

Scientific Literacy

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Last summer, a respected agricultural company announced the completion of field-testing of a laboratory-produced hormone to enhance cow lactation. The hormone was to be widely distributed to farmers in a test area of Wisconsin, but the bovine bonanza never occurred. Once news of the cow injections spread, negative responses from the public kept the milk from selling in the stores. People worried that milk from the treated cows was not natural.

The agricultural company, one of the Fortune 500, took out ads in local papers in an attempt to educate communities about the development and function of the lactation hormone. The hormone occurs naturally in dairy cows, and they had merely implanted the gene for the hormone into bacteria in order to make more of it cheaper. They then injected it into dairy cattle to induce higher milk production.

"Farming will be more efficient," they said, "milk prices will go down." "It's only Mother Nature improved," they said. But folks in Wisconsin wouldn't buy it. This public nonacceptance dealt a major blow to a promising technological application of science.

The State of Science and Society

We must create a scientifically literate public to prepare for our highly scientific future. Scientists are opening doors to solve the mysteries of genetically inherited diseases and permanently debilitating injury, but if they cannot gain the public's trust, they will not be able to procure funds for

research or be given the opportunities to apply their new technologies.

Just as our grandparents never envisioned space shuttles, gene therapy, and robotics, we may be completely unable to imagine where technology may lead us in 50 years. Computer use is expanding daily, and advances in medicine are rendering age-old health afflictions obsolete, even while medical techniques themselves grow antiquated overnight. Our modes of transportation will surely change their sources of power and design. In short, every facet of our lives is destined for technological change.

But as science becomes more specialized, more and more people will remain unaware of its workings. As scientific knowledge grows, the responsibility of every citizen to understand the issues that are bound to affect us also expands. In vitro fertilization, nuclear fusion, DNA analysis, and man-made bacterial life are realities confronting humankind today. The issue that has been forced upon us is, how much do we need to know to get by in this age of science? How must the educational process adapt so that functional citizens will enter society possessing the wherewithal to make life decisions?

How much do our kids need to know? We're trapped in a Catch-22 in high school science class: if we try to teach them everything they'll be overwhelmed, unable to comprehend the vast body of information presented and unwilling to pursue a career in science. If we present just a few concepts in a simplistic fashion, we will produce graduates incapable of college-level study with only a perfunctory knowledge of the key ideas in science. In concert with this dilemma is a resistance to the idea of tracking students so that the gifted are

channeled to the demanding courses while less capable kids are routed through a survey course.

The teaching of science to our kids today is in a state of extreme metamorphosis: out of the struggle to decide what kids need to know and the desire to mesh kids with all kinds of abilities together, we'll have to give birth to a whole new way of learning and teaching the sciences. It is essential that we do so if we want to interest students in science careers and equip them to comprehend the complex issues that will confront them in the newspaper and at the voting booth, the doctor's office, and the courtroom. What does the future hold for the teaching of science?

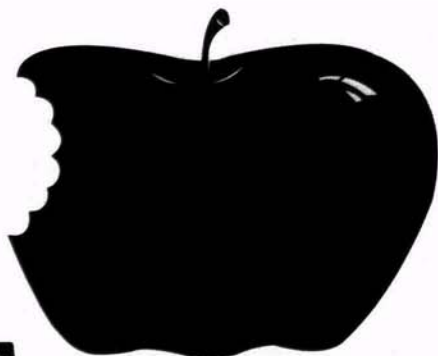
A Futurist Outlook

The science class of the future will be highly interdisciplinary—it will recognize that the sciences touch every facet of our lives from the pricing and availability of our foods to the maintenance of world peace. Future educators and parents will grapple with the need to teach kids how to apply science to global issues and how to glean science from issues of daily life in order to keep a proper perspective. The science wing of the school will no longer stand alone in the far-off reaches of campus.

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Instead, it will integrate geographically and socially with all of the disciplines it so directly impacts.

With the accumulation of science knowledge growing at an exponential rate, schools will leave behind the



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pedantic style of teaching science. Many of our brightest students are heading for careers that encourage more free-thinking and less term inundation. The future holds a completely new emphasis on the process of scientific endeavor, a focus on the germane concepts of daily life. Discussion topics in the science class of the future will revolve around real-world experience: "How can I assure the genetic fitness of my offspring?" "What are the nations of the world doing to curb ozone depletion?" "How will the extinction of the Black Lemur affect me?" And in the lab (which will be heavily funded by the private sector in recognition of the need for qualified graduates) students will conduct electrophoresis of the DNA from their own blood cells, launch atmospheric probes for analysis of the stratosphere, analyze their own brain waves to establish personal learning modes. It will be a busy, personalized, and meaningful place where learning how to know will supercede the absorption of concepts. Tests and seating charts will be out; research projects and labs without walls will be in.

The Future Is Now

In the future, the scientific community will provide guidance, leadership, and material support for science study in the high schools. The American Association for the Advancement of Science has already instigated this revolution with "Project 2061." In this landmark effort, scientists, engineers, and educators have emphasized recommendations such as the paring of content in favor of process. A veritable revolution awaits us; exciting times lie ahead, when we will unleash the creative powers of our youth upon science. ☐

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