

Letters to the Editor

Darwin and the Theory of Evolution

I have read with interest the article by Tim M. Berra concerning the work of Charles Darwin (*ABT* 42:8). Far too many people equate Darwin only with his theory of natural selection and fail to recognize that, above all, his insatiable curiosity caused him to deal with biology in its broadest sense.

It is unfortunate that either the original manuscript or the typography used when the article was set has resulted in Darwin being credited twice with the "Theory of Evolution," capitalized as though it were either a major publication or a major pronouncement on the part of Darwin. Darwin was not the author of the theory of evolution. The concept of evolution developed in the minds of the early Greeks by at least 600 B.C.

The term "evolution" occurs nowhere in the first edition of the *Origin of Species*, and only the final word on page 490, "evolved," refers in the past tense to an unfolding of life forms. Lamarck, Haeckel and Darwin, three of the greatest 19th Century evolutionists of Europe, never used the word "evolution" in the original editions of their works. The word "evolution" in Darwin's day was firmly tied to a concept of progress, and Darwin rejected the concept that evolution and progress were synonymous.

It was Herbert Spencer who used the term "evolution" as descent with modification. In his *Principles of Biology* (1864-67) the word "evolution" appears frequently as a synonym for organic change. Darwin, however, rejected the idea that organic change led to an abstract idea of progress, but rather interpreted it

as leading only to increasing adaptation between organism and environment. It is still a popular concept in the lay mind that evolution and progress are synonymous, and that evolution leads only to improvement.

Scientifically, "evolution" is used in the Spencerian sense of descent with modification and not in the vernacular sense of progressive development. Thus, referring to Darwin's "Theory of Evolution" is to imply an unintended insult, as Darwin preferred "descent with modification" and was never comfortable with the term "evolution."

In the segment "Books About Darwin," there is little to indicate Darwin's interest in plants even though, of the major publications cited earlier, fully a third deal directly with plants. A life of Darwin that emphasizes his contributions to botany is by Allan, M., 1977, *Darwin and His Flowers: The Key to Natural Selection* (New York: Taplinger, 318 p.) This work considers Darwin as a botanist and gives a different perspective to his contributions by so doing. It is a worthwhile addition to the books about Darwin.

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Berra Responds

The stated purpose of my article was to point out Darwin's other accomplishments, not to give a history of the concept of evolution. Certainly, a host of evolutionary ideas preceded Darwin's formulation. This is implicit in the bibliography. The fact remains, however, that it was Darwin's well-reasoned

account and thorough documentation which carried the day. When a modern biologist writes of evolution for the educated public s/he means "change of gene frequency" (a functional definition) that Darwin knew as "descent with modification" (a descriptive definition). I am well aware of the various misconceptions of some members of the public about evolution; however, I don't see much merit in exploring the other meanings of the word that are not germane to the purpose of the article. I pointed out Darwin's use of "evolution" in the 6th edition of *The Origin*. I don't want to engage in nitpicking about capitalization. Suffice it to explain that capitalization of Darwin's Theory of Evolution is simply an editorial preference of mine for added emphasis of Darwin's major pronouncement. I do not deny that many others offered faulty evolutionary hypotheses which created the intellectual milieu in which Darwin operated. However, Darwin offered THE Theory of Evolution (the one that works)! For further reading on Darwin's originality I recommend the following: Ghiselin, M.T. 1969. *The triumph of the Darwinian method*. University of California Press, Berkeley, 287 p. and Ghiselin, M.T. 1980. a review of *The Darwinian Revolution* by M. Ruse in *Systematic Zoology* 29:105.

Evolution and Creation

I would like to comment on Mary Lou McReynold's and Wayne Moyer's Letters to the Editor in the September issue of *ABT* (42:6). Apart from the "scientific-ness" of creation versus evolution, there is another aspect of the controversy of

which educators are unaware or are doing their utmost to ignore. That is the question of professional integrity and credibility involved in presenting one-sided arguments to young people. Darwin (1896) described *The Origin of Species* as "one long argument from the beginning to the end." Neo-Darwinists and textbook authors have followed Darwin's lead and have continued to present scientific evidence based upon an *a priori* belief in evolution. Educators had better consider, what the public is beginning to realize, that in presenting a one-sided argument, Darwin as scientist does not qualify as Darwin as teacher.

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Reference

DARWIN, F. (ed.) 1896. *Life and letters*
I. New York: D. Appleton and Company.

Moyer Responds

The professional integrity of educators requires that they teach science as defined by the scientific community not by religious groups, the state, or school administrators. They are licensed by their states to teach science, not theology.

McReynolds Responds

Amen! A real and growing problem.

Extended Discretion Approach

I was delighted to see William H. Leonard's article, "Using the Extended Discretion Approach in Biology Laboratory Investigations," in the September, 1980 *ABT* (42:6).

When several high schools in our district (Jefferson County, Colorado) went on a year-round calendar, we were faced with some students coming in and some leaving biology clas-

ses each eight and one-half weeks. (The school calendar has students going to school for two eight and one-half week quarters, then having an eight and one-half week vacation; one third of the student body and faculty is on vacation at any given time.) To avoid having the biology course totally sequential, our school chose to make an introductory eight and one half-week course (Biological Processes) a prerequisite to any of the other four eight and one-half week courses, which could then be taken in any order.

Advice from colleagues and common sense cautioned us to avoid a straight "techniques" course. Though we include such (microscope work, review of the metric system, some basic chemistry), we have built the introductory course around some of the best quantitative lab exercises often done in a Biology I course.

We begin with the yeast/molasses lab used in Chapter 1 of the *BSCS Green Version* (3rd edition), done with explicit directions but with emphasis on making a prediction and drawing a conclusion. This is followed (interspersed with techniques and some basic background on concepts like photosynthesis) by several other quantitative investigations. With each succeeding lab, students are expected to provide more of the work themselves. For example, the second lab requires students to write their own hypotheses. By the fourth lab, discussion questions are omitted; students must write their own discussion/conclusion paragraphs. For the last class investigation, students work in groups to solve the problem of how salt water affects radish seed germination. They plan their own procedure with a few hints like "ocean water is about 3.5% salt." Testing "solutions" of 20% salt is not uncommon in spite of the hints, allowing students to experience the frustration that often accompanies scientific work and giving them practice revising hypotheses. Students also have an opportunity to do an

unguided individual investigation dealing with the heart rate of a mammal. Most students require a few hints to get started; many need individual help. But the opportunity for creativity is there and many students relish it.

Although the subject matter of the labs is unrelated, we remind students that the investigations are related in that they exemplify the process of investigating biological phenomena.

We have not collected any data on how much this approach improves later performance or affects attitudes or understanding of science. However, the subjective impression is that laboratory performance in Advanced Biology, Chemistry, and Physics has improved since we instituted Biological Processes.

The frustration part of this is that when we continue the other Biology I courses, studying subject matter more than process, the laboratory investigations (*BSCS Green Version*) are, in many instances, less quantitative and often in cookbook style. Therefore, I am writing William Leonard for copies of existing Extended Discretion approach (ED) investigations and will work to adapt others to this format. If the textbook writers really believe what we all verbally accepted during the "biology teaching revolution" of the 1960s, we will see more ED investigations in textbooks.

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Leonard Responds

Thanks very much for your enthusiastic letter to the *ABT* editorials in response to my September *ABT* article describing the Extended Discretion Laboratory Instructional Approach. I share your perception that existing commercial laboratory programs are definitely lacking in activities which promote creativity, independence, planning, and the use of science processes.