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Mobilizing Scientific Societies

IN LAST WEEK'S EDITORIAL, I LAMENTED THE SUPERFICIAL, SKIN-DEEP APPROACH TO SCIENCE LEARNING that is common in America's schools.* The situation has proven highly resistant to change, and it continues to have a disastrous, long-lasting effect on the attitudes of students toward science (millions of whom are now adults). The main culprit is the strong demand for a broad "coverage" of each subject, which kills student interest and makes genuine comprehension almost impossible. At the precollege level, this push is driven by state-based textbook adoption policies, by high-stakes examinations, and—inadvertently—by a scientific community that largely fails to understand teachers' needs. How might scientists be mobilized to support a much more inspiring, in-depth form of science education?

Many beautiful stories lie at the heart of science. Consider, for example, the beginning of life for an animal like ourselves. Somehow a single fertilized egg cell is able to multiply to give rise first to a tiny embryo and then, through many cycles of cell growth and division, to an adult animal composed of thousands of billions of cells. This process requires that cells behave like tiny computers that store a memory of where they have been in the embryo, selectively expressing only those genes appropriate for their time and place in the giant "cell cooperative" that is a multicellular organism. Amazing time-lapse videos have been produced by researchers that could be enhanced with age-appropriate narrations to make this biology come alive. One need not know anything about the molecules or organelles inside cells, nor to be introduced to scientific terms like endoderm, mesoderm, and ectoderm, to appreciate the process of embryonic development that forms a human baby. Yet, a 700-page life science textbook for 12-year-olds selected by the state of California (with a glossary of 500 words) never challenges students to consider the fascinating question of what cells must do to produce an embryo, focusing instead on introducing them to many hundreds of dry "scientific" terms and a multitude of associations to memorize.

If funds were devoted to quality research in schools to ascertain what students actually learn from curriculum materials, a textbook like this could never survive. Badly needed are materials for teachers that guide students to confront a phenomenon such as embryo development and then, working in small groups with skillful coaching, to imagine potential ways to explain it. After struggling with such a problem, students may progress far enough to appreciate Watson and Crick's elegant 1953 solution to the mystery of how cells can carry the huge amount of genetic information needed to produce a human being. But with no understanding of this mystery, a student's encounter with DNA becomes just one more item to be memorized in a deadly dull glossary of biology terms. This is but one example of why teachers need enough time to teach such fundamental concepts in depth, instead of being pushed to "cover" a subject such as biology in a single school year.*

To facilitate such teaching, scientists will need to work in close partnership with outstanding teachers and other education experts—not only to research the effect of current curriculum materials and teaching methods on students (thereby advancing the science of education), but also to develop new, validated, Web-based curricula that address the critical national (and international) need for inspiring, in-depth lessons.

I propose that a set of scientific societies in different disciplines (covering biology, chemistry, physics, earth, and space sciences) be recruited for the above validation purposes. The publication of this issue coincides with the annual meeting of the American Society for Cell Biology in San Francisco, which is but one example of a large discipline-based organization with a strong interest in education,† ready, willing, and able to be called on to help change the current trajectory of science education in the United States and other parts of the world.

– Bruce Alberts

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