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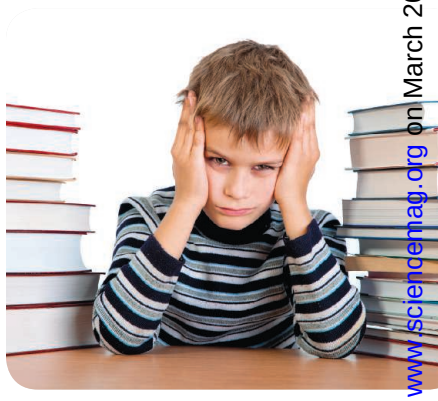
Trivializing Science Education

I WAS PROMPTED TO WRITE THIS EDITORIAL AFTER PLAYING AN ELECTRONIC VERSION OF THE old board game Trivial Pursuit with my grandchildren over the holiday break. For decades, my favorite category of questions to answer had been "Science and Nature." But in this 2009 edition, I could answer almost none of those questions—because "science" had apparently been redefined as knowing what disease killed character X in movie Y. Trivial Pursuit is of course merely a game; but it reminded me of the much more serious battle over the California State Science Education Standards that I and many others lost in 1998. As a result, for my grandchildren, "science" includes being able to regurgitate the names of parts of the cell in 7th grade, after memorizing terms such as Golgi apparatus and endoplasmic reticulum. Those of us who are passionate about science have thus far failed to get real science taught in most of our schools. Is it time to regroup with a different strategy?



Few people are aware of what has been learned from research about the teaching of complex scientific concepts to young people, and there is a strong tendency to assume that the best science curricula are the most "rigorous." Although rigor might appear to be a worthy goal, the unfortunate result of this persistent view is that difficult concepts are taught too early in the science curriculum, and they are taught with an overly strict attention to rules, procedure, and rote memorization. Below is an excerpt from my testimony to the California Standards Commission in 1998, when unsuccessfully opposing such ideas as teaching the periodic table of the elements in 5th grade:

"When we teach children about aspects of science that the vast majority of them cannot yet grasp, then we have wasted valuable educational resources and produced nothing of lasting value. Perhaps less obvious, but to me at least as important, is the fact that we take all the enjoyment out of science when we do so. Consider my field, for example. I have spent 30 years of my life working out the mechanisms that allow the DNA in our chromosomes to replicate. The entire DNA story is a beautiful one that should produce aesthetic enjoyment in the student when first learned. I was fortunate enough to have finished my precollege biology education before Watson and Crick unraveled this mystery with their discovery of the DNA double helix in 1953. I can therefore still remember the joy that I felt when I first learned about DNA. Unfortunately, most students today are taught about DNA at such an early age that they are forced to merely memorize the fact that 'DNA is the material from which genes are made,' a chore that brings no enjoyment or understanding whatsoever. Much later, when they do have the background to understand both the structure of the DNA molecule and its explanatory power, I fear that the joy of discovery has been eliminated by their earlier memorization of boring DNA facts. We have spoiled a beautiful story for them, by teaching it at the wrong time."

The preference for "rigor" in science education can also interfere with the teaching of science at the college level. For example, in an introductory biology class, students are often required to learn the names of the 10 enzymes that oxidize sugars in a process called glycolysis. But an obsession with such details can obscure any real understanding of the central issue, leaving students with the impression that science is impossibly dull, causing many to shift to a different major.

Tragically, we have managed to simultaneously trivialize and complicate science education. As a result, for far too many, science seems a game of recalling boring, incomprehensible facts—so much so that it may make little difference whether the factoids about science come from the periodic table or from a movie script. For my thoughts on how we can do better, stay tuned for next week's Editorial.

– Bruce Alberts

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