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Scientific Literacy

It is time to consider the problem of biconceptual education. The world today is divided into two conceptual groups, the scientist and the nonscientist, and the communication gap between them is wide and serious. It is not a problem of respect for scientists. We scientists get all the respect we need—any more is likely to make us candidates for television commercials. I am not saying that lawyers should start reading the *Physical Review Letters* or mayors the *Journal of the American Chemical Society*. What concerns me is that some of the fundamental concepts and methodologies of science are outside the understanding of the vast majority of the population, including its opinion-makers.

For example, scientists in every discipline understand that certain decisions that must be made are associated with some level of risk, but we watch with consternation as society acts as if zero risk could be achieved. The same parents, for instance, who drive their children to school without seat belts demand a flat statement of certainty about the risk posed to their children by being in school with a child with AIDS. The ever-rising levels of malpractice awards are based on the premise that if doctors are punished enough they will become perfect, but ignore the possible outcome that the consequent fee increases will inhibit those with marginal incomes from going to the doctor. Living near a nuclear power plant may be safer than attending a rock concert, but what television viewer would believe that?

A second example is the methodology of "the control." When Pasteur was ready to test his anthrax vaccine he infected both the previously immunized sheep and some nonimmunized controls. The fact that the former lived and the latter died showed that he had made an effective vaccine. Political and civic decisions are frequently made, however, with no attempt to obtain a control sample, which would help determine the efficacy of a course of action. I attended a school board meeting at which a new math program was proposed. A board member suggested that students be divided by lot into two groups, one group to be taught by the new math and one by the old math, with some evaluation at the end of the year. He was denounced by almost everyone at the meeting because one should not conduct "a lottery with students' lives." Prison programs on rehabilitation, medicare programs to balance costs, bilingual education programs, and many other worthy enterprises might be better handled, and more readily improved, if the initial experiments had appropriate controls.

These two examples of scientific concepts are directly transferable to public policy and should be taught to students at the elementary, high school, and college levels. They should be part of a screening test for television anchors, judges, and gubernatorial candidates. Instead, most schools today are diminishing science requirements. Even at the college level, the few universities that have general education requirements allow them to be satisfied by tourist-bus surveys of the wonders of astronomy or the marvels of the body, rather than by a more demanding course in the simple logic of science. Judges and legislators with little or no scientific training are making sweeping decisions on risks to the environment and from nuclear war and industrial accidents. Common sense would argue that an organization such as the Environmental Protection Agency should list the major hazards to health and evaluate them systematically, taking the most important first instead of the most recent headline case.

Scientists will be denounced for trying to introduce cold-blooded reason into an area in which warm-blooded humanity is supposed to reign supreme. But warm emotion frequently gives way to hot-headed anger and even bigotry. The scientific method has been the most effective means of overcoming poverty, starvation, and disease. Even those who are not professional scientists can understand its fundamental concepts, which will aid their decision-making in an increasingly difficult and technological world. It is time to bridge the "concept gap" by improving scientific literacy.—DANIEL E. KOSHLAND, JR.