

## Back-to-Basics: A Critical Juncture in Biology Education

Paul DeHart Hurd

Public criticism of science teaching is mounting. “Back-to-basics” is the plea of disenchanted parents. Education in general and science teaching are losing credibility. Parents have misgivings about educational goals; they have lost faith in the rationality of the curriculum; and they doubt the quality of what is learned. These indictments deserve serious analysis and an unambiguous response from teachers. How, then, should we respond to the charges of professional neglect?

Parents and teachers agree that after 12 years of schooling students should demonstrate competence in the common bases of human discourse, the “3 Rs.” All concerned will undoubtedly agree on the importance of the other “Rs”—Reasoning, Responsibility, and Reverence for democratic values.

But what if young people, after over a decade of schooling, are not able to read and understand a newspaper article on science? Suppose a student cannot use information acquired in science courses for interpreting and making responsible decisions about everyday affairs where science is relevant? What if the student cannot explain a probability statement about the weather, or more important, about the likelihood of inheriting a genetic disease? Or, suppose the student after completing a biology course fails to comprehend the seriousness of current issues, such as uncontrolled population growth, environmental manage-

ment, personal health maintenance, endangered species (including *Homo sapiens*), the world food supply, bioconversion as an energy resource, the interaction of cultural and biological evolution, or what is meant by the quality of life? What then? The question is rightfully raised: what is basic in biology education?

### A Preamble on Change

What is the real reason for the “back-to-basics” issue? This is not the first time parents have challenged conventional practices in science teaching. In the past 50 years, we have seen movements to “teach the fundamentals,” to “eliminate frills,” and to have a “no-nonsense curriculum.” Science curriculum improvement projects of the 1960s were the products of a basic education movement that began in the 1950s. The new curricula that resulted were developed by scientists who generally considered themselves fundamentalists in educational affairs. They interpreted “basic” to mean (1) understanding the structure of scientific disciplines; and (2) the ability to use the inquiry processes that foster the growth of science disciplines.

Nearly two decades have passed since the new science curricula were written. The question of what is “basic” is being raised once again. The public has developed a growing awareness of the serious gaps that exist between the goals of science teaching and recent transformations in science as well as the realities of life, both personal and social. Skepticism grows about the intellectual and practical uses of much of the material included in science courses.

Change is characteristic of the United States; however, Americans have little understanding of the concept of *change* itself. Changes have accelerated in degree and pace in recent years. The traditional paradigm of science is shifting to encompass technology, social problems, and human problems. This shift is evident in the emphasis on problem and mission-focused research in contrast to the traditions of basic research. The public is actively seeking to direct, and perhaps to control, the course of basic research. Science has become enmeshed, albeit unwillingly, in economic, political, and moral affairs. Bioethics, for example, has emerged as an important new field of scholarship. Thus, a qualitative measure is being added to

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the meaning of scientific progress. The limitations of the present methodologies of scientific investigation are increasingly being debated both by scientists and nonscientists.

Transformations in the biological sciences in recent years include more than a growth of knowledge, though this has been phenomenal. Fresh theoretical insights (sociobiology) as well as new technologies for research (recombinant DNA) have been developed. The meshing of disciplines—biochemistry, biophysics, human ecology, psychobiology—enlarges and enriches the fields of biological investigation. Some science historians see the merging of disciplines and the integrated fabric of modern scientific research as the most important advance in the evolution of science in this century.

Recent changes in our culture extend beyond science. New life styles are restoring our cultural pluralism. This change is reflected in the pressures to personalize science instruction. The resolutions of the crises causing tensions in our society—energy, environment, population, food, stress—depend in no small measure upon the proper use of scientific information and to a large extent of biological knowledge. Furthermore, any action taken on one problem generates new issues, and no issue is value-free. The linear thinking typical of scientific inquiry is not appropriate for such problems. The complexity of science/social problems demands multiple perspectives and systemic reasoning for a meaningful interpretation.

A public awareness is emerging, vague and undefined as it may be, that what currently constitutes science teaching is unresponsive to the needs of both our society and our young people. This is especially true for biology teaching. It is not so much that biology curriculum developers have been more negligent than those in other sciences; rather it is that biological knowledge is more directly and immediately related to human affairs.

The curriculum concerns parents express reflect their general attitudes toward science and technology. On the one hand, there is disenchantment with these enterprises; and on the other, an overconfidence that science and technology can solve all the problems of life and living. Clearly, however, the American people agree with Francis Bacon (1620) that human service is the ultimate goal of scientific effort.

### Defensive Avoidance

Within the past decade, a number of social, biological, and educational events have converged, each one affecting the others. These watershed events in science, in the culture, and in human affairs separate the past from the future and give rise to crises and gaps in our cultural evolution. In the present period of cultural disruption, "future shock" has become a national disease; its symptoms are nostalgia, resistance to change, emotional stress, and hostility.

The "back-to-basics" slogan expresses public concern about the direction education is taking in an era of cultural transformation and revitalization. Parents expect schools to respond actively to individual and social needs as they are today and as they are likely to be in the future. Curricula and instructional systems now in general use are seen as inadequate for the task and new educational goals and practices are needed. What is found, however, among a number of biology teachers and textbook authors is a misinterpretation of the basics movement interpreting it to mean going back to some earlier period of biology teaching.

A similar interpretation of the "back-to-basics" movement in science teaching is contained in a recent study by Stake and Easley (1978), who reported as follows:

We expected to find parents and economically distressed school critics advocating more emphasis on the

basic skills of reading, spelling, and arithmetic, with teachers arguing back that these skills do not add up to an education—but many teachers were "the advocates" more than anyone else around.

These "back-to" biology courses are characterized by an overemphasis on facts. Organisms are taught as being an array of parts; to know biology is to name these structures and their functions. Examination questions have one-word answers. Such a pseudo-reductionist viewpoint effectively excludes biosocial issues and personal questions from the classroom, because there is no biological basis for a rational discussion. Also characteristic of these courses is the omission of humans as biological organisms. Human anatomy is a part of the course; human beings are not. The human image is an asexual organism, without a complete life cycle, without a habitat, without historical beginnings; it is beige in color, of questionable maturity, devoid of culture, and has only primitive emotions.

Other teachers respond to the "back-to-basics" issue with the cliché "But I must prepare my students for college." Cumulative evidence from research on college success in science indicates that bright students who like science are skilled in mathematics and reading and come from families with an above-average socioeconomic status do well in college whether or not they have had a particular high school course in science.

Another defensive reaction to needed curriculum changes is the response, "Our school district is short of money." In response to this statement, one can only point out that curriculum improvement has always been more a matter of scholarship than finances. To change the context in which biological concepts and principles are taught so that they reflect contemporary thinking within the broad sweep of biology and, at

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## A Critical Juncture

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the same time, reflect cultural demands is primarily a philosophical transition.

### Biological Education: At the Crossroads

A positive approach to the "back-to-basics" issue is (1) a critical reexamination of the underlying reasons for teaching biology; and (2) the development of goals consistent with those reasons. The bases for carrying out these tasks also need review. We can derive a rationale and goals best by analyzing the relevant literature (scientific, social, and educational) and designing our own studies to see what approaches will work. This method contrasts sharply with the usual procedure—undocumented arguments followed by a compromise of diverse opinions.

Developing a rationale and the supporting goals for biology teaching should be explored anew without regard for past statements. When curriculum committees begin their efforts by examining existing goals, the end result is usually a more sophisticated description of traditional goals. By contrast, new perspectives for teaching biology should be the products of perceived changes in society and culture, perceived changes in the scientific enterprise, progress and potential of the life sciences, and the impact these conditions are likely to have on human affairs and the quality of life. The entire effort should be directed toward establishing cultural and scientific validity for curriculum change.

### Conclusions

However one examines the "back-to-basics" plea, it is a call to curriculum revitalization, not a pressure to return to traditions. Parents are concerned that schools seem unwilling or unable to resolve the educational problems posed by cultural changes

and increased scientific knowledge, or to find ways to make biology teaching a positive force in human evolution. Parents wonder whether the outcomes of schooling might be a selective illiteracy that will make it difficult for their children to cope realistically with biopersonal and biosocial problems. "Back-to-basics" expresses a concern about the danger not of absolute, but of relative, ignorance. Parent indictments of the present biology curricula stem from what is viewed as a lack of response to change and a lack of commitment to the public welfare. To change direction and to make biological enlightenment a reality will require a coalition of teachers, parents, research biologists, philosophers and sociologists of science, educational specialists, and perhaps others.

We have a professional responsibility to respond to public requests for a determination of what is "basic" in biology; we must respond in ways that are not educationally frivolous. We cannot justify in an intellectually honest way a modern biology program that replays the obsolete curricula of the past. We cannot avoid the educational crises that face us and that await us, but by understanding the nature of social change and the impact of science on our lives, we may be better able to deal with them.

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A culture which permits science to destroy traditional values but which distrusts its power to create new ones is destroying itself.

John Dewey