



Author's Response to a Review of **BIOLOGY**

by Miller & Levine

(2009 SC Edition)

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- Page 303: Figure 12-17 is a chart showing the genetic code. I am surprised that the reviewer asked whether it applied to bacterial or human DNA. In reality, the genetic code chart is presented in the form of RNA (not DNA), and the code as presented in this chart is the so-called canonical form, which applies to the nuclear genomes of all animals (including humans) and also to most bacteria.
- Page 330: The use of the term “pesticide” in this context is correct, since, as the reviewer admits, it is an inclusive term that applies to insecticides. Nonetheless, I do agree that the change he suggests would make the sentence more specific, and will make this change in the next printing of the textbook.
- Page 368: Despite the reviewer’s comment, I do not see a definition of evolution on this page. The next page (369) does define evolution as “change over time,” which is a correct definition of the process as it applies to biology.
- Page 369: Charles Darwin was born on the very same day (February 12, 1809) as Abraham Lincoln. We point this out to give students, who have also studied American history, a sense of historical context in the study of science. The fact that Darwin, an amateur naturalist, did not have a science degree is irrelevant to his scientific work, which stands or falls on its own merits, not on Darwin’s university transcript.
- Page 372: It is correct that the finches Darwin collected on the Galapagos were identified as such only after Darwin returned to England and consulted an expert. However, our book says nothing to the contrary, and therefore does not require any correction on this point.
- Page 373: The reviewer’s comment here is poorly-informed. Darwin’s notebooks from his voyage to the Galapagos show that he gathered extensive evidence of evolutionary change. The claim that Darwin “shifted” his views for theological reasons are not supported by any Darwin scholar I know of.
- Page 374: The fact that some geological features can be formed rapidly does not mean that all are formed that way. There is abundant evidence, taught as a required part of the earth science curriculum in South Carolina, that the well-defined geological ages of the earth extend over hundreds of millions of years.

- Page 375: Our textbook correctly points out that Alfred Russell Wallace shares credit with Charles Darwin for the theory of evolution. Because the volume and influence of Darwin’s work is much greater than Wallace’s, we properly place our emphasis on Darwin’s work. It is worth noting, however, that the reviewer contradicts his own assertions about evolution as anti-religious by citing Wallace. Alfred Russell Wallace was a believing Christian, and certainly did not develop his own formulation of the theory of evolution out of hostility to faith.

- Page 378: Charles Darwin used the term “species” as it was generally understood by naturalists of his time. He presented extensive evidence that present-day species were the modified descendants of earlier species, and this evidence, despite the claims of the reviewer, is found throughout Darwin’s book *On the Origin of Species*.

- Page 380: The reviewer makes the nonsensical claim that Darwin could not have developed a theory of evolution without using the word “evolution” in *On the Origin of Species*. The reason, as the reviewer should know, is that Darwin did not use the word “evolution” at first to describe his ideas. Rather, he preferred the term “descent with modification.” The use of a different term does not in any way change the fact that his work did, indeed, establish what we refer to today as the theory of evolution.

The reviewer’s claim that the theory of evolution is responsible for 300 million deaths is absurd and insulting. The murderous totalitarian states led by Hitler and Stalin were driven by ideologies of socialist utopianism, racism, and anti-Semitism, not by a scientific theory relating to the origin of species.

- Page 381: The reviewer is correct that this phrase was indeed coined by Spencer, and I will correct it in the next printing of our book.

- Page 381: When the reviewer claims that there is no support for a species “changing into a new organism,” he is mistaken. An example is given on page 405 of our textbook of one species of squirrel having split into two new species. I would also refer him to the work documenting speciation in *Rhagoletis*, the apple maggot fly, in North America over the past 400 years (see, for example, “Mayr, Dobzhansky, and Bush and the complexities of sympatric speciation in *Rhagoletis*,” Feder *et al* , Proceedings of the National Academy of Sciences, vol. 102, pp. 6573-6580 [2005]).

- Page 382: The reviewer claims that we should not say that living things are related by common descent. However, South Carolina Science Standard B-5.2 requires exactly this when it states that students must be able to explain how “genetic processes result in the continuity of life-forms over time.”

- Page 385: Curiously, the reviewer complains that the appendix has been mistakenly cited as a vestigial organ when it actually performs a useful, if non-essential function. This comment suggests that the review does not understand the meaning of the word “vestigial,” which does not imply that an organ is without function. Rather, it means that the organ is reduced in size and importance, a “vestige” of its appearance in other organisms, as our text correctly notes. The comment also suggests that the reviewer has not read our book carefully, since we do not cite the appendix as such an organ.

- Page 385: The reviewer makes the curious claim that we “fail to cite a resource where Charles Darwin outlines his theory of evolution.” Darwin outlined his theory in his book *On the Origin of Species*, as we previously noted, so this objection of the reviewer is without merit.

- Page 386: These comments of the reviewer clearly refer to our Figure 15-17 and associated text on page 385. Although the reviewer uses the word “fraud” to describe drawings of comparative embryology made by Ernst Haeckel, the photos in our textbook are absolutely accurate. They were each taken roughly one third of the way through embryonic development for each species, and are absolutely accurate. The reviewer asks that we cite the work of “M. Peterson et al.” In reality, there is no such paper.

He is likely thinking of the work of Michael Richardson: [Anatomy and Embryology, **196**(2):91–106, 1997]. However, Dr. Richardson, whom the reviewer apparently regards as an authority on this issue, actually agrees with our text on the degree to which comparative embryology supports evolution. In 1998 Dr. Richardson wrote: “Haeckel's inaccuracies damage his credibility, but they do not invalidate the mass of published evidence for Darwinian evolution. Ironically, had Haeckel drawn the embryos accurately, his first two valid points in favor of evolution would have been better demonstrated.” [source: *Science* 280: 983. 1998].

- Page 404: The reviewer states that dogs are all members of the same genus. Actually, they are members of the same species (*Canis familiaris* or *Canis lupus familiaris*). But we don't even mention dogs on this page. Evidently, he objects to reproductive isolation as a mechanism for speciation in evolution. However, this is a key element of evolutionary theory, which South Carolina students are required to understand as part of Science Standard B-5.

- Page 406: The reviewer requests a reference for the information in Figure 16-13. This information is available from many sources. A summary of the work of Peter and Rosemary Grant, from which this table is derived, can be found in: Hosken and Balloux, *Trends in Ecology & Evolution* Volume 17, Issue 10, 1 October 2002, Pages 447-448. The reviewer suggests that we include additional data showing survival rates with small seeds. Quite frankly, I see no reason to do this, since it would not change the conclusions drawn from these studies or help to clarify the material for students.

- Page 409: This statement is indeed speculative, which is why we used the word “might.” Contrary to the claims of the reviewer, speculation is an important part of forming scientific hypotheses, and therefore perfectly valid when presented as such. The reviewer seems to question the validity of evolutionary scenarios with respect to the Galapagos finches. It is worth noting that molecular studies have confirmed the relationships between the finch species, as noted in “A Phylogeny of Darwin's Finches Based on Microsatellite DNA Length Variation,” by Kenneth Petren, B. Rosemary Grant, Peter R. Grant *Proceedings of the Royal Society: Biological Sciences*, Vol. 266, No. 1417 (Feb. 22, 1999), pp. 321-329.

- Page 410: The reviewer claims that there are scientific data that do not support evolution. However, he does not say what that data might be. Instead, he claims (without any supporting data or reference) that information showing that living organisms appeared on the planet nearly 3 billion years ago is unreliable. Why is that information unreliable? Has the reviewer discovered patterns of radioactive decay that violate the laws of physics? He does not say, and therefore it is impossible to evaluate these critical comments. It is worth noting that South Carolina Science Standard 8-2.5 requires students to “Illustrate the vast diversity of life that has been present on Earth over time by

using the geologic time scale.” If we took the reviewer’s comments as they are intended, it would violate this Standard.

- Page 414, Q28: This question asks students to infer the sizes of seeds eaten by three species of bird on the basis of their beak sizes. This is a perfectly reasonable question, based on the information about the work of Peter and Rosemary Grant as described on pages 406-407 of the text. The answer, of course, is that beak sizes in the Galapagos finches correlate well with the sizes of seeds eaten by the birds.
- Page 416: This ancient scorpion, trapped in amber, is used to indicate that fossils provide reliable and detailed records of past life. The text makes no other claim about the scorpion shown within the amber, and therefore there is no reason for the reviewer to object to it.
- Page 424: The groundbreaking Miller-Urey experiments are described in our text because of their historical importance. They were the first to show that important biological compounds could spontaneously be formed from simpler compounds under conditions thought to resemble those on the primitive earth. As we correctly note, we now know that the exact conditions used more than 50 years ago when the experiment was first conducted were incorrect. However, subsequent experiments have shown that the basic results found in the experiment are still valid. That is more than enough reason to include this experiment in the textbook. The Precambrian period does indeed include most of the earth’s history. However, the emergence of multicellular life occurred near the end of the Precambrian (in the Vendian). Since we are more interested in multicellular life (being multicellular ourselves), it is appropriate to concentrate on the emergence of multicellular animals and plants, which took place after the Precambrian.
- Page 437: Coevolution is widely accepted as an evolutionary phenomenon, and the fact that the reviewer believes that nitrogen fixation could not have evolved this way is no reason to take this important process (coevolution) out of the text.

Concluding Note: Although the reviewer has made a few helpful criticisms which we will be glad to incorporate in our text, the concerns and objections to the treatment of evolution in our textbook expressed by this reviewer are without scientific merit. To accept such criticisms would render a book unable to meet the South Carolina standards 8-2, 8-3, and B-5. In this document I have tried to answer each of these criticisms of evolutionary theory as completely as possible. However, if the Board has additional questions about evolution and its treatment in our text, I would be delighted to answer these in writing or in person as the Board’s schedule and my own academic duties permit.

Respectfully Submitted,



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