

Critical Analysis of Evolution: Problems with cited references

At the February Board of Education meeting a question was raised concerning the sufficiency of references in the Critical Analysis of Evolution lesson if the citation to Jonathan Wells' *Icons of Evolution* was removed. Dr. John West, Associate Director of Discovery Institute's Center for Science and Culture asserted that there were more than sufficient citations in the lesson plan for students and teachers to call upon to support "both" sides of the listed topics - even if *Icons* was deleted. During questioning by Board member Robin Hovis, it was recommended that an evaluation be carried out comparing the cited references to the assertions contained in the lesson plan. The attached table comprises such an analysis.

For each of the citations in the Critical Analysis lesson plan under the five "Aspects", the references were classified according to type (e.g., popular book, text book, primary scientific article, popular science magazine). Then, it was determined whether the reference supports either the current scientific view, or the purported challenges. A comment field is provided to note the age of the reference, whether, or how completely, it addresses the stated topic, and the quality of the reference for use in an average 10th grade classroom.

As it turns out, once Wells' *Icons of Evolution* is removed from the list, the only support for the "challenges" to current evolutionary explanations is Michael Denton's *Evolution: A Theory in Crisis* (and it is cited only for the Homology topic). Even the larger list of background references does little to add to any of the discussions.

In actuality, the "challenges" to aspects of evolutionary theory exist only in the body of the lesson plan, and are not derived from the world of practicing biologists. Thus the lesson plan fails to meet the intent of the standard which is to demonstrate how scientists critically examine aspects of evolutionary theory.

Many of the cited references are not readily available to teachers or students. For example, *Principles of Numerical Taxonomy* by Sokal and Sneath is over 40 years old and out-of-print. Being a college-level text on the advanced statistical treatment of taxonomic data, it is also far beyond the level of 10th Grade Biology. Also, having been written in 1963, it contains essentially no information on the burgeoning field of genetic homology. Several of the references are incorrectly or incompletely cited, making a search for the original article more difficult. This indicates also that the author of the lesson plan never actually read the articles in question, but simply copied the citations (with their incumbent errors) from another source. Searches were performed using an on-line membership to the AAAS archives of *Science*, and EBSCOHost through the Columbus Library System (as recommended in the lesson) to find other journal articles. In spite of these resources, it was still necessary to use university library collections to find copies of the older *Natural History* and *Biological Journal of the Linnean Society* articles. Given the difficulties we had in locating references with a reasonably diligent search and access to major library collections, then it is unfair to think that a 10th Grade Biology teacher in rural Ohio will have better success.

Inability to access and use the references cited in the lesson will force students out onto the Internet to acquire the material to complete their assignments.

	Critical Analysis of Evolution – Grade 10 (Lesson: L10-H23)	What scientists say:
1 p. 321	General Tips: •Students should use school library resources such as InfOhio's Access Science and EBSCO to locate information on aspects of evolutionary theory.	Many of the cited references are not readily available to teachers or students, even using the recommended library resources. For example, <i>Principles of Numerical Taxonomy</i> by Sokal and Sneath (citation #38) is over 40 years old and long out of print. The on-line archives of <i>Science</i> (requires membership), and EBSCOHost through the Columbus Library System were searched to find other journal articles. In spite of these resources, it was necessary to access a university library to find copies of the older <i>Natural History</i> and <i>Biological Journal of the Linnean Society</i> articles.

2 p. 326	Aspect 2: Fossil Record Citation #8. Darwin, Charles. <i>On the Origin of Species: A Facsimile of the First Edition</i> . Cambridge: Harvard UP, 1975.	Darwin's landmark work, while of historical interest, has no bearing on current research on homology. It is also puzzling why the writer did not reference Darwin's 6th and final edition rather than the first (can be obtained for free at http://gutenberg.net/browse/BIBREC/BR2009.HTM).
	Citation #9. Denton, Michael. <i>Evolution: A Theory in Crisis</i> . Bethesda: Adler and Adler, 1986.	Denton, a micro-biologist, includes homology in his anti-evolution tract. Denton simply denies that organisms which share many anatomical, embryological, and molecular similarities most likely have a common ancestry. Instead, he proposes that many of the similarities are the result of convergent evolution. He cites embryological dissimilarities, particularly between the mammalian and reptilian blastula, ignoring all of the similarities that do exist and that are displayed in just about every biology textbook. His work is not taken seriously by practicing biologists. A critique of Denton's book is found at: http://www.talkorigins.org/faqs/denton.html Denton, in an essay "Comments on Special Creationism" in the book "Darwinism Defeated?" makes the following statement largely reflecting his previous views: "In his advocacy of special creationism I believe Johnson is merely the last in a succession of vigorous creationist advocates who have been very influential within conservative Christian circles, particularly in the united States, during the twentieth century, none of these advocates however, has had any lasting influence among academic biologists. This is not because science is biased in favour of philosophical naturalism but because the special creationist model is not supported by the facts and is incapable of providing a more plausible explanation for the pattern of life's diversity in time and space than its evolutionary competitor. The reason why no current member of the U.S. National Academy of Science is a special creationist is because of the facts, the same facts that in the nineteenth century convinced Darwin and Wallace and all the leading Christian biologists, including Joseph Hooker, Asa Gray, and Charles Lyell, of the reality of descent with modification." (p. 152)
	15. Fitch, W., and E. Margoliash, "Construction of Phylogenetic Trees." <i>Science</i> 155 (1967): 281.	This reference: a) is 34 years old; thousands of more recent studies on the molecular aspects of genetic homology could be chosen; and b) contains subject matter far beyond the reach of 10th graders; it is totally inappropriate.
	39. Sokal, R., and P. Sneath. <i>Principles of Numerical Taxonomy</i> . San Francisco: Freeman, 1963.	This text book edition is 41 years old and even the 1973 edition is out-of-print. It does not address the great wealth of genetic information that has been uncovered in biological research since the early 1970s. This is an upper-level college text that presents a statistical treatment of data far beyond the comprehension level of 10th Graders. It is totally inappropriate.

3 p. 327	Aspect 2: Fossil Record Citation #8. Darwin, Charles. <i>On the Origin of Species: A Facsimile of the First Edition</i> . Cambridge: Harvard UP, 1975.	Darwin's landmark work, while of historical interest, has no bearing on current research on the fossil record. Indeed nearly all of the fossil record has been compiled since Darwin's time. It is also puzzling why the writer did not reference Darwin's 6th and final edition rather than the first (can be obtained for free at http://gutenberg.net/browse/BIBREC/BR2009.HTM).
	Citation #10. Doolittle, W. Ford "Uprooting the Tree of Life," <i>Scientific American</i> (2000): 90-95	While this is a very readable paper on genetic phylogeny, it doesn't get into the fossil record at all. The Board has directed that it be removed from the list of references.
	Citation #11. Erwin, Douglas. "Macroevolution is More Than Repeated Rounds of Microevolution," <i>Evolution & Development</i> 2 (2000): 78-84.	The paper talks about the need for a refocusing of research into the causes of macroevolutionary change. It says little about the nature, extent, or completeness of the fossil record. The paper's content is far beyond the reach of 10th graders and is totally inappropriate.
	Citation #29. National Academy of Science. <i>Teaching About Evolution and the Nature of Science</i> . Washington: National Academy Press, 1998.	This is a basic teaching guide on the whole subject of biological evolution. There is little specific content on the nature, extent, or completeness of the fossil record; and what there is does not support the "challenge."
4 p. 327	Aspect 3: Antibiotic Resistance	There are no references offered for this lesson. The writer refers teachers and students to an expanded set of citations in the General Tips Section; however, none of these citations address the subject of antibiotic resistance. An excellent set of references is readily accessible through the Public Broadcasting System's Internet version of its award-winning series on Evolution.
5 p. 327	Aspect 4: Peppered Moths (<i>Biston betularia</i>): Citation #5 Chermas, J. "Exploring the Myth of the Melanic Moth." <i>New Scientist</i> . (1986): 25.	This paper is incorrectly cited; the correct title is: "Exploding the myth..." It is an 18-year old reference and is not readily available to teachers or students (EbscoHost only lists this journal from 2003).
	Citation #26. Mikkola, K. "On the Selective Forces Acting in the Industrial Melanism of <i>Biston oligia</i> Moths." <i>Biological Journal of the Linnean Society</i> 21 (1984): 409-421.	This paper is incorrectly cited, indicating that the writer did not consult the original text. <i>Oligia</i> not a species but a separate genus of moths. The correct title is: "On the selective forces acting in the industrial melanism of <i>Biston</i> and <i>Oligia</i> moths (Lepidoptera: Geometridae and Noctuidae)." It is a 20-year old reference and is not readily available to teachers or students (EbscoHost only lists this journal from 2003).
	Citation #44. Wells, Jonathan. <i>Icons of Evolution</i> . Washington: Regency Publishing, 2000.	Rev. Wells' work is an Intelligent Design Creationist polemic, not a work of science. It is a collection of long-discredited creationist arguments against evolution. Wells badly misrepresents the state of research in this aspect and ignores the evidence that contradicts his unsupported claims (for a critique of Wells' treatment of Peppered Moths, go to: http://www.ncseweb.org/icons/pdfs.html). The publisher is Regnery Publishing, Inc.
6 p. 328	Aspect 5: Endosymbiosis (formation of cellular organelles) Citation #24. Margoulis, L., and D. Sagan. "Bacterial Bedfellows." <i>Natural History</i> 96 (1987): 26-33.	The age of this journal article may make it difficult for teachers/students to access (EBSCOHost only lists <i>New Scientist</i> back to 1990). The book, <i>What is Life</i> (1995) by Margulis and Sagan is still in print and probably more easily obtained.
	Citation #25. Martin W., and M. Muller. "The Hydrogen Hypothesis for the First Eukaryote." <i>Nature</i> 392 (1998): 37-41.	The content of this paper is far beyond the level of 10th Grade science students. It is an inappropriate reference.

Citation #31. Pennisi, E. "Direct descendants from an RNA world." <i>Science</i> 280 (1998): 673.	This news article does not bear on the question of endosymbiosis.
---	---

Contributors to this table (alphabetical order):

Tom Baillieul,
Richard Hoppe,
Steve Rissing,

Barbara Forrest,
Keith Miller,
Ted Scharf,

John Geohegan,
Ken Miller,
Dave Thomas,

Alan Gishlick,
Patricia Princehouse,
Jon Woolf

References:

Baillieul, T. (2004). Analysis and review of cited references in OBE Lesson L10-H23. http://ecology.cwru.edu/ohioscience/References_analysis.html

Behe, M. (1996). *Darwin's black box: The biochemical challenge to evolution*. New York, The Free Press.

Forrest, B., and Gross, P.R. (2004). *Creationism's Trojan Horse: The wedge of Intelligent Design*. Oxford, Oxford University Press.

Hoppe, R.B., Princehouse, P., and Mckee, J. (2004). Examples of errors in "Critical Analysis of Evolution" (OBE Lesson L10-H23).

Majerus, (1998).

Sjogren, J.F., Lattimer, R.L., and Rudy, D.D. (2003). The evolution controversy: *Understanding the basic issues in the debate between biological evolution and Intelligent Design*. Science Excellence for All Ohioans: www.sciohio.org

Wells, J. (2000). *Icons of evolution: Science or myth?* Washington, D.C., Regnery Publishing, Inc.