

Response to Charge of Misquotation by David Hillis

by Jonathan Wells, Ph.D.
Discovery Institute
1511 Third Avenue, Suite 808
Seattle, WA 98101

It has come to my attention that on July 9, 2003, Dr. David Hillis of the University of Texas testified to you that I misquoted him in my 2000 book *Icons of Evolution*.

Specifically, Dr. Hillis testified: "Jonathan Wells quotes me extensively in his *Icons of Evolution* book, which has been mentioned several times today. Implying that I do not think that the concept of homology can be applied to molecular biology. A point that he then uses to dismiss molecular studies of biology. In fact, those quotes in that book are taken completely out of context from a chapter in which I discuss exactly the opposite point; namely, that all of molecular biology can be understood only in the light of homology and that biogenetic relationships among all living organisms are clearly recorded in the genomes of those organisms. No one could have possibly read my writings and thought that I supported Wells's argument. And yet he presents my quotes as if I had." (Transcript of Proceedings before the State Board of Education: Public Hearing on Textbooks, p. 134)

Dr. Hillis went on to say: "His [Wells's] arguments are clearly meant to confuse and misinform the public and this school board not to inform them of the scientific literature." (ibid., p. 134)

Like Dr. Hillis, I am a scientist, and as a scientist I am interested in the truth. Thus I am writing to let you know exactly what I quoted from Dr. Hillis's writing. I leave it to you to decide whether I have misrepresented the truth.

In a chapter of my book devoted to the concept of "homology" in biology, I pointed out that the word has various meanings. Two of these are the classical or morphological meaning (similarity in structure and position due to a common archetype or design) and the Darwinian or evolutionary meaning (similarity due to descent from a common ancestor). In my book I provided extensive documentation from the scientific literature to show that there is widespread confusion between the two meanings of "homology," that morphological similarity does not necessarily provide evidence of common ancestry, and that philosophers of science have criticized the way some biologists define homology as similarity due to common ancestry and then try to use homology as *evidence* of common ancestry (a form of circular reasoning). I also mentioned the fact that many biologists look to molecular similarities to solve the problem, but that molecular similarities can be as difficult to interpret as morphological similarities.

In my book, *Icons of Evolution*, I quoted from Dr. Hillis's chapter in a 1994 book edited by Canadian biologist Brian K. Hall, *Homology: The Hierarchical Basis of Comparative Biology* (Academic Press). Here is the relevant passage from my book, quoted in its entirety (Dr. Hillis's words are in bold):

Unfortunately, molecular sequence comparisons face as many difficulties as morphological comparisons. First, in molecular phylogeny the meaning of "homology" is no less problematic. As molecular biologist David Hillis wrote in 1994, "**the word homology is now used in molecular biology to describe everything from simple similarity (whatever its cause) to common ancestry (no matter how dissimilar the structures).**" Thus "**molecular biologists may have done more to confound the meaning of the term homology than have any other group of scientists.**" Second, identifying homologous sequences is as difficult as identifying homologous organs. According to Hillis: "**Some proponents of molecular techniques have claimed that molecular biology 'solves the problem of homology,' ... [but] the difficulties of assigning homology to molecules parallel many of the difficulties of assigning homology to morphological structures.**" (*Icons of Evolution*, p. 67)

In other words, I quoted Dr. Hillis to support my assertions that (a) there is confusion among biologists over the two different meanings of "homology," and (b) molecular studies have not cleared up the confusion. Nothing in what I wrote implies (as Dr. Hillis claims) that we should "dismiss molecular studies of biology." My point was simply that the confusion over "homology" continues despite the work of molecular biologists.

Incidentally, my entire chapter on homology (except for the last two sections, in which I do not quote Hillis), was peer-reviewed before publication by Brian K. Hall -- the editor of the very book in which Hillis's chapter appeared (see *Icons of Evolution*, p. xiii). Although Hall disagreed with my pessimistic attitude toward Darwinian evolution, he found no fault with my use of Hillis's chapter.

As an appendix to this letter, I am attaching the paragraphs of Hillis's chapter from which I quoted, so you can judge for yourself whether I took those quotes "completely out of context," as Dr. Hillis claims.

APPENDIX

Dr. Hillis's quotes are from the first and fourth paragraphs of the introduction to his chapter in Hall's book, and the first and last paragraphs of its conclusion. Those paragraphs follow unabridged. (As above, the portions I quoted are in bold.)

Introduction, first paragraph: "This book is evidence that concepts of homology are diverse among biological disciplines. These different concepts often lead to confusion when biologists of different flavors attempt to talk among themselves. Confusion, however, exists within specific research areas as well: **molecular biologists may have done more to confound the meaning of the term homology than have any other group of scientists.** In many circles of molecular biologists, homology has come to mean 'similarity': a simple quantifiable relationship, for which the word similarity adequately suffices. For instance, one often reads about a comparison made between two genes, in which the individual making the comparison describes the two genes as '50% homologous,' whereas the author actually means that the two genes have a measured similarity of 50% (i.e., they share 50% of their aligned nucleotides in common). The two genes may or may not be similar as a result of common ancestry, and therefore may not be homologous under the evolutionary meaning of the term."

Introduction, fourth paragraph: "Although similarity at some level seems a necessary prerequisite to recognize homology (Patterson, 1988), some authors have taken the concept of homology to its logical conclusion: homologous structures include any 'parts that arise from the same source' (Ghiselin, 1976, p. 138) or 'trace back to a single genealogical precursor' (Goodman et al., 1987, p. 146). Under such a definition, structures may have diverged into such dissimilar parts that they are no longer recognizably similar, although are [sic] still homologous because of their common ancestral origin. Thus, **the word homology is now used in molecular biology to describe everything from simple similarity (whatever its cause) to common ancestry (no matter how dissimilar the structures).** I fall at the end of the continuum that relates homology to common ancestry, and use the word similarity to describe the likeness of structures (including molecular sequences)."

Conclusion, first paragraph: "**Some proponents of molecular techniques have claimed that molecular biology 'solves the problem of homology,'** (Sibley and Ahlquist, 1987). Although a better understanding of molecular biology has provided many new insights into relationships among genes and their products, there is still ample room for mistaken inferences about homologous molecular relationships. Distinguishing orthology [similarity due to common ancestry -- JW] from paralogy [similarity due to gene duplication -- JW] is the greatest

obstacle for most evolutionary applications of molecular techniques. Duplicated gene loci and paralogous pseudogenes appear to be the rule rather than the exception in the eukaryote nuclear genome, so care is required if orthologous products are to be compared among taxa."

Conclusion, last paragraph: "As we begin to discover more about the processes that produce molecular variation among species, relationships among genes and their products look increasingly complex. **The difficulties of assigning homology to molecules parallel many of the difficulties of assigning homology to morphological structures.** (Patterson, 1988). This may be a partial explanation for the similar levels of homoplasy [similarity not due to common ancestry -- JW] that are observed in molecular and morphological phylogenetic studies (Sanderson and Donoghue, 1989). Hopefully, then, a better understanding of homologous relationships at the molecular level can lead to a better understanding of homology in general."