Association of Christian Schools International v. Stearns, et al.

Expert Witness Report of Francisco J. Ayala, Ph.D.

1. Introduction

I have examined the high school textbook *Biology for Christian Schools*, Second edition (Bob Jones University Press, 1999) ("BfCS-2") and Third edition as embedded in the Teacher's Edition (Bob Jones University Press, 2005) ("BfCS-3") with respect to the following questions: (1) whether this textbook presents the scientific knowledge and methodology that are generally accepted in the scientific community and (2) whether this textbook is appropriate for use as the principal text in a UC-preparatory high school biology course. For this purpose, I will follow the University of California "2007 Guide to 'a-g' Requirements and Instructions for Updating Your School's 'a-g' Course List."

I have also examined the high school textbook *Biology: God's Living Creation*, Second edition (A Beka Book, Pensacola, 1997) ("BGLC") as well as the Teacher's Guide, Second edition (A Beka Book, Pensacola, 1998), for this book, with respect to the same two questions stated in the previous paragraph.

In this Report, I will present my determinations and conclusions concerning, first, the BfCS textbook and thereafter, the BGLC textbook. **I have concluded that neither one of these two books is appropriate for use as the principal text in a UC-preparatory high school biology course, because they present information contrary to knowledge generally accepted by the scientific community concerning physics, chemistry, astrophysics, geology, and biology. These two textbooks also reject the methodology generally accepted in science, which relies on observation and experimentation and on the formulation of laws and theories that need to be tested rather than accepted on the basis of the Bible or any other authority.** The two textbooks demand that the statements in the Bible be held as literal and unquestionable truth, no matter what scientific evidence may exist to the contrary. In contrast, the a-g requirements emphasize critical thinking. UC's requirements do not require students to "subscribe" to scientific methods, theories or facts, but they do require that the students be well prepared in understanding them and in thinking critically about scientific questions.

2. Expert Qualifications

I am University Professor and the Donald Bren Professor of Biological Sciences at the University of California, Irvine. I am the author of more than 500 scientific papers and 20 books.

On June 12, 2002, President George W. Bush awarded me the National Medal of Science at the White House.

I am a member of the U.S. National Academy of Sciences and member of other honorific societies and scientific academies in the U.S. and in seven other countries. I have received the title of Doctor *Honoris Causa* from 12 universities in six countries. I have also received numerous gold medals and other awards from many distinguished institutions in the U.S. and abroad.

I have been President and Chairman of the Board of the American Association for the Advancement of Science, the largest general-purpose scientific organization in the world. I have also been President of Sigma Xi, the Scientific Research Honors Society, and of the Society for the Study of Evolution. I have served on many advisory boards of scientific societies and the U.S. government, including the U.S. President's Committee of Advisors on Science and Technology (1994-2001).

In addition to my scientific contributions, I have lectured and written extensively about religion and science. I am editor (with R.J. Russell and W.R. Stoeger) of *Evolutionary and Molecular biology: Scientific Perspectives on Divine Action* (Center for Theology and the Natural Sciences, Berkeley, CA and Vatican Observatory, Vatican City, 1998, 592 pp.). I am the author, most recently, of *Darwin's Gift to Science and Religion* (Joseph Henry Press, Washington, DC, 2007, 256 pp.). I served for more than a decade as a member of the Board of Directors of the Center for Theology and the Natural Sciences, in Berkeley, CA.

My Curriculum Vitae and List of Publications are attached as **Appendix C** to the present document (**Appendix C1**, "Curriculum Vitae"; **Appendix C2**, "Books Published"; **Appendix C3**, "General Publications").

3. Findings concerning *Biology for Christian Schools* (BfCS) as a biology textbook.

a. Summary determinations.

According to BfCS-3, p. 197, "Christians need not wonder about the beginning of life ... since it is clearly outlined in Genesis 1 and 2.... Because God is the source of all truth, all accurate scientific knowledge will fit into this outline." Further, on p. 203, "The account of Creation given in Genesis 1 and 2 states that God created the Universe in six days.... The Genesis account gives no indication that the days described are long ages of millions of years or

that the days are twenty-four hours long, separated by long ages of millions of years. The Bible gives a straightforward timetable of the Creation events—six literal days, each one twenty-four hours in length."

Further, the Teacher's Edition, asserts on p. 198: "Biblical creationism and evolution are incompatible. The earth is not billions, millions, or even tens of thousands of years old. Noah's Flood was a worldwide catastrophe, the geological and biological implications of which are usually overlooked."

These statements are contrary to generally accepted scientific knowledge in the physical sciences, which hold that the universe, as well as the earth and the solar system, are billions of years old (astrophysics and nuclear physics); and that the geological record, with its orderly succession of fossils, is not the product of a single universal flood, but rather came about by deposits accumulating over millions of years (geology, geochemistry, geophysics, and paleontology).

The cited statements also contradict generally accepted knowledge in the biological sciences that hold that the millions of different species of plants, animals, and microorganisms that live on earth today are related by descent from common ancestors, by evolution and diversification over hundreds of millions of years (evolution, genetics, molecular biology, paleobiology).

The cited statements from BfCS refer to the Bible as "the source of all truth," which is contrary to the methodology generally accepted in the scientific community, which seeks to acquire scientific knowledge by discovery, observation, and experimentation, and which considers all scientific knowledge subject to the possibility of refutation by further discoveries. The arguments against evolution in BfCS are based on beliefs about an entity outside the natural world. But science can only investigate naturally occurring phenomena. In a science textbook, religious beliefs should not be used as scientific evidence or against scientific evidence.

I conclude that *Biology for Christian Schools* is not appropriate for use as the principal text in a UC-preparatory high school biology course, because students would have been taught knowledge generally rejected by the scientific community. BfCS rejects evolution, which is the central organizing principle that biologists use to understand the living world. To teach biology without explaining evolution deprives students of a powerful concept that brings order and coherence to all biology. This textbook also rejects

knowledge generally accepted by the scientific community concerning physics, chemistry, astrophysics, geology, and other disciplines. This textbook also rejects the generally accepted methodology for acquiring scientific knowledge by asserting that decisions among alternative explanations of the natural world should be determined by the Bible.

b. *Biology for Christian Schools* **is pervaded by religious teachings that substitute for scientific knowledge. Some examples.** (Chapter and page numbers refer to the third edition.)

- Chapter 8 (table of contents, p. viii, and text, pp. 197-233) is titled "The History of Life," The first two of the three sections in this chapter are titled "A Biblical Worldview," pp. 197-202 and "Biblical Creationism." (pp. 203-219).
- "This chapter is designed to help clarify what the Bible says about origins and to encourage Christians to trust the biblical worldview when interpreting scientific evidence. The first part of this section [8A] defines the concept of a worldview and discusses aspects of Christian and non-Christian worldviews. The second part discusses how a biblical worldview affects the Christian perspective when studying and using the science of biology." (p. 197).
- "The Bible clearly describes God's work in creating the universe out of nothing, or *ex nihilo*. Although there were no human beings watching as God created, the account He gave in Genesis is accurate." (p. 198).
- "When God created everything, it was originally perfect and perfectly declared the glory of the Creator." (p. 198).
- "However, man and the universe are no longer perfect. Sin is a reality as are pollution, toxic wastes, and death. The second component of a biblical worldview, the *Fall*, accounts for these and other problems." (p. 198).
- "And since the evolutionist does not believe in the fall of man into sin, there is no need to believe in redemption. Instead, he thinks that the only way to understand reality is by the study of science." (p. 199).
- "In the light of Proverbs 1:7, despite all their efforts, those who are not right with God have no true knowledge of reality." (p. 200).

- "How Should a Christian View Biology? In Paul's letter to the Colossians, he describes some differences between the 'old man' (the fallen, sinful condition) and the 'new man' (the life in Christ)." (p. 201).
- "One of the privileges of the Christian is the constant renewing of his understanding to become more like Christ. This mind-renewing is a work of God … and will result in an appropriate approach to studies like biology." (p. 201).
- "[The antediluvian earth] was similar to the present-day earth. There were seas, rivers, and mountains (Gen. 1:10; 2:10; 7:20), as well as animal and plant life. Many Bible scholars agree that there was no rainfall before the Flood, plants being watered by a mist that rose from the earth (Gen. 2:5-6)." (p. 206).
- "The average human life span before the Flood (based on Genesis) was 912 years. After Noah, the life span quickly dropped to about 400 years." (p. 207).
- "For everything on the earth to be destroyed, the flood had to be universal; otherwise, people and animals could have migrated beyond the area of a local flood." (p. 207).
- "The testimony of Christ (Luke 17:27) and of Peter (2 Pet. 2:5; 3:6) is that the world was destroyed by the Flood." (p. 208).

The quotations given in this section (**3b**) of the expert testimony are illustrative examples. Numerous others could be added. This is also the case for sections **3c, 3d, 3e,** and **3f**.

c. *Biology for Christian Schools* **uses biblical and religious arguments, rather than the scientific method, as evidence. Some examples.** (Page references are to the third edition.)

- The method to decide among alternative theories is clearly set forth in the "Introduction for the Student" of BfCS: "The people who have prepared this book have tried consistently to put the Word of God first and science second." (p. xi).
- "You may even find [in an encyclopedia article] a 'scientific' explanation of the biblical locust (grasshopper) plague in Egypt.... If the conclusions contradict the Word of God, the conclusions are wrong, no matter how many scientific facts may appear to back them." (p. xi).
- "The challenge for the Christian biology student is … to consider the information in light of the Word of God." (p. xi).

- "The knowledge of the Bible needed to make good decisions comes only with years of studying the Bible and listening to good preaching and teaching." (p. xi).
- "Christians must disregard those guesses and beliefs that contradict the Bible." (p. xi).

The reliance on the Bible and religious beliefs as the authority to decide between alternative statements concerning scientific knowledge pervades BfCS. A few examples follow.

- "The Bible teaches that things are getting worse and that God is the source of all that is good. But some people claim that scientific efforts are improving man's existence and will continue to do so.... To answer these questions, one must look closely at what science is and at what God reveals about Himself." (p. 3).
- "Logic, observations, workability, common beliefs, or personal faith cannot disprove these claims of the Bible." (p. 8).
- "Most of all, the Christian biologist knows that all scientific conclusions should be consistent with the Bible's description of reality and that God's Word is the only true measuring stick for scientific accuracy." (p. 201).
- "And since Christians are to be 'the light of the world,' they must seek to let the Christian worldview, the gospel, influence every area of their lives, even in the way they study biology." (p. 202).
- "It is far more important to have a thoroughly Christian worldview of Creation and biological history than to be concerned about things God did not choose to tell us." (p. 203).
- "Since the God who created everything that scientists study is the same God who gave the Bible, primary allegiance in scientific study should be to the unaltering standard of God's Word." (p. 204).
- "The Bible also states that the floodwaters covered the entire world;... Evidence for a worldwide flood can be seen from the following examples.
    - *God's revelation to Noah.* God states in Genesis 6:7 that He will destroy man from 'the face of the earth.' In Genesis 6:17, God tells Noah that the flood will 'destroy all flesh, wherein is the breath of life, from under heaven; and every thing that is in the earth shall die.' For everything on the earth to be destroyed, the

flood had to be universal; otherwise, people and animals could have migrated beyond the area of a local flood.

- *Confirmation in the New Testament.* The testimony of Christ (Luke 17:27) and of Peter (2 Pet. 2:5; 3:6) is that the world was destroyed by the Flood.
- *The covenant of the rainbow.* God made a covenant with Noah that there would never again be such a flood. The rainbow symbolizes His promise (Gen. 8:21; 9:11, 15-16). God has repeatedly broken the covenant if it referred to local flooding since there are both rainbows and local floods today.
- *The continental shelves and seamounts.* The shelves of land around the continents, as well as many mountains in the sea, appear to have been dry land at one time. They would have been above sea level before the Flood.
- *Universality of the fossil record.* The waters covered the highest mountains to a depth of over 20 ft (Gen. 7:19-20; 8:5). Since water seeks its own level, covering a mountain by this depth requires a universal flood. Fossils have been found around the world and on the tops of mountains; therefore, the mountaintops had to have been underwater at some point." (pp. 207-208).

- "Section 8B discusses the authority of the Bible as the primary means of support for a young earth and the reality that there is no conflict between true science and the Bible." (p. 219).

d. *Biology for Christian Schools* **rejects generally accepted scientific knowledge concerning the origin of the universe and of the earth, and instead proposes notions generally rejected by the scientific community. Some examples.** (Page references are to the third edition.)

- "Most evolutionists believe that the earth is billions of years old. They claim that dates for the beginning of the earth could not have been recorded because man had not yet evolved. They choose to ignore the Word of God, which contradicts their theories on such matters." (pp. 212-213).
- "If one believes in the inerrancy of the Bible and consistently applies a biblical worldview, then the biblical evidence and the physical evidence support a young earth." (p. 212).

- BfCS makes the following case for a "young" earth, that is, an earth that has existed for less than 10,000 years:

  "In the 1600s, James Ussher, an Irish Anglican clergyman, tabulated the dates of various biblical events by using the ages of people recorded in Scripture and other available historical records. His dates appear in many reference Bibles (including the *Scofield Reference Bible*). In *The Annals of the World*, published in 1658, Archbishop Ussher placed Creation at 'the entrance of the night preceding the twenty third day of Octob. in the year of the Julian Calendar, 710' (4004 BC). Although most people are a bit skeptical about Ussher's exact date and time of day, anyone using the biblical genealogies can arrive at about the year 4000 BC (approximately 6000 years ago) as the time of Creation." (p. 212).

- BfCS rejects generally accepted knowledge (important conclusions and the extensive evidence supporting them) that is central to several scientific disciplines: astrophysics, astronomy, nuclear physics, geophysics, geochemistry, geology, paleontology, biology, evolutionary theory, genetics, molecular biology, paleobiology, and anthropology. The generally accepted knowledge that makes up the core of these disciplines affirms that the universe and the earth are billions of years old and that living organisms have evolved for millions of years. The extensive and generally accepted knowledge from these disciplines, severally and jointly, overwhelmingly evinces that organisms have evolved over millions of years and that the universe and the earth are billions of years old.

e. *Biology for Christian Schools* **rejects generally accepted scientific knowledge concerning the evolution of organisms, and instead proposes notions generally rejected by the scientific community. Some examples.** (Chapter and page numbers refer to the third edition, unless otherwise noted.)

- "Collectively, these [Biblical] passages [Genesis 1 and 2] provide a divinely inspired outline of the history of life. Because God is the source of all truth, all accurate scientific knowledge will fit into this outline. Anything that contradicts God's Word is in error or has been misunderstood. This chapter is designed to help clarify what the Bible says about origins and to encourage Christians to trust the biblical worldview when interpreting scientific evidence." (p. 197).

- "This chapter's first paragraph is actually a statement of position for Creationism against evolution. Go over this position carefully with the students. Once it is accepted, all else regarding evolution and creation is merely a logical ramification of this position." (*Teacher's Edition*, p. 197).
- "Since God created the universe, He is the one most qualified to give guidelines for understanding and interpreting His universe." (p. 198).
- "Biological evolution proposes that over time less complex organisms give rise to more complex organisms, which in turn produce even more complex offspring. Since the evolutionist has no way to account for God's workings among mankind … And since the evolutionist does not believe in the fall of man into sin, there is no need to believe in redemption. Instead, he thinks that the only way to understand reality is by the study of science." (p. 199).
- "The implications of … accepting the worldview of evolution are serious ... [A]ccepting evolution can result in several dangerous conclusions." (p. 200).
- "Though evolutionists struggle to understand the universe … 'no man can find out the work that God maketh from the beginning to the end' (Eccles 3:11). Those who reject the Christian worldview offered by the Creator God in His Word can never come to a true understanding of reality." (p. 200).
- "It should also be remembered that the gene pool of Adam and Eve was perfect at Creation and began to decay only after the Fall. At the time of Cain and his wife the gene pool was probably not so corrupted that genetic defects would have resulted from intrafamilial marriages." (*Teacher's Edition*, p. 203).
- "Biblical Arguments Against the Gap Theory." BfCS seeks to settle a scientific matter by the authority of the Bible: "*The argument from silence*.... If such an approach were applied to the entire Bible, it would quickly become clear that the real authority would not be the Bible … Since the Bible is accurate, it is impossible for both the gap theory and Romans 5:12 to be correct." (p. 205).
- "A person who counts the number of layers above a fossil and then attributes a certain age to each layer is assuming that fossils were formed progressively. But as previously discussed, fossils are probably the record of one major catastrophe, Noah's Flood." (p. 213).

- "This section [8C] discusses the basics of evolution as well as some serious scientific problems with the theory." (p. 219).

I point out that section 8C deals (by way of negative argument) with the history of evolutionary theory (Lamarck and Darwin, ~ 6 pages) and Modern Evolutionary Theories (~7 pages). There is no substantive presentation of the theory of evolution or evidence supporting it, a presentation that typically calls for about 20 percent of the text in a biology textbook.

Remarkably, the final paragraph of chapter 8, "The History of Life," and of section 8C, dedicated to the rejection of biological evolution and of the multidisciplinary evidence that supports it, reads as follows:

> "When the Christian views the scientific evidence carefully, he finds nothing in that evidence to seriously challenge the validity of the Christian worldview of the Bible's record that the world was made by a direct act of God. Scientific evidence continues to support the creationist view rather than the evolutionary view. But the most important foundation for understanding science is reliance upon the record of the Creator of the universe. God's Word is always true, and all true science must flow from a Christian worldview based on God's truth." (p. 232).

f. *Biology for Christian Schools* **rejects the generally accepted knowledge that humans are part of the animal kingdom. Some examples.** (Page references are to the third edition.)

Zoologists classify animals in hierarchic groupings from more inclusive (for example, classes like the reptiles and the mammals) to gradually less and less inclusive (for example, rodents and primates, which are orders within the mammals) down to genera and species (such as chimpanzees, gorillas, and humans within the primates). Thus, our species *Homo sapiens* belongs to the order of primates, within the class of mammals. Similarly, physiologists, ecologists, ethnologists and other biologists generally accept that humans are animals, a conclusion with important implications in those disciplines.

BfCS rejects this knowledge:

- "[M]an is a special creation that is completely separate from the physical universe and the animal kingdom. God did something very special when He created man—He

'breathed into his nostrils the breadth of life,' and He created man in His image." (p. 622).

- "The book of Genesis teaches that God took 'the dust of the ground'—a heap of chemicals—and shaped a man and then blew into his nostrils the breadth of life … Humans are different from animals, for 'God created a man in his own image' (Gen. 1:27)." (p. 623).
- "Man is a special creation of God. Animals were not formed and given life and souls in the image of God." (p. 623).
- "The Bible says that when a person does his own will rather than the Lord's will, he allows Satan to control him (Rom. 6:16). When a Christian daily denies himself, refusing to allow sin to control him, and chooses instead to do the will of God, he becomes stronger and grows in the Lord. This daily dying [sic] to self is impossible without the strength God gives to do His will (Ps. 73:26; Phil. 2:13)." (p. 747).
- "As is often the case, Satan took something good—sex—and perverted it. Satan subtly uses the normal drives and processes of the body to entice people to sin." (p. 762).

I conclude that statements from BfCS cited in sections 3a, 3b, 3c, 3d, 3e, and 3f are intended to settle scientific issues, yet they are religious, not biological or scientific statements. Consequently, I have concluded that *Biology for Christian Schools* is not appropriate for use as the principal text in a UC-preparatory high school biology course, because students would have been taught knowledge generally rejected by the scientific community. BfCS rejects evolution, which is the central organizing principle that biologists use to understand the living world. To teach biology without explaining evolution deprives students of a powerful concept that brings order and coherence to all biology. This textbook also rejects knowledge generally accepted by the scientific community concerning physics, chemistry, astrophysics, geology, and other disciplines. This textbook also rejects the generally accepted methodology for acquiring scientific knowledge by asserting that decisions among alternative explanations of the natural world should be determined by the Bible.

4. <u>Centrality of the Theory of Evolution in Biology</u>

I have concluded that BfCS suffers from numerous fatal flaws that disqualify it as an appropriate high school textbook to fulfill the a-g requirements of the University of California. Most fundamental among these fatal flaws is the rejection of the theory of evolution, and of the knowledge from other disciplines associated with the theory of evolution. Examples of the rejection of the theory of evolution in BfCS have been given in Sections **3a, 3b, 3c, 3d, 3e** and **3f** (above).

Scientists no longer question the basic facts of evolution, as a process by which living organisms have evolved over eons of time from common ancestors. This conclusion and many details of the process have been demonstrated through extensive testing by thousands of specialists in biology, medicine, anthropology, geology, chemistry, and other scientific disciplines. Discoveries in different disciplines have reinforced one another, and evidence for evolution has continued to accumulate for 150 years.

The discovery and understanding of the processes of evolution represent one of the most powerful achievements of science. Evolution successfully explains the diversity of life on earth and has been confirmed repeatedly through observation and experimentation in a broad spectrum of scientific disciplines. Moreover and very importantly, evolution science provides the foundation for modern biology. As the eminent biologist Theodosius Dobzhansky has stated: "Nothing makes sense in biology except in the light of evolution."

The science of evolution is important beyond pure scientific knowledge. It has opened the doors to entirely new applications in medicine, agriculture, and the management of natural resources. Understanding of the evolutionary process has led to the development of technologies that can help us prevent and combat disease.

The U.S. National Academy of Sciences, the most distinguished scientific organization in the world, on which the U.S. government relies for advice on matters of science and technology, has repeatedly asserted the fundamental place that knowledge about evolution plays in biology. For example, "evolution is the central organizing principle that biologists use to understand the world. To teach biology without explaining evolution deprives students of a powerful concept that brings great order and coherence to our understanding of life." (*Teaching About Evolution and the Nature of Science*, National Academy Press, Washington, DC, 1998, p. 3). And, as the same document asserts (p. 56): "The scientific consensus around evolution is overwhelming."

Similarly, this document refers to evolution as "the most important concept in modern biology, a concept essential to understanding key aspects of living things." (p. viii).

In the Preface to a different document from the National Academy of Sciences, Dr. Bruce Alberts, its president, has written: "The concept of biological evolution is one of the most important ideas ever generated by the application of scientific methods to the natural world. The evolution of all the organisms that live on Earth today from ancestors that lived in the past is at the core of genetics, biochemistry, neurobiology, physiology, ecology, and other biological disciplines. It helps to explain the emergence of new infectious diseases, the development of antibiotic resistance in bacteria, the agricultural relationships among wild and domestic plants and animals, the composition of the Earth's atmosphere, the molecular machinery of the cell, the similarities between human beings and other primates, and countless other features of the biological and physical world." (*Science and Creationism. A View from the National Academy of Sciences*, Second edition, National Academy Press, Washington, DC, 1999, pp. viii-ix).

The same document asserts: "[M]any scientific explanations have been so thoroughly tested and confirmed that they are held with great confidence. The theory of evolution is one of these well-established explanations. An enormous amount of scientific investigation since the mid-19th century has converted early ideas about evolution proposed by Darwin and others into a strong and well-supported theory. Today, evolution is an extremely active field of research, with an abundance of new discoveries that are continually increasing our understanding of how evolution occurs." (p. 1).

The California Academy of Sciences, in a Statement approved by the Science Council of the Academy on March 28, 2007, asserts: "Evolution is a central concept in modern science, including biology, geology, and astronomy. The California Academy of Sciences, with its broad mission to explore, explain, and protect the natural world, recognizes that evolution is fundamental to understanding biological diversity and is a critical organizing principle for both scientific research and science museums."

Similar statements from scientific societies, professional organizations, and science academies asserting the centrality of evolution as the organizing principle of biology, and the practical applications of evolutionary knowledge, are innumerable.

The centrality of evolution in biology is reflected in typical biology textbooks. As an example, the college-level textbook *Essential Biology* by N.A. Campbell, J.B. Reece, and E.J.

Simon (Pearson Benjamin Cummings, San Francisco, CA, 2004) dedicates about 20 percent of the book to evolution (5 chapters out of 29, and 140 pages of text out of 656). In addition, one of three sections of chapter 1 ("Introduction: Biology Today") is titled "Evolution: Biology's Unifying Theme." Moreover, *every chapter* (chapter 2 – chapter 29) ends with a section, the first half of which is titled, "Evolution Connection." This use is consistent with the dictum cited above, of the eminent biologist Theodosius Dobzhansky, "Nothing makes sense in biology except in the light of evolution." It is also in agreement with statements from the U.S. National Academy of Sciences (and similarly form other distinguished scientific constitutions and scientific societies), such as, for example, the one cited above: "The evolution of all the organisms that live on Earth today from ancestors that lived in the past is at the core of genetics, biochemistry, neurobiology, physiology, ecology, and other biological disciplines." (*Science and Creationism: A View from the National Academy of Sciences*, 2nd ed., National Academy Press, Washington, DC, 1999, p. viii).

5. Genomics' important contributions to human biology

Genomics is a biological discipline that has emerged in the last two decades. Genomics compares the genomes of different species and thus provides evidence about the evolution of the species and identifies the genetic basis of the distinctive characteristics of species. Much is learned about human biology by comparing the human genome with the genome of chimpanzees (the animals most closely related to humans) and the genomes of other primate and animal species. Genomics is one of the fastest advancing subdisciplines of biology and one that is making important discoveries at an accelerating rate, particularly concerning human biology, and, as a result, advances in medicine.

Biology for Christian Schools rejects the generally accepted knowledge that humans are part of the animal kingdom and, thus, excludes comparisons between the human genome and other animal genomes as a means of acquiring knowledge about human biology and medicine.

The DNA of humans is packaged in two sets of 23 chromosomes, one set inherited from each parent. The total number of DNA letters (four nucleotides represented by A, C, G, T) in each set of chromosomes is about three billion. The Human Genome Project has deciphered the sequence of the three billion letters in the human genome. A draft of the genome sequence was completed in 2001. In 2003 the Human Genome Project was finished. A draft of the DNA

sequence of the chimpanzee genome was published on September 1, 2005. The genome of another primate, a rhesus monkey, was completed in early 2007.

Much is learned about human evolution and human biology by comparing the human genome with the genomes of other species. In the genome regions shared by humans and chimpanzees, the two species are 99 percent identical. One percent of the total seems very little, but it amounts to a difference of 30 million DNA letters out of the 3 billion in each genome. Twenty-nine percent of the enzymes and other proteins encoded by the genes are identical in both species. Out of the one hundred to several hundred amino acids that make up each protein, the 71 percent of nonidentical proteins differ between humans and chimps by only two amino acids, on the average. Comparisons of the two genomes provide insights into the rate of evolution of particular genes in the two species. One significant finding is that genes active in the brain have changed more in the human lineage than in the chimp lineage. Also significant is that the fastest evolving human genes are those coding for "switch" proteins, which control the expression of other genes. They determine when other genes are turned on and off. On the whole, 585 genes, including genes involved in resistance to malaria and tuberculosis, have been identified as evolving faster in humans than in chimps. There are several regions of the human genome that seem to contain beneficial genes that have rapidly evolved within the past 250,000 years. One region contains the *FOXP2* gene, involved in the evolution of speech.

Extended comparisons of the human and chimp genomes and experimental exploration of the functions associated with significant genes are advancing considerably our understanding of what it is that makes us distinctively human. *Biology for Christian Schools* ignores or denies all this sort of knowledge.

6. <u>Findings concerning</u> *<u>Biology: God's Living Creation</u>* **<u>(BGLC) as a biology textbook.</u>** (The statements about scientific knowledge and practice made in 3, 4, and 5 above are herein incorporated by implicit reference.)

a. Summary determinations.

According to BGLC (Preface, p. iii), "*Biology: God's Living Creation* presents life as God created it and now controls it ... High school students need to understand God's living creation from a Biblical perspective ... The study of the human body is given prime emphasis as the temple of God ... Evolution is presented for what it is—a retreat from science ... Since the

day that Darwinism invaded the classrooms, God's glory has been hidden from students. Now there is an opportunity in the Christian classroom to declare that glory with *Biology: God's Living Creation.*"

BGLC instructs that the Bible, rather than the study of nature, should be the source for answers to many questions that scientists answer through experiments and observation:

- "*The scientist needs the Bible* ... many vital facts about the origin of the universe, the origin of life, and the ultimate destiny of the cosmos cannot be discovered through science alone. To answer these questions, one needs the Book of books, the Bible, which contains information one cannot get from the study of nature." (p. 358, italics in the original).
- "The facts about the manner and order of Creation that God has chosen to reveal to us in the Bible are all that we (including the scientist) can know with certainty about the beginning." (p. 359).
- "The Scriptures teach that the earth was originally created in a perfect state, but man's subsequent fall into sin plunged the world into a state of imperfection and death ... The curse of sin also affected the animal and plant kingdoms, instead of being in perfect harmony with each other, animals and plants now had to struggle to survive." (p. 360).
- "The Scriptures also demonstrate ... For example, we know that dozens of species of sparrow are descended from only seven sparrows that survived the Flood aboard the ark." (p. 360).

Chapter 15 (pp. 398-407) is titled "Why I Accept the Genesis Record" and it is a sustained statement arguing that the Genesis record of the creation of the world and of life should be accepted literally and, as a result, scientific evidence of evolution rejected.

The cited statements, which are merely a few examples among many, many other similar statements, are contrary to generally accepted scientific methodology and to generally accepted knowledge in the physical sciences and in the biological sciences (see, *supra*, at 3a).

I have concluded that *Biology: God's Living Creation* is not appropriate for use as the principal text in a UC-preparatory high school biology course, because students would have been taught knowledge generally rejected by the scientific community. BGLC rejects evolution, which is the central organizing principle that biologists use to understand the world. To teach biology without explaining evolution deprives students of a powerful

concept that brings order and coherence to all biology. This textbook also rejects knowledge generally accepted by the scientific community concerning physics, chemistry, astrophysics, geology, and other disciplines. BGLC also rejects the generally accepted methodology for acquiring scientific knowledge by asserting that the decision among alternative explanations of the natural world is the authority of the Bible.

b. *Biology: God's Living Creation* **is pervaded by religious teachings that substitute for scientific knowledge. Some examples.**

In the examples that follow, the Bible is quoted (or religious beliefs pointed out) as the authority justifying the biological knowledge cited. This biology textbook repeatedly refers to religious or non-biological issues as if they were biological knowledge.

- "We can illustrate how important bread is for human sustenance when we look at how Christ compared Himself to bread. As bread is the sustainer of the physical body, so Christ is the source and sustainer of spiritual life." (p. 60).
- "The intricate workings of the human body point to God's wisdom in creation and cause us to exclaim with the Psalmist: *'I will praise thee; for I am fearfully and wonderfully made: marvellous are thy works; and that my soul knoweth right well.'—Ps. 139:14*" (p. 117, italics in the original).
- "Not only are a person's physical traits initiated at conception, but his spiritual nature is also present: *'For thou hast possessed my reins: thou hast covered me in my mother's womb. I will praise thee; for I am fearfully and wonderfully made: marvellous are thy works; and that my soul knoweth right well. My substance was not hid from thee, when I was made in secret, and curiously wrought in the lowest parts of the earth. Thine eyes did see my substance, yet being unperfect; and in thy book all my members were written, which in continuance were fashioned, when as yet there was none of them.'—Ps. 139:13-16*" (p. 125, italics in the original).
- "God created for man a perfect body. Until Adam and Eve sinned, their bodies were without flaw. Ever since their sin, however, the human body has been subject to disease, decay, and death. *'And the Lord God said, Behold, the man is become as one of us, to know good and evil: and now, lest he put forth his hand, and take also of the tree of life, and eat, and live for ever: Therefore the Lord God sent him forth from the garden of*

Eden, to till the ground from whence he was taken. So he drove out the man; and he placed at the east of the garden of Eden Cherubims, and a flaming sword which turned every way, to keep the way of the tree of life.'—Gen. 3:22-24" (pp. 128-129, italics in the original).

- "God promises to give the Christian a new body someday which will be free from the imperfections brought upon us by sin. *'For our conversation is in heaven ... the Lord Jesus Christ ... shall change our vile body, that it may be fashioned like unto his glorious body ...'—Phil. 3:20-21*" (p. 129, italics in the original).
- "The hand is a wonderful gift of the Creator to man. It is one of the seven wonders of the human body. Only an omnipotent and all-wise God could have designed and created the human hand." (p. 151).
- "[S]tatistics show that most new cases of HIV infection in the U.S. result from disobedience to God's standards of morality." (p. 331).
- "Other Scripture versus indicate that the fear of the Lord is essential to good health." (p. 333).
- "After the fall of man because of sin, God cursed the earth and altered man's association with its creatures. Because of the curse of God, man was driven from the Garden of Eden to work among other living creatures for his survival." (p. 338).
- "*The return to the authority of the Scriptures, which was the hallmark of the Protestant movement, made people very interested in the natural world which the God of the Scriptures had created.* They wanted to discover the secrets that God has concealed in the universe (see Prov. 25:2) ... As science turned to the principles in the Bible, a great new era began." (p. 343, italics in the original).
- "The Scriptures give us the truth about God and about man's relationship to God and also provide us with a true account of the origin of all things." (p. 350).
- "The Bible teaches that the earth and living things did not develop gradually, but were divinely created." (p. 369).
- "The direction of science is to be forward, making progress in man's subduing of the earth as commanded by God in Genesis 1:28." (p. 396).
- "As you read Genesis 1:20-25, you will become aware of two of the main attributes of the animal kingdom." (p. 410).

- "The Bible teaches that he [man] was created on the same day as the land animals (Gen. 1:24-26), after the creation of the mammals." (p. 415).
- "The Creation account clearly distinguishes man from the animals, however: *And God said, Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth.—Gen. 1:26*" (p. 415, italics in the original).
- "Adam named all the animals, and an affection between man and beast must have resulted … It was not until after the fall of man into sin that man's relationship with nature, including the animal kingdom, changed. Man then found it necessary to kill animals for clothing, sacrifice, or in self defense." (p. 415).
- "[A]fter the Flood, God put a fear of man into the animals and allowed man to eat animals for food. One day God will restore the original tranquility of nature, and the lion will lie down with the lamb (Isa. 11:6)." (p. 415).
- "[T]he Bible is completely true and accurate when it speaks of scientific matters." (*Teacher Guide*, p. 89).

c. *Biology: God's Living Creation* **uses biblical and religious arguments, rather than the scientific method, as evidence. Some examples.**

- "Thus, the Bible is very important to the scientist because it records vital facts about the history and future of the physical universe that he would not otherwise know." (p. 358).
- "*Biology: God's Living Creation* is written from the Christian perspective … It gives him [the student] an infallible source of truth—the Bible—with which to compare its observations." (*Teacher Guide*, p. vi).
- "The similarities between man and animals are explored and proved to be the result of a common Designer, not a common ancestor." (*Teacher Guide*, p. vi).
- "[T]he Bible confirms what nature clearly reveals—that 'in the beginning, God created …'" (*Teacher Guide*, p. vi).
- "The Scriptures … provide us with a true account of the origin of all things. In addition, *God's Word furnishes us with an interpretative framework* by which to view life and the world." (p. 350, italics in the original).

- "How should a Christian view taxonomy in biology? The answer is simple. Use it as a tool to describe the wisdom of the Creator." (p. 90).
- "If [a student of botany] has eyes to see, he will discover that it is utterly absurd and irrational to assume that these wonders could have just happened, when everywhere he finds careful design and meticulous laws to govern them." (p. 95).
- "Explain how … bacteria and fungi are necessary, in God's providence, to life on the present earth." (p. 113).
- "Because the Bible is true and accurate in all that it states, it is a valuable tool to the naturalist." (p. 341).
- "*Modern science is built on Biblical principles.*" (p. 343, italics in the original).
- "*The goal of science is to determine God's laws of nature (God's normal ways of governing His creation) and to use them for man's benefit and God's glory.*" (p. 353, italics in the original).

Page 393 of BGLC is a full-page panel titled "Creation, Evolution, and Their Correspondence to Reality." With respect to 12 scientific issues, the panel compares what "A scientist who accepts the Bible would predict" with what "A scientist who rejects the Bible might predict." A third column states that "Modern science has uncovered these facts" for each of the 12 issues. Statements attributed to scientists in the second column are inaccurate and misleading. For example: "The universe is disordered, without rhyme or reason"; "At some point the differences between living and nonliving things are obliterated"; "The possibilities for variation are unlimited"; "Fossils should be arranged in a simple-to-complex sequence." Similarly, the statements in the third column are inaccurate and misleading. For example: "Evolutionists cannot explain [the universe's] lawfulness but neither can deny it"; "The earth's magnetic field, … the scarcity of helium in the earth's atmosphere, the lack of certain chemical concentrations in the oceans, etc., suggest that the earth is relatively young"; "Continuum of intermediate forms is not found"; "The distinct groups of living things observed today are the same ones we find in the fossil record." And so on.

d. *Biology: God's Living Creation* **rejects generally accepted scientific knowledge concerning the evolution of organisms and other matters such as the origin of the universe and of the**

earth, and instead proposes notions generally rejected by the scientific community. Some examples.

- "[E]volutionism poisons biology textbooks and distracts from God's glory in creation. High school students need to understand God's living creation from a Biblical perspective." (p. iii).
- "The great coal deposits in the bowels of the earth are the fossil remains of the luxuriant antediluvial plant life which was wiped away and buried in the Great Flood." (p. 73).
- "The Biblical 'kind' is usually a broader category than our modern term 'species.'" (p. 88).
- "[T]here are no vestigial organs, only organs that we do not yet fully understand" (p. 124).
- "Scripture verses indicate that *the fear of the Lord* is essential to good health." (p. 333, italics in the original).
- "After the fall of man because of sin, God cursed the earth and altered man's association with its creatures. Because of the curse of God … finding answers for his inquisitive mind would be much more difficult." (p. 338).

BGLC rejects biological evolution. Chapter 14 (pp. 358-396) is titled "Evolution: A Retreat from Science." Three sections of this chapter are: "Paleontology: Evidence against Evolution," "Biology: Evidence against Evolution," and "Evolution Is Not Science." These sections reject generally accepted scientific knowledge about the old age of the earth, radiometric dating, and that fossils are remains of organisms that lived long ago, even many millions of years ago. These three sections of BGLC reject generally accepted scientific knowledge that there are transitional forms -- intermediate between different kinds of organisms -- such as birds and reptiles, or humans and apes. These three sections of BGLC also reject the generally accepted scientific knowledge about that paleontology, comparative anatomy, genetics, and molecular biology provide evidence for evolution, and that evolution has been repeatedly tested by observation and experimentation. For example:

- "[T]he fossil record, when viewed from a Biblical perspective, is actually one of the most powerful evidences against evolution." (p. 367).
- Page 388 of BGLC displays six composite figures with the heading "God's Plan for Variety in Nature." The three panels on the left side are labeled "Truth" and have the

following descriptions: "Many varieties of canines have developed from a single pair of canines that left the Ark." "Many varieties of sparrows have developed from seven sparrows that left the Ark." "Much variety within the human race has developed from the eight people who left the Ark." The three panels on the right are labeled "Error" and reject generally accepted knowledge (although inaccurately presented) concerning the evolution of the organisms therein represented: "Dogs, seals, raccoons, bears, cats and hyenas supposedly evolved from a single weasel-like animal." "All birds supposedly evolved from a dinosaur ancestor." "Man … evolved from an apelike creature to his present stature."

- "A belief in special creation is no less 'scientific' than a belief in evolution, for both are based on faith. It is clear, however, that *the facts of modern science agree marvelously with the Biblical account of Creation.* 'The more one studies paleontology, the more certain one becomes that evolution is based on faith alone.'" (p. 396, italics in the original).

e. *Biology: God's Living Creation* **rejects the generally accepted scientific knowledge that humans are part of the animal kingdom.**

BGLC denies that humans have evolved from nonhuman ancestors, because "This directly contradicts the Biblical teaching that God created man: 'And the Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul.' Gen. 2:7" (p. 374).

BGLC does not include humans within the order of primates or within the kingdom of animals (pp. 429-430), because humans were separately created. "Man is the most magnificent part of God's creation—far more complex in structure and design than the earth or any heavenly body." (p. 116).

- "God created for man a perfect body. Until Adam and Eve sinned, their bodies were without flaw. Ever since their sin, however, the human body has been subject to disease, decay, and death." (p. 128).
- "According to God's precision engineering, the muscular system functions …" (p. 130).
- "God designed these curves of the vertebral column to provide the spine with additional strength and flexibility." (p. 133).

- "[B]ehaviorists foolishly ignore the testimony of God all around them in creation and their own minds and persist in rejecting God." (p. 175).
- "[T]he human body is of supernatural design." (p. 245).
- "'And the Lord God formed man of the dust of the ground' ... (Gen. 2:7; see also Job 12:10 and Isa. 42:5). What is man without breath? He is dust." (p. 269).

I conclude that the BGLC statements cited in sections 5a, 5b, 5c, 5d, and 5e are intended to settle scientific issues, yet they are religious, not biological or scientific statements. Consequently, I have concluded that *Biology: God's Living Creation* is not appropriate for use as the principal text in a UC-preparatory high school biology course, because students would have been taught knowledge generally rejected by the scientific community. BfCS rejects evolution, which is the central organizing principle that biologists use to understand the living world. To teach biology without explaining evolution deprives students of a powerful concept that brings order and coherence to all biology. This textbook also rejects knowledge generally accepted by the scientific community concerning physics, chemistry, astrophysics, geology, and other disciplines. This textbook also rejects the generally accepted methodology for acquiring scientific knowledge and asserts that decisions among alternative explanations of the natural world should be determined by the Bible.

7. General Conclusion

I have been asked to provide an expert opinion on two books used by high school students at Christian academies: *Biology for Christian Schools,* Second edition (Bob Jones University Press, 1999) and Third edition (as embedded in the Teacher's Edition (Bob Jones University Press, 2005); *Biology: God's Living Creation,* Second edition (A Beka Book, Pensacola, 1997) and the Teacher Guide, Second edition (A Beka Book, Pensacola, 1998).

In particular, I have been asked to address two questions:

1. Whether the textbooks present the scientific knowledge and methodology that are generally accepted in the scientific community.

2. Whether any one of these textbooks is appropriate for use as principal text in a preparatory high school biology course for which "d" credit is sought under the University of California's "a-g guidelines."

The University's general guidelines for approval of a-g courses include the following provisions:

The purposes of the a-g subject area requirements are to ensure that entering students

- Can participate fully in the first year program at the University in broad variety of fields of study;
- Have attained the necessary preparation for courses, majors and programs offered at the University;
- Have attained a body of knowledge that will provide breadth and perspective to new, more advanced studies; and
- Have attained essential critical thinking and study skills.

The following general criteria must be satisfied for courses to meet the requirement:

- Be academically challenging;
- Involve substantial reading and writing;
- Include problems and laboratory work, as appropriate;
- Show serious attention to analytical thinking as well as factual content; and
- Develop students' oral and listening skills.

The following specific criteria must be satisfied for courses to meet the "**(d) Laboratory Science**" requirement:

- Provid[e] fundamental knowledge in . . . biology, chemistry, [or] physics; and

- Take an approach consistent with the scientific method in relation to observing, forming hypotheses, testing hypotheses through experimentation and/or further observation, and forming objective conclusions.

My determination is that neither one of these two books is appropriate as a core textbook for meeting the "d" requirement under the University of California "a-g guidelines." Both of these textbooks exclude and explicitly reject scientific knowledge generally accepted by the scientific community. Moreover, these two books exclude and explicitly reject the scientific

methodology generally accepted by the scientific community, by placing the Bible as the ultimate authority when scientific knowledge is not consistent with the Bible.

These two books fail to meet the purpose of the a-g requirements seeking to ensure that entering students "Have attained essential critical thinking and study skills." As repeatedly quoted in this Report the two textbooks under consideration demand that the statements in the Bible be held as literal and unquestionable truth, no matter what scientific evidence may exist to the contrary.

Therefore, neither of these two textbooks is appropriate for use as the principal text in a University of California preparatory high school biology course.

8. Signature

Francisco J. Ayala
University Professor and
Donald Bren Professor of Biological Sciences
University of California, Irvine
April 26, 2007

Appendix A. Brief Expert Report on Biology-Relevant Issues in *Physics for Christian Schools*, Second edition (Bob Jones University Press, 2004)

I have examined the high school textbook *Physics for Christian Schools* (PfCS), Second edition (Bob Jones University Press, 2004), chapter 16, section C (16.14 and 16.15) "Entropy and Its Consequences" (pp. 361-367), as well as chapter 29, concerning "Radioactive Dating" (29.11), "Problems with Radioactive Dating" (29.12) and "Geochronology: Determining the Age of the Earth" (29.13) (pp. 638-642), with respect to the following question: whether these textbook sections present the scientific knowledge and methodology that are generally accepted in the scientific community.

I conclude that these textbook sections convey information contrary to the methodology and to knowledge generally accepted by the scientific community concerning the physics and biological issues at hand.

Introduction

In an introductory section, PfCS states the following:

- "The only sure truths are found in God's Word, which is settled forever in heaven" (Ps. 119:89)." (p. 16).
- "[T]he Bible, written through the inspiration of an omniscient God, can never be proved wrong." (p. 16).
- "[S]cience has difficulty defining and explaining the causes of natural phenomena." (p. 16).
- "[S]cience cannot solve ... questions of origins (as mentioned earlier), because no one was present at Creation to record the events." (p. 17).

These statements are contrary to the methodology generally accepted by the scientific community and/or contrary to knowledge generally accepted by the scientific community.

a. Sections 16.14 and 16.15

- "[E]ntropy increases in all natural processes." (p. 361).
- "The second law says that every *natural* process makes the universe more disorderly." (p. 361, italics in the original).

- "A random change, known as a mutation, destroys some information and harms a body." (p. 362).
- "The first law [of thermodynamics] is a result of the fact that only God can create or destroy. The only exceptions to this law are divine actions." (p. 362).
- "[N]aturalistic evolutionary cosmology is thermodynamically impossible." (p. 363).
- "[E]volutionists are in error when they say that the second law allows evolution." (p. 363).
- "If the second law can be ignored as many times as evolution requires, it is not an accurate reflection of nature." (p. 363).
- "[T]he heat death will never happen, because … The Lord will return and replace this universe with a new one." (p. 363).
- "God's Word had declared [the second law of thermodynamics] millennia before scientists stumbled upon it [(in 1852)] … 'The earth shall wax old like a garment, and they that dwell therein shall die in like manner' (Isa. 51:6). 'For the creature was made subject to vanity …. The whole creation groaneth and travaileth in pain together until now' (Rom. 8:20, 22). 'All go unto one place; all are of the dust, and all turn to dust again' (Eccles. 3:20)." (pp. 364-365).
- "[A]dult organisms are no more complex than the initial fertilized egg. Every major cell function takes place in the first cell." (p. 365).
- "Adam's healthy body lasted 930 years before it returned to dust, but the longevity of his descendants decreased, especially after the Flood." (p. 365).
- "Adam's brain needed only one day to register and name every beast of the field and every fowl of the air." (p. 365).

These statements are contrary to the methodology generally accepted by the scientific community. PfCS uses the Bible's statements instead of scientific evidence to settle scientific issues, and/or conveys information contrary to knowledge generally accepted by the scientific community. (I point out that the second law of thermodynamics only applies to closed systems. The earth is not a closed system; that is why evolution can happen. Entropy can decrease in open systems. Entropy decreases locally when an egg develops into a chicken or as I write this sentence.)

b. Sections 29.11, 29.12, and 29.13

- "[S]imple assumptions that would make C-14 dating reliable are not possible." (p. 641).
- "[Scientists] assume, then, that any argon found in the rock is radiogenic because they also assume that the argon atoms become trapped in the mineral crystal lattices after solidification. Neither of these assumptions is supported in laboratory experiments or field observations." (p. 641).
- "[G]eologists assume that nonradiogenic lead nuclides have always occurred in the same proportions and that any lead-206 or -207 above the expected proportions is radiogenic." (p. 641).
- "By mentioning the various methods of *geochronology*, we are not giving credence to any of them." (p. 641).
- "The only scientific conclusion one can make is that radioactive dating of the earth's rocks will not produce meaningful ages." (p. 642).

These statements, and thus **the information conveyed in sections 29.11, 29.12, and 29.13 of PfCS, contradict knowledge generally accepted by the scientific community.**

Appendix B. Comment on "Expert Witness Report of Michael Behe"

Professor Michael Behe in his "Report" reviews the "California State Board of Education (CDE) Standards" for "Biological Science content" and states that CDE "intends that 'Standards describe *what* to teach, not *how* to teach it.'" (p. 3, emphasis added). Thus, "in deciding if a textbook met a standard, I examined whether the text mentioned the concept that the standard concerned, either directly or nearly directly" (p. 2). Professor Behe adds that "I counted a textbook as having met a standard to 'discuss' or 'analyze' evidence even when it did so from a skeptical point of view." (p. 3).

Consequently, Professor Behe considers that the two textbooks under consideration in the present report (*Biology for Christian Schools*, Second edition (Bob Jones University Press, 1999) and Third edition (as embedded in the Teacher's Edition, Bob Jones University Press, 2005); *Biology: God's Living Creation*, Second edition (A Beka Book, Pensacola, 1997) and the Teacher Guide, Second edition) meet either 8 or 10 of the 13 CDE Standards in Evolution (Table 1, p. 31). Professor Behe (in Table 2) cites some of the pages where the two textbooks discuss some of the standards (8e and 8f) concerning evolution, while noticing that standard 8g is not mentioned at all. However, as the statements quoted as examples in my report make eminently clear, the two textbooks under consideration reject generally accepted knowledge concerning biological evolution. This is not a matter of *how* to teach the topic, but indeed *what* to teach about it.

Professor Behe concludes that "As Tables 1-4 show, the Christian texts meet about the same *number* of standards as do the approved texts. Thus *by that measure* they are as consistent with the 'knowledge generally accepted by the scientific community' as the approved texts." (p. 26, emphasis added). But that "measure" is not appropriate. What counts in preparing the students is not whether a standard is mentioned, but rather what is being taught under that standard.

Professor Behe further asserts that "the Christian texts can also be used to meet the general criteria of the University of California ... including a good understanding of the scientific method." (p. 26). However, as the statements quoted as examples in my report make it eminently clear, the two textbooks under consideration affirm that the authority of the Bible trumps any conclusions reached by the scientific community. This affirmation is contrary to the scientific method as generally accepted by the scientific community.

Professor Behe holds that "it is personally abusive and pedagogically damaging to de facto require students to subscribe to an idea … Requiring a student to, effectively, consent to an idea violates his/her personal integrity." (p. 27). But as repeatedly quoted in my report, the two textbooks under consideration demand that the statements in the Bible be held as literal and unquestionable truth, no matter what scientific evidence may exist to the contrary. On the contrary, UC's requirements do not require students to "subscribe" to the scientific methods, theories or facts, only that the students be well prepared in understanding them. The a-g requirements emphasize critical thinking.

In conclusion, Professor Behe's Report does not, in any way, validate the Plaintiffs' claim against the University of California concerning the unsuitability of the two textbooks under consideration.

Francisco J. Ayala, Ph.D.

Data and Information Considered As Basis and Reasons for Opinions

Publications referred to in the report

My years of research and teaching

The Complaint in this case and the parties' briefs on the Motion to Dismiss

UC A-G Guide (http://www.ucop.edu/a-gGuide/ag/content/Guidetoa-gReqs_2007.pdf)

Report of Dr. Behe, produced by Plaintiffs in this case

Textbooks/Publications:

- *Biology for Christian Schools*, 2nd edition (Bob Jones University Press, 1999)
- *Biology for Christian Schools*, 3rd edition, as embedded in the Teacher's Edition (Bob Jones University Press, 2005)
- *Biology: God's Living Creation*, 2nd edition (A Beka Book, Pensacola, 1997)
- *Biology: God's Living Creation* Teacher Guide, 2nd edition (A Beka Book, Pensacola, 1998)
- *Essential Biology* by N.A. Campbell, J.B. Reece, and E.J. Simon (Pearson Benjamin Cummings, San Francisco, CA, 2004) (portions only)
- *Physics for Christian Schools*, 2nd edition (Bob Jones University Press, 2004) (portions only)
- *Science and Creationism. A View from the National Academy of Sciences*, 2nd edition, National Academy Press, Washington, DC, 1999) (*available at* http://www.nap.edu/catalog/6024.html)
- *Teaching About Evolution and the Nature of Science*, National Academy Press, Washington, DC, 1998) (*available at* http://www.nap.edu/catalog/5787.html)

Copies Attached

Copies are attached of the following items, not publicly available or produced in discovery in this action:

- Appendices to report

Documents to be provided within 3 days to Plaintiffs

- California Academy of Sciences "Evolution Statement" (UC00274707)

Compensation

The compensation to be paid for work on this report, deposition testimony, and trial testimony is $250 per hour.

Testimony in Other Cases

None in the preceding four years, at trial or by deposition.