest quality into a wide variety of ongoing efforts to improve the human condition. But thus far we have failed abysmally in such tasks.

There is clear evidence that our approach to teaching science is ineffective. According to the National Science Foundation (NSF), more than five million people in the U.S. work in careers requiring expertise in science and technology, including some 600,000 life and physical scientists. How is it possible for such a science-rich society to produce high school graduates who, in international comparisons, repeatedly rank near the bottom in their understanding of science and mathematics? And how can we explain the fact that, in a survey conducted by the NSF, less than one-fourth of U.S. adults were able to explain in their own words what it means to study something scientifically (NSF, 2006)?

Why do we not apply a scientific way of viewing the world to a broader range of human problems?

Many scientists would probably answer such questions by putting the blame on others. But in my opinion, an important explanation for these paradoxes is our overly narrow view of the applicability of scientific skills for society. This view causes us to adopt attitudes that severely limit the spread of science and its values beyond our university (and science-based industry) walls.

Making a Science Out of Science Education

As a first step, can we make a science out of science education? As scientists, we are all devoted to collecting and objectively evaluating data to build a powerful knowledge base in our particular discipline, whether it is cell biology, organic chemistry, or astrophysics. But our reliance on data often stops there. Our disinterest in collecting evidence on the learning of students and using it to improve our own college and graduate school teaching is legendary, and it explains the current push from some farsighted colleagues for what they call "scientific teaching" (Handelsman et al., 2004). The ASCB has had a major role in promoting these new efforts through *CBE—Life Sciences Education* (www.lifescied.org). Led by Editor-in-Chief William B. (Bill) Wood, this pioneering, open-access education journal has recently expanded to cover the entire range of biological sciences, and I encourage everyone to both read it and contribute articles.

Consider the area that I know best, K–12 science education in the U.S. For many decades, we have spent enormous amounts of time and money on all sorts of projects aimed at improving science education in U.S. school districts, including some in San Francisco where

I have been personally involved. Along the way, we have made many mistakes, from which we should have learned a great deal; instead, failures are generally viewed as embarrassments and swept under the rug. As a result, those working to improve education tend to make the same mistakes over and over again in different contexts.

There is a potential advantage to the highly decentralized education system in the U.S.: It gives rise to a large number of varied approaches toward a common goal. As scientists, we should be eager to treat these as "experiments" from which to collect data to build a sound basis of knowledge on which to base future educational efforts. Only by honest, detailed research that extracts the reasons for the many successes and failures can we hope to build continuously improving systems of education—systems that make continual progress, as we do in science. But very little effort has thus far been devoted to this type of scientifically based research. As a result, our nation's schools continue to be driven by one simple "magic bullet" solution after another, as new leaders seek a quick fix to ongoing problems.

Can we as scientists change enough to make a difference? Our introductory college courses provide a great, if largely unexploited, opportunity to give our citizens (including our future political leaders) a sound basis for understanding and respecting the nature of science. Moreover, because introductory courses set the standard by which all science teaching at lower levels is judged, we cannot expect to teach inquiry-based science at lower levels if we fail to teach science as inquiry in Biology 1 and other undergraduate courses (Alberts, 2005). I am encouraged that we finally seem to have reached a tipping point in the seriousness with which most colleges and universities are addressing the teaching of introductory college science courses. This proves that professors can indeed change!

Scientists Are a Resource

There is a large, underutilized resource for spreading science throughout our societies: our scientists. Because of the need to invigorate laboratories with eager young minds, we are producing an excess of Ph.D.s for conventional scientific careers. Many of these outstanding young people deserve and are demanding access to a much broader range of career options as a part of their Ph.D. training. I view this as a great opportunity. Can we begin to build a new type of scientific enterprise, one in which universities focus on seeding large numbers of highly skilled scientists throughout society as future leaders in education research, pre-college teaching, journalism, business, science policy, law, and politics?

We should be ambitious in attempting to demonstrate that our scientific way of viewing the world can have a profound, beneficial impact on a broad range of national and international policies. A future article in this series will suggest some possible strategies by which we might hope to address Ebadi's challenge. ■

—Bruce M. Alberts

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The ASCB 2007 Call for Award Nominations

Norton B. Gilula Memorial Award

Who is Eligible: An outstanding graduate or undergraduate student who has excelled in research

How to Apply: The student or advisor should submit a one-page research statement, a list of publications, if any, the abstract submitted to the current year's Annual Meeting, and the advisor's letter of recommendation. Duplicate applications from graduate students may be submitted for the Gilula and Bernfield Memorial Awards.

Awards: The winner is presented a plaque. Expenses to attend the Annual Meeting are paid.

Deadline: August 1

Merton Bernfield Memorial Award

Who is Eligible: An outstanding graduate student or postdoctoral fellow who has excelled in research

How to Apply: The student or postdoc or his or her advisor should submit a one-page research statement, a list of publications, a copy of the abstract submitted to the current year's Annual Meeting, and the advisor's letter of recommendation. Postdocs may also submit the recommendation of their graduate student advisor. Duplicate applications from graduate students may be submitted for the Gilula and Bernfield Memorial Awards.

Awards: The winner is presented a plaque and will speak in a Minisymposium at the Annual Meeting and receives financial support to attend the Annual Meeting.

Deadline: August 1

All applications and nominations should be submitted to:

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