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An Evaluation of the Myth That "Nothing in Biology Makes Sense Except in the Light of Evolution"

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Abstract

Darwinists commonly claim that evolution is the foundation of all of the sciences, especially the life sciences and that "nothing in biology makes sense except in the light of evolution." To evaluate this claim I reviewed both the textbooks used for life science classes at the college where I teach and those that I used in my past university course work. I concluded from my survey that Darwinism was rarely mentioned. I also reviewed my course work and that of another researcher and came to the same conclusions. From this survey I concluded that the claim "nothing in biology makes sense except in the light of evolution" is false.

Keywords: Teaching of evolution, the application of evolution, creationism, college text books

Introduction

In 1929, an article in *Popular Science* was written to encourage the teaching of the theory of evolution in spite of the laws that were passed by several states to curb the teaching of Darwinism. The article claimed that "The theory of evolution is altogether essential to the teaching of biology and its kindred sciences" (Armstrong 1929, p. 135). The most popular biology book in the 1920s by Dr. Truman Moon, entitled *Biology for Beginners*, stated that the theory of evolution is "the cornerstone of all recent science and the foundation of all modern thought" (quoted in Armstrong 1929, p. 133). Almost a half-century later, the eminent American evolutionist, Theodosius Dobzhansky (1900–1975), claimed that "evolution" is the cornerstone of biology and is central to understanding both living and extinct organisms (Dobzhansky 1973, p. 125).

His statement that "nothing in biology makes sense except in the light of evolution" has been repeated in thousands of articles to argue that Darwinism must have a central place in all areas of life-science education, including biology, anatomy, medicine, agriculture, and biotechnology (for example, see Antolin and Herbers 2001, p. 2379). Orthodox Darwinism is defined as the evolution of all complex life forms on earth from a single common ancestor as a result of natural selection acting on random mutations in the genome over vast periods of time through strictly naturalistic processes. A recent internet search revealed over 50,000 hits for Dobzhansky's quote. As a result of this oft-repeated assertion, many argue that evolution must be a central part of all public school and college life science classes. In the words of the National Academy of Science, evolution is "*the most important concept* in modern biology, a concept essential to understanding key aspects of living things" (emphasis mine) (National Academy of Science 1998, p. viii). This claim is made because Darwin's

> *Origin of Species* has had more influence on Western culture than any other book of modern times. It was not only a great biological treatise, closely reasoned and revolutionary, but it carried significant implications for philosophy, religion, sociology, and history. Evolution is the greatest single unifying principle in all biology (Prosser 1959, p. 539).

Dawkins opines that, without Darwinism, "biology is a collection of miscellaneous facts." He adds before children "learn to think in an evolutionary way" the material that students learn

> will just be facts, with no binding thread to hold them together, nothing to make them memorable or coherent. With evolution, a great light breaks through into the deepest recesses, into every corner, of the science of life. You understand not only what is, but why. How can you possibly teach biology unless you *begin* with evolution? How, indeed, can you call yourself an educated person, if you know nothing of the Darwinian reason for your own existence? (Dawkins 2002, p. 58).

The claim that evolution is central to biology has been around for decades. For example, the Scopes Trial transcript included the following words penned by Vanderbilt University biology professor Dr. E. N. Reinke:

> To deny the teacher of biology the use of this most fundamental generalization of his science would make his teaching as chaotic as an attempt to teach … physics without assuming the existence of the ether (Reinke 1927, p. 8).

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The ether idea has now been fully refuted, a fact that illustrates the fallibility of the biology claim if the analogy were true. The evolution-is-central-to-biology belief has even made the *Doonesbury* cartoon; the lead character stating that "Evolution is the foundation of all life sciences. Without it, whole fields from genetics to ecology can't exist!" (Trudeau 2011).

Although Darwinists often talk about the central importance of "evolution" in gaining a basic understanding of the natural world, in the daily work of both scientific education and scientific research, evolution is rarely mentioned or even a concern. This has been my experience as a research associate involved in cancer research in the department of experimental pathology at the Medical University of Ohio and as a college professor in the life and behavioral sciences for over 30 years. As Conrad E. Johanson, Ph.D., Professor of Clinical Neurosciences and Physiology and Director of Neurosurgery Research at Brown Medical School in Rhode Island noted, research scientists

> rarely deal directly with macroevolutionary theory, be it biological or physical. For example, in my 25 years of neuroscience teaching and research I have only VERY rarely had to deal with natural selection, origins, macroevolution, etc. My professional work in science stems from rigorous training in biology, chemistry, physics, and math, not from world views about evolution. I suspect that such is the case for most scientists in academia, industry, and elsewhere (Johanson, pers. comm.).

Renowned chemist and National Academy of Science Member, Dr. Philip Skell, Professor Emeritus of Pennsylvania State University (see Lewis, 1992), surveyed his colleagues "engaged in non-historical biology research, related to their ongoing research projects." He found, in answer to the question, "Would you have done the work any differently if you believed Darwin's theory were wrong?" that "for the large number" of the Darwinist researchers he interviewed, "differing only in the amount of hemming and hawing" was "in my work it would have made no difference." Some added they thought it may make a difference for other researchers (Skell, pers. comm.).

Another scientist, Professor Henry F. Schaefer III, the Graham-Purdue Professor of Chemistry and Director of the Center for Computational Chemistry at the University of Georgia, added that

> Darwinian assumptions are not needed for the day-to-day work of science. If you look at the biochemical literature for scientific papers that try to explain how biochemical systems developed step-by-step in Darwinian fashion, there aren't any. It's startling. Most biologists completely ignore evolution in their work, and the ones that think about it simply look for relationships and don't bother with Darwinism. My University of Georgia colleague in biochemistry, Professor Russell Carlson, has expressed the same sentiment to me privately (Schaefer 2004, p. 102).

From 1981 to 1997, Professor Schaefer was the sixth most highly cited chemist in the world out of a total of 628,000 chemists whose research was cited at least once. The Science Citation Index reported that, as of December 31, 2010, his research had been cited over 47,000 times.

Of interest is that the fact that molecular, cell, and developmental biology majors at Yale University Graduate School are no longer required to complete courses on evolution (Hartman 1997). I have noted from my own research, both to my frustration and over my objections, that many of the subscriptions to journals focusing on evolution at both the University of Toledo Medical College and Bowling Green State University have been dropped. I was told by the reference librarian that there was little demand for them.

I also interviewed several biology professors. Typical is Tony Jelsma, who obtained his Ph.D. in Biochemistry in 1989 and did postdoctoral research for almost eight years before landing a position teaching at the Department of Biology, Dordt College (Sioux Center, Iowa). His B.Sc. (1983) and Ph.D. (1989) were both completed at McMaster University. He stated that he did not encounter Darwinism in his work or studies except in one undergraduate biochemistry class where he studied the abiotic synthesis of adenine (Jelsma, pers. comm.).

A Survey of Textbooks

Having taught biology, genetics, zoology, psychology, and related courses at the college level for the past 40 years, I evaluated this claim by examining the content of the major textbooks that I have used to teach science courses. I found most of the biochemistry/molecular biology, genetics, and cell biology texts we have used never, or hardly ever, mentioned Darwinism (see Table 1). The only courses that covered it in any detail were Biology 101, zoology, and anthropology. In my experience, even in these classes, many instructors skipped the section on evolution.

Even those textbook chapters labeled "evolution" often spend much time on non-evolution topics, such as basic genetics, human development, population genetics, and similar areas. None of the anatomy and physiology textbooks we have used *ever* mentioned evolution. The only reference to Darwinism in the microbiology texts we used was on the development of bacterial resistance (which is not a concern for intelligent design or even creationists because many of the mechanisms producing resistance are well known and do not support orthodox evolution, see Bergman 2003).

Table 1. The college natural science texts I have used in the past 20 years and their evolution coverage.

Text	Biological Evolution Content
1. Introduction to Biology	
Biology (S. Mader) McGraw–Hill, 6th ed., 1998.	A total of four out of 51 chapters cover evolution, occasionally mentioned in the other 47 chapters.
Life (R. Lewis, et al.) McGraw–Hill, 4th ed., 2002.	One unit on evolution (five chapters out of 45). occasionally mentioned elsewhere.
Essential Biology (N.A. Campbell, J.B. Reece, and E.J. Simon) Pearson, 2nd ed., 2007.	Mentions Darwinism in almost every chapter, and one whole unit on evolution (unit 3, chapters 13 to 17 plus parts of chapter 18).
Biology (N.A. Campbell et al.) Benjamin Cummings, 9th ed., 2011.	Mentioned in most every chapter, covered in detail in chapters 22–26.
2. Anatomy and Physiology	
Hole's Anatomy and Physiology (D. Shier, J. Butler and R. Lewis) McGraw–Hill, 10th ed., 2003.	None
Principles of Anatomy and Physiology (G.J. Tortora, S.R. Grabowski and B. Roesch) Harper Collins, 8th ed., 1996.	None
Anatomy & Physiology (E.N. Marieb and K. Hoehn) Benjamin Cummings, 4th ed., 2011.	None
3. Biochemistry/Molecular Biology	
Biochemistry, A Foundation (P. Ritter) Brooks/Cole, 1996.	A few sentences or very short paragraphs added, seemingly as an afterthought, in a few sections.
General, Organic, and Biochemistry (W.H. Brown and E.P. Rogers) Brooks/Cole, 1987.	None
General, Organic, and Biological Chemistry (S. Solomon) McGraw–Hill, 1987.	None
Foundations of Life: An Introduction to General, Organic, and Biological Chemistry (D.M. Feigl, J.W. Hill, and E. Boschmann) Macmillan, 3rd ed., 1991.	None
Fundamentals of Genera, Organic, and Biological Chemistry (J. McMurry and M.E. Castellion) Prentice–Hall, 2nd ed., 1996.	None
4. Microbiology	
The Microbial Perspective (E.W. Nester and M.T. Nester) Saunders, 1982.	Mentioned only in relationship to bacterial resistance.
Microbiology (J. Black) Wiley, New York, 7th ed., 2008.	Microevolution briefly discussed (such as in the section on the development of bacterial resistance).
5. Genetics	
Human Genetics (R. Lewis) McGraw–Hill, 8th ed., 2008.	Parts of one chapter out of 22, a few sections elsewhere.
6. Zoology	
College Zoology (R. Boolootian and K. Stiles) Macmillan, 10th ed., 1981.	One chapter (chapter 41, pp.664, 686); also mentioned in a few other places.
Integrated Principles of Zoology (C.P. Hickman, L.S. Roberts and A. Larson) McGraw–Hill, 12th ed., 2003.	Parts of one chapter and short sections in several other chapters out of 38 chapters.
7. Anthropology	
Anthropology (C.R. Ember and M.R. Ember) Prentice–Hall, 5th ed., 2003.	Parts of five chapters out of 22 chapters.
Cultural Anthropology (C.P. Kottak) McGraw–Hill, 10th ed., 2003, 14th ed., 2011.	Major parts of three chapters and small sections of two other chapters out of 25 chapters. 2011 ed., chapters 5, 6, 8–10.
8. Chemistry	
Fundamentals of Chemistry (R.A. Burns) Prentice–Hall, 4th ed., 2003.	None
Chemistry and Society (M.M. Jones et al.) Saunders, New York, 5th ed., 1987.	None
9. Geology	
Essentials of Geology (S. Chernicoff and H.A. Fox) Houghton Mifflin, 2nd ed., 2003. (S. Chernicoff and D. Whitney) Houghton Mifflin 4th ed., 2007.	Rarely mentioned. Coverage in a few paragraphs.
10. Physical Science	
Physical Science Principles and Applications (C.A. Payne, W.R. Falls and C.J. Whidden) William C. Brown, 1992.	None. (Mentioned only once on page 320 in reference to DNA).

Methodology

The methodology employed in this study to determine if a textbook and college class promoted Darwinism involved reading the entire text and reviewing all of the class notes. This was necessary because if textbook indexes were scanned for the terms "Darwinism" and "evolution" the number of expected hits would be fairly low because phrases can be used in textbooks to teach the ideas inherent in Darwinism without mentioning the terms evolution, Darwinism, or Darwin.

For example, Darwinism and biological evolution may not be directly mentioned in geology textbooks, but they assume evolution in the discussions of the organisms found in the various layers, and in descriptions of the millions of years involved in depositing the rock layers. If Darwinism and evolution was limited to overt statements of the biological aspects of Darwinism, its impact in the thinking shaped by what is taught in the textbooks and coursework will be misjudged. Nonetheless, it is still true that, although Darwinism and naturalistic evolution are the underlying assumptions of many textbooks, they have little impact on the actual day-to-day research and implications of the scientific work.

If the methodology involved in the textbook searches were limited to explicit references of biological Darwinism, then many geology textbooks would have little to say on the subject, although the underlying naturalism would still be the foundation for the teaching. In more advanced textbooks Darwinism is rarely even mentioned, supporting the research in this article: textbooks are able to teach the content without clear references back to the supposed evolutionary past. This illustrates the fact that an evolutionary understanding is not necessary to conduct most research or develop certain therapies, since those applications are dependent on the present physical processes, not on their origin.

In spite of the blatant teaching of Darwinism and naturalistic philosophy in some of the more recent textbooks, those ideas have little effect on the production of medicines, technologies, therapies, etc. A veterinarian does not need to know how the horse's hoof evolved in order to treat an injury or infection.

Discussion

Judging by the textbooks reviewed, Darwinism (the naturalistic evolution of life from a common ancestor) is often judged as unimportant and thus totally ignored in most science classes. Although the evolution content of newer books is increasing, especially in introductory textbooks, likely in response to the intelligent design and creationist movements, it is still largely insignificant based on my review. Because I have much interest in the subject, I usually cover it in more depth than is usual. Many of the instructors at the colleges where I have taught largely ignored the evolution sections of textbooks, partly because there is a great deal of other material that *must* be covered and *something* has to be cut—and many teachers elect to skip evolution because it is one of the least-important subjects in most science majors. How many healthcare workers need to understand Darwinian theories? They do need to understand antibiotic resistance and natural selection but not Darwinism as defined above. In short, judging by my survey of major textbooks, the oft-repeated claim about Darwinism being central to natural science is false.

If, as Dobzhansky claimed, "*nothing* in biology makes sense except in the light of evolution" (emphasis added) (Dobzhansky 1973, p. 1), why is evolution rarely mentioned in most natural science books? At my college we usually use the leading college texts in each area (for example, the anatomy and physiology text we have used for almost 20 years is the *Anatomy and Physiology,* Hole et al., 2003, 10th ed.), a standard text. It is a minor topic even in most introductory biology books that cover the subject in more depth than most all other courses except formal classes on evolution.

While developing a college-level course on evolution, I surveyed most four-year colleges and universities in Ohio and many in Michigan. Biology majors at the schools surveyed were required to take only one class in evolution (and all schools surveyed used the same text, *Evolutionary Analysis* (Freeman and Herron 2001) a fairly good text that I also considered for my own evolution class, which is now being developed).

My experience also conforms to the results of my research. Several studies have found that most future science teachers do not complete courses that focus on evolution as part of their training (Rutledge and Mitchell 2002; Rutledge and Warden 2000). Moore found that

> many of today's high school teachers don't recall hearing the word *evolution* in their college biology courses, apparently because many biology professors do not teach evolution (Moore 2004a, p. 864).

This conforms to my survey of local college biology students living in northwest Ohio. Most schools either skip the chapters on evolution or only spend a class or two on the subject. About 30% cover both creation and evolution, and 20%, in one student's words, "try to jam evolution down our throats" and succeed, primarily, in turning off students to biology, and often science as well. Another problem is that many teachers who teach Darwinism objectively are accused of not teaching it at all when, in fact, they cover it in much more depth than most teachers (Court Case 2002; Moore 2004b).

Coverage of Darwinism in My College Science Course Work

I also reviewed all of my graduate and undergraduate college course work in science to determine the time spent on Darwinism in each class. The review included course work completed at Wayne State University, Medical University of Ohio, Bowling Green State University, University of Wisconsin, Miami University (Oxford, Ohio), University of Toledo, University of California–Berkeley, and several other colleges. All hours were converted to quarter hours, and some classes are in process.

My review of my course work (over 1,000 quarter hours) completed at seven universities and five colleges conformed to my survey of my teaching experience. Except in courses devoted to evolution, the subject was rarely covered in science classes, although it occasionally came up in other classes (see Table 2). I found in my biology/natural science education, which entailed over eight years of full-time college, that Darwinism was rarely mentioned. For my graduate degree in biomedical science, it never came up either in class or in the textbooks except to note that a gene was "evolutionarily conserved," meaning only that the gene sequence was very similar in most life forms, both advanced and so-called primitive.

Because this is a topic in which I was very interested when in college, whenever it came up in class I listened attentively and would have remembered if it was discussed in class. Based on a review of my detailed notes, even the course that I completed on evolutionary biology covered mostly the history of the creation-evolution conflict, genetics, animal breeding, and related topics. Darwinism was actually discussed more in behavioral science classes and textbooks compared to natural science classes—and in these cases it was often assumed to be true. The evolutionary worldview dominated, and Darwinism, including naturalism, was rarely questioned, even in my Bible as Literature class.

Dr. Scott Hanson also reviewed his course work at a major Canadian university, the results of which are in Table 3. His survey came to the same conclusion as my study. Adam S. Wilkins' in the journal *BioEssays* flipped Dobzhansky's claim, observing that

> evolution occupies a special, and paradoxical, place within biology as a whole. While the great majority of biologists would probably agree with Theodosius Dobzhansky's dictum that "nothing in biology makes sense except in the light of evolution", *most can conduct their work quite happily without particular reference to evolutionary ideas.* "Evolution" would appear to be the indispensable unifying idea and, at the same time, a highly superfluous one (emphasis mine) (Wilkins 2000, p. 1051).

O'Leary adds that the reason why

> evolution is "highly superfluous" is that, in reality, nothing in biology makes sense except in the light of biochemistry, which is what gives biology its place in the linked chain of sciences. Evolution is a form of history, a history that may or may not have happened as described in any current work on the subject (O'Leary 2004, p. 100).

Future Research

The sample size represents the experience of only two individuals, thus it has a limited scope and should be replicated by evaluating a large number of recent science textbooks. Furthermore, due the organized opposition to Darwin critics by evolutionists, in some of the more recent biology and earth science textbooks virtually every chapter has implied or openly taught an evolutionary view of the living world and universe. Evolution is now promoted more heavily than in the past and students report it is today more often a major emphasis of some professors, even in psychology classes where some students may be required to study evolutionary theories of development and write papers on the topic.

Conclusions

The message that Darwinists convey to the public is often very different from what they recognize as true among themselves. Although they state to the public that "nothing in biology makes sense except in the light of evolution," most scientists can "conduct their work quite happily without particular reference to evolutionary ideas" (Witham 2002, p. 43). One "notable aspect of natural scientists in assembly [at conferences] is how little they focus on evolution. Its "day-to-day irrelevance is a great 'paradox' in biology" (Witham 2002, p. 43).

Nonetheless Darwinists often are "loath to display publicly their internal divisions." An exception is a challenge by mathematicians at Philadelphia's Wistar Institute of Anatomy and Biology that attracted "evolutionists of some note" as participants. The result of the conference was "the mathematicians and the biologists agreed to disagree" (Witham 2002, p. 37). In short, the mathematicians believed that, in contrast to the evolutionists, it "seemed improbable that the mere shuffling of genes could yield such combinations as a DNA molecule of the human brain, or move through populations and produce dramatically new species" (Witham 2002, p.37). Witham added that presenting both sides may convince many students [that] to reject the Darwinist side is a major motivation for the almost fanatic efforts by Darwinists to ensure that only one side of the controversy is taught. Eugenie Scott, in contrast to the empirical literature (and the experience of most teachers), argues that only pure unadulterated evolution should be taught,

Table 2. Undergraduate and graduate sciences classes completed by Jerry Bergman at Wayne State University; Medical College of Ohio; University of California–Berkeley; University of Toledo; University of Wisconsin; Bowling Green State University and other colleges and universities.

Number	Course Title (credits)	Darwinism Content
Biology/Science		
BIO 0161	Anatomy & Physiology I (5)	None
BIO 0162	Anatomy & Physiology II (4)	None
BIO 0151	General Biology I (6)	Some in chapter II of text (Kimball)
BIO 0152	General Biology II (6)	All of chapter VII (pp. 540–614) but was not covered in class
BIO 0507	Genetics (4)	Mentioned briefly (the professor often mocked creationists)
BIO 0220	Introduction to Microbiology (4)	None
BIO 0271	Comparative Vertebrate Zoology (6)	Almost none
BIO 0509	Evolution (4)	Topic of class, mostly covered history, genetics, and other topics that did not review evidence for the theory
BIO 137	Surface Phenomena in Physical and Biological Systems (4)	None
PSY 0330	Psychophysiology (4)	None
HYG 0281	Individual Hygiene (3)	None
PER 0172	First Aid (4)	None
SCE 3561	Science in the Elementary Schools (4)	None
GEG 0652	Field Study (4)	None
GEG 0390	Directed Study (2)	None
PHY 0191	Physics and Astronomy (4)	None
GSC 0156	Physical Science/Chemistry (4)	None
GEO 0110	World and Regional Geography (4)	None
GEO 0210	Elements of Geography (4)	None
U420-100	General Geology (4)	None
U640-100	Meteorology (3)	None
U736-101	Introduction to Philosophy (5)	Discussed very briefly in several units
U224-103	General Chemistry I (4)	None
U224-104	General Chemistry II (4)	None
CHM 698.0	Organic Chemistry (3)	None
CHM 698	Topics in Biochemistry Technology (3)	None
20.879	Basic and Advanced Light Microscopy (4)	None
PSY 0490	Biology of Learning (4)	None
BIO 2805	Substance Abuse (3)	None
U694-132	Nutrition Today (4)	None
NV 0502	Topics in Nutrition (8)	None
BIO 0332	Nutrition and Health Habits (3)	None
BIO 0523	Studies in Literature (Biological Evolution) (4)	Topic of class
BIO 0507	Evaluation Concepts and Methods (Eugenics) (12)	Topic of class
BIO 0508	Biometry (12)	None
BIO 0515	Human Development (Brain and Communication) (8)	None
BIO 0521	Holism, Concept: Its Origins and Implications (4)	None
BIO 0522	Ecology (4)	None
BIO 0523	Health and Healing Perspectives (4)	None
BIO 0507	Parasitology (4)	None
BIO 0573	Neuroscience (4)	None
BIO 0503	Cell Ultrastructure (4)	None
BIO 0502	Cell Biology (4)	None
MM 0311	Materials and Methods (3)	None
MM 0512	Doctoral Supplement Materials and Methods (1)	None
IS 0542	Ph.D. Diss. (noninvasive biology research/diagnostic tech.) (12)	None
10.651	Basic Science Interdepartmental Seminar (1)	Mentioned briefly
03.521	Recombinant DNA Methodology (2)	None
156898.02	Computed Tomography (4)	None

Table 2 (continued).

Number	Course Title (credits)	Darwinism Content
Biology/Science		
03.673	Research in Biochemistry (14)	None
03.657	Readings in Biochemistry (2)	None
03.672	Current topics in Biochemistry (3)	None
03.672	Current topics in Biochemistry (2)	None
20.886	Transmission Electron Microscopy (5)	None
15.889.09	Radiology: Magnetic Resonance Imaging (4)	None
CHM 698	Separation Science (3)	None
20.611.01	Human Genetics (3)	None
15.898.02	Computer Tomography (4)	None
20.673	Research, Biomedical Science (4)	None
50.699	Thesis Research (8)	None
50.699	Thesis Research (4)	None
10.672	Current Topics in Pathology (Cancer) (4)	None
IND1 500	Structure and Function of Normal Body (12)	None
IND1 699	Thesis Research (10)	None
CHM 699.7	Research in Chemical Education (1.5)	None
NERS 856	Readings in Neural Science (1.5)	None
DENT 656	Readings in Oral Biology (1.5)	None
PUBH 689	Independent Study in Environment Health (4)	None
CHM 698.M	Risks and Choices (5)	None
OCCH 501	Occupational Health (4)	None
CHM 699V	Industrial Chemistry follow-up (1.5)	None
PUBH 601	Public Health Epidemiology (4)	None
OCCH 673	Research in Occupational Health (4)	None
PUBH 603.01	Advanced Epidemiology (4)	None
CHM 698.P	Foods and Flavors (3)	None
CHM 698.T	Science of Pyrotechnics (3)	None
PUBH 698	Capstone Seminar (4)	None
HEAL 6600	Health Behavior (4)	None
PUBH 605	Introduction to Environmental Health (4)	None
PUBH 696	Public Health Internship (3)	None
CI 5950	Foundations of Grant Writing (4)	None
PATH 620.10	Principles of Toxicology (4)	None
PUBH 696	Public Health Internship (1)	None
CHM 689	Microscope (4)	None
PUBH 604	Public Health Administration (4)	None
PUBH 515	Principles of Environmental Health (4)	None
PUBH 550	Public Health Microbiology (4)	None
CHM 629	Chemical Aspects of Forensic Science (4)	None
CHM 628c	Pharmacology (4)	None
HEAL 6640	Issues in Public Health (4)	None
OCCH 561	Physical Agents (4)	None
OCCH 689	Independent Study (Mutations) (4)	None
OCCH 510	Human Systems and Occupational Diseases (3)	None
OCCH 640	Environmental and Occupational Health Law (3)	None
CHM 689	Safety (2)	None
CHM 689	Artful Chemistry (3)	None
OCCH 505	Principles of Occupational Safety (3)	None
OCCH 520	Air Monitoring and Analytical Methods (4)	None
CHM 627	Chemistry Research (5)	None
CHM 689	Chemistry of Corrosion (3)	None
OCCH 699	Thesis Research (4)	None
OCCH 535	Human Factors and Ergonomics (3)	Several sections alluded to evolution as being a reason for back and other health problems

Table 2 (continued).

Number	Course Title (credits)	Darwinism Content
Biology/Science		
OCCH 525	Chemistry of Hazardous Materials (3)	None
MAT 0151	Comparative Mathematics (4)	None
ELE 3315	Methods and Materials in Mathematics (4)	None
PSY 0310	Statistical Methods (4)	None
EER 6660	Field Studies in Research (4)	None
EER 9666	Directed Research (4)	None
EER 7661	Evaluation and Measurement (4)	None
EER 7664	Fundamental Research Skills (4)	None
EER 9668	Advanced Research and Experimental Design (4)	None
EER 7663	Fundamentals of Statistics (4)	None
EER 8663	Advanced Problems in Measurement (4)	None
EER 7665	Computer Use in Research (4)	None
EER 8664	Variance and Co-Variance Analysis (4)	None
EER 9666	Research Problems (4)	None
EER 9669	Doctoral Research (Evaluation and Research) (45)	None
Total hours		**549**
In my experience, Darwinism is often discussed in non-science classes. For this reason I also evaluated my non-science course work, mostly in the behavioral science area.		
Psychology		
PSY 0251	Introduction to Psychology (4)	Mentioned in several chapters
PSY 0340	Development Psychology (4)	Briefly mentioned
PSY 0305	Psychology of Perception (4)	None
PSY 0335	Theories of Personality (4)	None
PSY 0310	Statistical Methods Psychology (4)	None
PSY 0460	Social Psychology (4)	Briefly mentioned
EDP 3731	Introduction to Study of Child (4)	Briefly mentioned
PSY 0330	Psychology of Adjustment (4)	None
PSY 0430	Abnormal Psychology (5)	None
PSY 0111	Industrial Psychology (3)	None
EDP 5745	Child Psychology (3)	None
EDP 7735	The Learning Process (3)	None
CP 7830	Environment and Child Psychology (6)	None
CP 6831	Introduction to Psychological Testing (3)	None except eugenics was covered unobtrusively
EDP 7741	Human Developmental Psychology (4)	Briefly mentioned
EDP 5741	Mental Hygiene and Education (3)	None
EDP 7731	Advanced Educational Psychology (6)	None
EDP 5742	Juvenile Delinquency and Schools (3)	None
EDP 5745	Adolescent Psychology (3)	None
EGC 7701	Role of the Teacher in Guidance (3)	None
EGC 7704	Case Problems in Guidance (3)	None
EGC 7705	The Counseling Process (3)	None
EDP 7749	Terminal Master Dissertation (4)	Was encountered in my research
PSY 0303	Intro to Experimental Psychology (6)	Briefly mentioned
PSY 0562	Psychology of Influence (4)	None
PSY 0628	Psychoanalytic Theory (4)	None
PSY 0330	Psychophysiology (4)	Briefly mentioned
PSY 0480	Concept Development in Children (4)	None
PSY 0508	Behavior Pathology I (5)	None
PSY 0509	Behavior Pathology II (5)	None
PSY 0440	Social Issues in Child Development (4)	None
PSY 0580	Psychology of Chiliastic Movements (4)	None
REH 0567	Community Approach to Counseling (4)	None
PSY 0682	Issues in EEOC Compliance (3)	None
REH 0558	Psychosocial Aspects of Disability (3)	None
Total		**137**

Table 2 (continued).

Number	Course Title (credits)	Darwinism Content
Sociology		
SOC 0251	Introduction to Sociology (4)	None
SOC 0514	Social Stratification (4)	None
SOC 0541	Juvenile Delinquency (4)	Covered briefly
SOC 0202	Social Problems (3)	Discussed in connection with the biological theories of crime
SOC 0506	The Family (4)	Covered in class, not in textbook
SOC 0600	Methods in Social Research (4)	None
SOC 0616	Industrial Sociology (4)	None
SOC 0508	Race Relations in the USA (4)	None
SOC 0550	Marriage and Family Problems (4)	None
SSC 0151	Foundation of Modern Society, I (4)	Covered briefly
SSC 0152	Foundation of Modern Society, II (4)	Covered briefly
EDS 7621	Educational Sociology (3)	None
EDS 7623	Intergroup Rel. Comm. and School. (4)	None
POL 0511	Public Opinion and the Political Process (4)	None
POL 0151	American Government (5)	None
SOC 0460	Social Psychology (4)	None
ECI 0251	Basic Economics (5)	Social Darwinism covered briefly
ANT 0210	Introduction to Anthropology (5)	Covered rather extensively in both reading and lectures
SOC 0612	Community (4)	None
SOC 0680	Women and Institutions (4)	None
SOC 0670	The Sociology of Homosexuality (4)	None
SOC 0540	The Sociology of Education (4)	None
SOC 0561	Corrections (4)	Discussed in connection with biological theories of crime
SOC 0599	Master's Thesis (10)	None
SOC 0590	Juvenile Delinquency (4)	None
SOC 0544	Deviant Behavior (4)	None
SOC 0682	Issues in Criminology (4)	None
SOC 0570	Studies in Suicide (4)	None
SOC 0652	Collective Behavior (4)	None
SOC 0504	Development of Modern Sociology (4)	None
SOC 0680	Ethnic Groups in America (4)	None
SOC 0562	Criminal Law (4)	None
SOC 0523	Sociology of Organization (4)	None
SOC 0525	Demography (4)	Covered as related to population problems
SOC 0535	Proseminar in Society Psychology (4)	None
SOC 0680	Police and Community (4)	None
SOC 0580	Social Gerontology (4)	None
SOC 0580	World Poverty (4)	None
SOC 0580	Theories of Social Problems (4)	None
SOC 0580	Sociology of Sport (4)	None
SOC 0580	Applied Social Research (4)	None
SOC 0502	Modern Social Theory (4)	None
SOC 0460	Family and Sex Roles (4)	None
SOC 0660	Theories of Criminology (4)	None
SOC 0670	Male Sex Roles (4)	None
SOC 0660	Myth and Myth Making (4)	Some coverage as related to world myths
Total		**191**
Education/Library Science		
ED 3015	Schools and Society (4)	None
SSE 4571	Methods Social Stud. Ed. (4)	None
SSE 4572	Student Teaching Seminar—High School (4)	None
ELE 3321	Literature for Children (4)	None

Table 2 (continued).

Number	Course Title (credits)	Darwinism Content
Education/Library Science		
ELE 4312	Student Teaching (Elementary) (16)	None
SSH 4572	Student Teaching (Secondary) (16)	None
SPE 5404	Diagnostic Speech Improvement (3)	None
ELE 3317	Methods and Materials of Language Arts Education (4)	None
EDP 3601	Introduction to the Philosophy of Education (4)	Covered both in the text and in class
LIB 0101	Introduction to Library (4)	None
LIB 0103	Introduction to Audio-Visual Material (5)	None
IT 5761	Technology in Education (4)	None
Total		**72**
History		
HIS 0201	American Democracy to 1815 (4)	None
HIS 0202	American Democracy 1815–1885 (4)	None
HIS 0110	The World and the West—Foundations (4)	Covered briefly
HIS 0120	The World and the West 800–1700 (4)	Covered rather extensively in both the text and classroom lectures
HIS 0130	The World and the West—Modern (4)	Covered in relation to the Scopes trial
Total		**20**
Other Course Work		
DRT 0111	Lay Out Drafting (4)	None
DRT 0112	Production Drafting (4)	None
ENG 0205	Composition and Literature (4)	None
ENG 151	English I (4)	Covered indirectly
ENG 152	English II (4)	Covered indirectly
ENG 261	Public Speaking (4)	Not covered
GER 0090	German Ph.D. Reading Requirement German (6)	Not covered
GRK 0101	Elementary Greek (4)	Not covered
ENG 0234	English Bible as Literature (4)	Covered in class discussions
ART 0156	Art Appreciation (4)	Not covered
PE 0134	Handball (1)	None
PE 0135	Archery (1)	None
PE 0136	Bowling (1)	None

and should be taught as fact, because "using creation and evolution topics for critical-thinking exercises in primary and secondary schools is virtually guaranteed to confuse students about evolution." Her real concern is that teaching both sides may lead students to "reject one of the major themes of science," i.e., Darwinism (Witham, 2002, p. 23). In this conclusion she is correct.

Many scientists are aware of the fact that Darwinism is largely ignored in science instruction. One good example provided by Dawkins was in an after-lunch discussion with the teachers at a school he visited. He concluded that almost every teacher

> confided that, much as they would like to, they didn't *dare* to do justice to evolution in their classes. This was not because of intimidation by fundamentalist parents (which would have been the reason in parts of America). It was simply because of the A-level syllabus. Evolution gets only a tiny mention, and then only at the end of the A-level course. This is preposterous, for, as one of the teachers said to me, quoting the great Russian American biologist Theodosius Dobzhansky …'Nothing in biology makes sense except in the light of evolution' (Dawkins 2003, p. 58).

The fact is virtually everything in biology makes perfect sense without ever mentioning Darwinism. Likewise, Shanks' (2004, p. 228) claim that "evolutionary biology is the veritable glue that holds all the disparate branches of biological inquiry together and gives common focus to their collective endeavors" could hardly be true if it is not covered in most science classes. Shanks argument, that if you remove evolution "the biological sciences would degenerate into an incoherent collection of rudderless ships," is irresponsible because evolution is often not in either the course work or the textbooks. The problem is, as recounted in *The Harvard Crimson*:

> Although the postmodern era questions everything else—the possibility of knowledge, basic morality and reality itself—critical discussion of Darwin is taboo. While evolutionary biologists test Darwin's hypothesis in every experiment they conduct, the basic premise of evolution remains a scientific Holy of Holies, despite our absurd skepticism in other

Table 3. Undergraduate and Graduate Biological Sciences Classes Completed in the University of Guelph Honors Program

Course Title	Darwinism Content
Fundamental Chemistry	None
Organic Chemistry	None
Biochemistry	None
Introductory Zoology	Darwinism discussed or implied in text, at best a minor part of the course
Comparative Vertebrate Anatomy	Text contained some discussion of evolution, assumed to be true
Biophysics I	None
Biophysics II	None
Calculus	None
Advanced Calculus	None
Introductory Statistics	None
Genetics	None
Electives	None
Preveterinary Year (Major course work only)	
Health Management I	None
Health Management II	None
Animal Nutrition	None
Veterinary Embryology	None
Year One, Doctor Veterinary Medicine, Ontario Veterinary College, University of Guelph	
Veterinary Biochemistry	None
Veterinary Anatomy	None
Veterinary Physiology	None
Veterinary Histology	None
Veterinary Bacteriology	None (did mention antibiotic resistance)
Veterinary Virology	None
Veterinary Parasitology	None
Veterinary Medicine I	None
Veterinary Genetics	None
Health Management I	None
Clinical Medicine I	None
DVM Year Two	
Health Management II	None
Veterinary Pathology	None
Clinical Medicine II	None
Theriogenology	None
Veterinary Anesthesiology	None
Principles of Veterinary Surgery	None
Veterinary Epidemiology	None
DVM Year Three	
Clinical Pathology	None
Food Animal Medicine and Surgery	None
Bovine Medicine and Surgery	None
Equine Medicine and Surgery	None
Small Animal Medicine and Surgery	None
Surgical Exercises	None
Clinical Medicine III	None
Exotic Animal Medicine and Surgery	None
Veterinary Clinical Rotations	None
Veterinary Internship	None

areas. Oxford zoologist Richard Dawkins writes: "It is absolutely safe to say that, if you meet somebody who does not believe in evolution, that person is either ignorant, stupid, or insane." Biologists continue to recite the worn credo, "the central, unifying principle of biology is the theory of evolution." But where would physics be if Einstein had been forced to chant, "the central unifying principle of physics is Newtonian theory," until he could not see beyond its limitations? (Halvorson 2003, p. 4).

In conclusion, my research agrees with University of California Ph.D. cell biologist Jonathan Wells, who also concluded the claim

that "nothing in biology makes sense except in the

> light of evolution" is demonstrably false. A person can be a first-rate biologist without being a Darwinist. In fact, a person who rejects Dobzhansky's claim can be a better biologist than one who accepts it uncritically. The distinctive feature and greatest virtue of natural science, we are told, is its reliance on evidence. Someone who starts with a preconceived idea and distorts the evidence to fit it is doing the exact opposite of science. Yet this is precisely what Dobzhansky's maxim encourages people to do (Wells 2000, p. 247).

Much of the problem, as an article in *Life* magazine said, is "for all its acceptance as the great unifying principle of biology, Darwinism, after a century and a quarter, is in a surprising amount of trouble" (Hitching 1982, p. 48).

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