

Why My Kids Hate Science

BY ROBERT M. HAZEN

Last year my sixth-grade daughter, Elizabeth, was subjected to science. Her education, week after week, consisted of mindless memorization of big words like "batholith" and "saprophyte"—words that an average Ph.D. scientist wouldn't know. She recited the accomplishments of famous scientists who did things like "improved nuclear fusion"—never mind that she hasn't the vaguest notion of what nuclear fusion means. Elizabeth did very well (she's good at memorizing things). And now she hates science. My eighth-grade son, Ben, was also abused by science education. Week after week he had to perform canned laboratory experiments—projects with preordained right and wrong answers. Ben figured out how to guess the right answers, so he got good grades. Now he hates science, too.

Science can provide an exhilarating outlet for every child's curiosity. Science education should teach ways to ask questions, and create a framework for seeking answers. In elementary school, because of jargon and mathematical abstraction, my children got the mistaken impression that science is difficult, boring and irrelevant to their everyday interests. Year by year, class by class across America, the number of students who persevere with science education shrinks.

As a professional geologist who has tried to convey some of the wonder and excitement of science to nonscientists, I am saddened and angered to see "the great science turnoff." I know that science is profoundly important in our lives. Informed decisions can't be made about where we live, what we eat and how we treat our environment without basic knowledge about our physical world, the knowledge that constitutes scientific literacy. Yet studies and surveys prove that our educational system is turning out millions of scientifically illiterate graduates. What's gone wrong? Who is to blame?

Some people say the problem is too much TV, or lack of parental supervision, or the sometimes poor media image of scientists. Perhaps the fault lies in declining national standards of education, poorly trained teachers or inadequate resources. Maybe students are just too dumb. But I can't escape the truth. Blame for the scientific literacy crisis in America lies squarely at the feet of working scientists. Too often we have sacrificed general education for our own specialized interests. Why haven't children been taught the basics in science? Because most university scientists at the top of the educational hierarchy couldn't care less about teaching anyone but future scientists. To them, science education is a long process of elimination that weeds out and casts aside the unworthy. It's not surprising that scientists have guided science education in

this way. All the good things in academic life—tenure, promotion, salary, prestige—hinge on one's reputation in specialized research. Educators focus on teaching advanced courses to students who are willing to run the laboratory. Time devoted to teaching, or even reading, general science is time wasted.

One amazing consequence of this emphasis is that working scientists are often as scientifically illiterate as nonscientists. I'm a good example. The last time I took a course in biology was in ninth grade, long before genetics had made it into the textbooks. In college I studied lots of earth science, even more in graduate school. But from that distant day in 1962 when I dissected a frog, to quite recently when as a teacher I was forced to learn about the revolution in our understanding of life, I was as illiterate in modern genetics as it was possible to be. The average Ph.D. scientist doesn't know enough to teach general science at any level.

Working physicists or geologists or biologists know a great deal about their specialties. That's why Americans win so many Nobel Prizes. But all that specialization comes at a price. National science leaders, who usually are the ones who have done the best playing the research game, have fostered an education policy more concerned with producing the next generation of specialized scientists than educating the average citizen. This policy has backfired by turning

off students in unprecedented numbers.

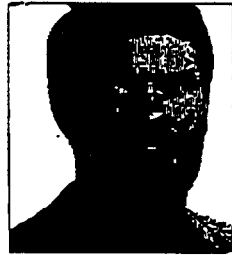
The picture may seem bleak, but the solution is not all that difficult. First, we need to recognize that science can be shared without jargon and complex mathematics. You don't have to be a scientist to appreciate the overarching scientific principles that influence every action of our lives. The central ideas of science are sim-

ple and elegant—together they form a seamless web of knowledge that ties together every aspect of our physical experience.

Then we need teachers who are able to convey this unified vision with confidence and enthusiasm. Teachers can't give students a vision if no one has ever given it to them, so every college and university needs to institute general science courses. These courses should be required of all future teachers. Administrators at institutions of higher learning should be as quick to reward the gifted teachers of general science with raises and tenure as they have been to reward the gifted science researcher.

The science classroom, at least through junior high school, should be a hands-on exploration of the universe. Textbooks that are daunting and boring should be burned. Standardized tests that bully teachers into creating rigid curricula should be outlawed. Our children should be given the chance to explore backward in time, look outward through space and discover unity in the workings of the cosmos. Armed with that knowledge they will someday combat disease, create new materials and shape our environment in marvelous ways. Science will also give them the means to predict the consequences of their actions and perhaps, with wisdom, to save us from ourselves.

Hazen, a scientist at Carnegie Institution of Washington and Robinson Professor at George Mason University, is co-author with James Trefil of "Science Matters: Achieving Scientific Literacy," published by Doubleday.



Who is to blame for this turnoff? Scientists themselves are at fault.