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

Expert Report of Professor Donald Kennedy

I. Introduction

I have been asked to provide an opinion on ***Biology: God's Living Creation*, Second Edition, and Teacher's Guide (A Beka Book, Pensacola, Fla, 1998)**, used by certain high schools in their curricula. I have examined with particular care Chapter 14: Evolution, and the accompanying portions of the Teacher's Guide, with attention to whether the content of this textbook and the guidance given to teachers are designed to teach students about the nature of science, are consistent with generally accepted scientific understandings, and are likely to provide students with the knowledge and opportunity to develop skills expected of incoming college students.

In particular, I examine whether this textbook and the direction given to teachers are appropriate for meeting the requirements for a course for which credit is sought under the University of California's "a-g guidelines." These guidelines are designed to ensure that entering students can participate fully in the first year program at the University in a broad variety of fields of study, and in particular;

- 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 requirements:

- 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.

II. Expert Qualifications

My CV and publication list are appended hereto as Exhibit A. Among my specific qualifications for this review are the following.

I taught for four years introductory survey courses in introductory Zoology for prospective majors and for non-majors at Syracuse University; I also made trips to high schools under the auspices of the National Science Foundation, during which I taught a number of classes and met with secondary school science faculty. After arriving at Stanford University in 1960, I undertook responsibility for a large course for general students in Biology as one of two primary lecturers, and also supervised laboratory instruction. Later I taught in the Biology department's core curriculum for majors, and after that taught in the sophomore core series in the Program in Human Biology. After serving as President of Stanford, I returned to the classroom, again in the Program in Human Biology for five years. Over 42 years of teaching at Stanford, I estimate that I have taught over 15,000 students at beginning or second-year levels. I also taught in several summer institutes for high school science teachers, mostly in the 1960's.

I have served as Chairman of the Advisory Committee to the National Academy of Science's Center on Science, Mathematics, Engineering and Technology Education for five years.

I was Chairman of the Committee of the National Academy of Sciences (NAS) that produced "*Teaching about Evolution and the Nature of Science*" (hereinafter "Teaching About Evolution"), a publication distributed to secondary school science teachers nationally. I also served as a member of the NAS Committee that produced "*Science and Creationism: A View from the National Academy of Sciences.*" Copies of those publications are appended hereto as Exhibits B and C, respectively, and incorporated herein by reference.

I am the editor-in-chief of the journal *Science*, and I am a member of the National Academy of Sciences, the Institute of Medicine, the American Academy of Arts and Sciences, and the American Philosophical Society.

III. Standards Applied

Several requirements should be met by a science textbook and curriculum that are intended to prepare students for university work. These include (1) a clear presentation of the nature of science, as opposed to other methods of inquiry such as theology (see *Teaching About Evolution*, p. 27 ("Science is a particular way of knowing about the world. In science, explanations are restricted to those that can be inferred from confirmable data . . . Explanations that cannot be based on empirical evidence are not a

part of science.")); (2) instruction in the fundamental factual and experimental underpinnings of the particular scientific discipline such as biology and in the concepts and theoretical structure that form the core of that discipline and (3) promotion of critical thinking skills.

In courses in biology and earth sciences, evolution of the Earth and its landforms and evolution of the biota (lifeforms) are core elements of both disciplines. The *National Science Education Standards*, developed by the National Research Council and the National Academy of Sciences, and the *Benchmarks for Science Literacy*, released by the American Association for the Advancement of Science, both provide that students need to understand the concept of evolution, the evidence and arguments that support it, and its importance in history and to many disciplines. The Standards and most state frameworks for secondary-school level science, in addition to identifying core factual knowledge that students should learn, emphasize two other requirements for science education. The first is that students must understand the concepts underlying the historical evidence for evolution as well as the processes that underlie how evolution works over time. This is essential for understanding much of the rest of what is important in biology. The second is that students must develop critical thinking skills, in order to identify connections and choose among competing explanations for the observations they make.

It should be noted that teaching about evolution does not entail a conflict between science and religion generally. Many religiously affiliated schools, including the large number of Catholic secondary schools in the nation, teach evolution and the earth

sciences in ways that communicate the science effectively and often with exceptional skill. Issues in this proceeding involve the teaching of these disciplines in secondary schools that are dedicated to a particular set of Fundamentalist Christian beliefs that hold that the Bible (including its account of the Creation) is literally true. Even in such schools, however, it is important that the students be provided with a sufficient understanding of the nature of science and of the theory of evolution and the scientific evidence and arguments for that theory so that they are prepared for college. It is not required either that they believe it or that they discard faiths that they find incompatible with it. Quite to the contrary, as we stated in *Teaching About Evolution*, p. 59, "it is quite possible to comprehend things that are not believed." Thus, the problem is not, since these are private not public schools, that the creationist view is taught as an alternative to scientific explanations, but that the nature of science, the theory of evolution, and critical thinking are *not* taught adequately.

IV. Methods of Analysis

I read both *Biology: God's Living Creation* (hereinafter referred to as A Beka) and the Teacher's Guide that is given to teachers to accompany this text. I gave particular attention to Chapters 14 and 15 in both A Beka and the Teacher's Guide and evaluated the material in light of the standards set out in the University of California's a-g guidelines. I also read *Biology for Christian Schools*, Second Edition, paying particular attention to Chapter 7C: Theories of Biological Evolution (hereinafter, referred to as

BJU). Although I discuss principally A Beka below, the fundamental failings of A Beka also exist in the BJU textbook.

V. Findings

In general, I find that, where the two texts treat such basic factual issues as biological structure, human anatomy and physiology, and the different taxonomic status of plant and animal groups, they are generally acceptable. However, the texts do not appropriately teach evolution or the scientific evidence for it, and they thereby fail to teach students material that is critical to understanding biology as a whole. By teaching students to reject scientific evidence and methodology whenever they might be inconsistent with the Bible, moreover, both texts fail to encourage critical thinking and the skills required for careful scientific analysis. For example, chapters in both A Beka and BJU devote considerable attention to the diversity of plant and animal life. Understanding the process of evolution is essential to knowing how modern biologists who teach at the post-secondary level understand this phenomenon of diversity. Yet rather then present the process of evolution, BJU employs cartoons to ridicule phylogenetic trees and the concept of common ancestry. A Beka employs nice drawings of related animals in groups of three, in two vertical rows. One row is labeled "Error"; each group in it is displayed according to evolutionary relationships accepted by most biologists. In the other, labeled "Truth," one group shows seven species of sparrows. (Fig. 14.18, p. 388). The legend reads, "Many varieties of sparrows have developed from seven sparrows that left the Ark." Even the student who accepts the Ark with respect to

the ancestry of the seven sparrows is given no means by which he or she could explain the differences. Is it a process of natural selection acting on variations, or is it the result of post-Ark special creation? No opportunity has been given for the exercise of critical thinking. In short, the texts are inadequate both because of their failure to acquaint the student with evolutionary theory and because of their failure to encourage and develop critical thinking skills.

A. Presentation of the Evolution of the Earth

In A Beka and in its Teacher's Guide, the creationist view is applied to the origin of the Earth and its history, as it is to the issue of evolution as a biological explanation. In this text, it is asserted that the present physical Earth is the result of a single, recent, creation event. This curricular approach gives rise to a broad array of collateral harms. For example, the fossil record and the means of dating events in that record are both handled in a way that is likely to generate confusion on the part of the student. In Chapter 14 of the text, a brief description of radiocarbon dating is given but is followed by the statement: "[R]adiometric dating of fossils (like the geologic column itself) is also based upon circular reasoning. . . . In fact, if evolutionary assumptions are replaced with creationist assumptions, the dates given by several dating methods often become more or less consistent with the Genesis chronology." (p. 372). In Geology courses given at UC, the student who had learned this would very likely be asked to analyze a variety of experimental findings, based on isotope ratios and other measures, that establish major transitions occurring between well-dated epochs many tens or hundreds of millions of years old, and she would be expected to explore evidence that the oldest fossils date to

about 3.6 billion years – far older than the "Genesis chronology" that suggests the Earth is approximately 10,000 years old would allow.

In the Teacher's Guide for Chapter 14 of the A Beka book, the author discusses Charles Lyell, one of the first geologists to demonstrate that many gradual, slow processes like sedimentation and erosion by wind and water acting over time have accounted for many of Earth's landforms. The text says: "[Lyell's] extreme view of uniformity [of geological processes] is what is usually termed 'uniformitarianism' by creationists." (Teacher's Guide, p. 93). Contrary to what the Teacher's Guide suggests, geologists including Lyell do not deny that occasional catastrophic events such as asteroid collisions or volcanic eruptions have helped shaped the Earth's surface. But geologists do agree that slow processes have played the major role. To "refute" Lyell's mischaracterized view and to support the view of a young earth, the teacher is asked to refer, not to scientific evidence, but to 2 Peter 3:3-6: "'[T]here shall come in the last days scoffers . . . saying . . . all things continue as they were from the beginning of the creation. For this they willingly are ignorant of, that by the word of God the heavens were of old, and the earth standing out of the water and in the water: Whereby the world that then was, being overflowed with water, perished.'" (Teacher's Guide, pp. 93-94). Teaching a student distorted versions of important scientific theories and evidence and then telling her to reject those theories based on Scripture alone will not prepare her to participate in a college science curriculum.

B. Earth and Evolution: Presentation of Paleontology

The link between the evolution of the earth and that of biological species is the science of paleontology. That science depends on the radiographic dating of rocks and other materials found in strata at various levels, and the correlation of these dates with fossils contained in those strata. The dates of the strata, and their morphologic similarity in various regions, allow correlations between the ages of different fossils found in different places.

It is notable that the important chapter in Biology for Christian Schools that deals in part with paleontology – Chapter 14, Subtitled "Evolution: A Retreat from Science" – concentrates heavily on a historical discussion about Darwin's life and followers, rather than on the science of paleontology itself. Much of the Darwin section of the Teacher's Guide consists of an effort to tie Darwin to such doctrines as racism and eugenic practice, an effort plainly contrived to discredit his scientific ideas, mainly through the claims made by followers like Herbert Spencer. When the text deals directly with evolutionary sequences in paleontology, it mischaracterizes elements presented in the "Origin of Species" and fails to acknowledge the rich store of more recent information about the fossil record that supports the basic principles Darwin set forth.

For example, where the Teacher's Guide deals with the actual science, it pays particular attention to the lack of transitional forms, but the evidence here is a single claim about whale evolution made by Dr. Duane Gish of the Institute for Creationist Research about a series of transitional forms based on clear anatomical homologies

showing the likely historical lineage leading to modern whales. One of these was terrestrial and probably a carnivore. Gish's comment was that anyone calling such an animal a whale would have no difficulty finding "transitional forms." Of course the paleontologist who derived the relationship did not call the proposed evolutionary precursor a whale, and he derived the case for an historical relationship from clear skeletal homologies. Likewise, punctuated equilibrium, a concept introduced by Stephen J. Gould which holds that the evolution of species takes place in bursts after long periods when little change occurs, is caricatured by describing its advocates as believing that, because evolution occurs in isolated populations, it happens "too fast to leave fossils, behind but too slow to observe today." (Teacher's Guide, p. 95). That characterization contradicts, without any evidence, the conclusions of Gould and other students of evolution, who point to the fact that various geologic conditions and differences in evolutionary rate can account for the observation that evolution appears to have occurred in historical spurts.

As noted earlier, the most scientifically accepted way of dating fossils is by associating them with strata whose rocks can be shown to have the same age in different regions. But this is treated in the text as "speculation." In the Teacher's Guide, p. 96, the teacher is told that "the fossil record merely indicates that they were buried in different places (perhaps because they lived in different regions or habitats)" – as though that disposed of the observations that sequences of change observed in a series of animal forms can be associated with measured geological time. The science of paleontology is based on a generally accepted way of dating the age of rocks or other materials by

geologists. That is why it is possible to construct time sequences in which different forms have existed. There are places where dating cannot be done, so the record will have some gaps. But what we know about the history of life on Earth depends on the reliability of most of these methods, most of the time. In A Beka and its Teacher's Guide, attention is focused on the rare exceptions, with the implication that those rare exceptions are sufficient to disprove a theory that is supported by the vast weight of the evidence. In so doing, the text fails to teach students how to evaluate a body of scientific evidence or to engage in critical thinking about scientific issues.

C. Evolution and the Life Sciences

As to evolution and its meaning to the life sciences, Theodosius Dobzhansky, the distinguished pioneer of population genetics and evolution, said: "Nothing in biology makes sense except in the light of evolution." His point was that evolution is required to explain two of the most curious and baffling facts about life on the planet. The first is its extraordinary diversity: there are tens of millions of different species, each distinguishable by anatomy, behavior, or function from every other – and these can be shown to be different in time from forerunners that are now extinct but whose remains can be dated to an earlier time. Why are they so different from one another? The scientific explanation is that forces of natural selection gradually diversify natural populations by increasing the abundance of some variation that arose by genetic mutation or recombination, eventually resulting in the origin of a new species from the old, usually through geographic isolation. In dozens of situations, this process can actually be observed in a human lifetime – sometimes to our medical disadvantage, as when a

bacterium that causes a preventable illness evolves resistance to an antibiotic and converts the illness to unpreventable.

The second curious fact is that, reduced to their component units and their fundamental chemistry, this extraordinary diversity of living things turns out to depend on a much smaller variety of underlying mechanisms. The evidence is consistent with the elaboration of a few basic units and principles to serve a much richer array of bodily forms and functions. An important challenge for the student in high-school biology is to work out how the properties of complex, multicellular organisms can be understood from the assembly of a much simpler array of component parts.

These two curious facts are central to biology and, without grappling with them, one cannot be said to have grappled with biology. Understanding evolution is necessary to derive explanations for either.

How does natural selection, operating over time, favor some mutations over others, and change the character of the species – leading to the curious fact of extraordinary diversity? Darwin did not have access to the modern science of genetics, so he could not explain the biological mechanism that permits one species to give rise to a second, reproductively isolated species. This process can now be understood and is now taught extensively and well in college and university classes. What has been learned since Darwin about evolution is thus an important basis for the teaching of modern biology. Recent gains in our understanding of evolution aimed at solving the puzzle of

diversity have depended on what biologists have called the "modern synthesis" – that is, the blending of paleontology, biogeography, and the genetics of populations. Mutation is one of the ways, though not the only one, in which genetic variation can be introduced in a population of organisms belonging to one species.

Rather than explaining anything about this modern synthesis, Chapter 14 delivers the following dismissal of the central mechanism by which the process of evolution results in increasing biological diversity. On p. 362, in a section entitled "The failures of Charles Darwin," the text states: "This reasoning is faulty because variety within kinds has definite boundaries – a fact that Darwin was not aware of. Because natural selection itself produces no new characteristics, natural selection cannot create new kinds of organisms. Rather, it keeps a kind strong and healthy by suppressing harmful changes. In other words, natural selection acts to preserve existing kinds, not create new kinds." In four sentences, each of which contains claims known to be incorrect by modern biologists, the entire basis on which the evolutionary processes acts on variation to produce change is dismissed. A consistent message in this chapter is that genetic changes (mutations) are always harmful and act to suppress variation (see below). But occasional mutations afford advantages to the sub-population possessing them, and these may be subject to positive selection. When this produces variants that are sufficiently different, new species can be formed. This rests on a variety of lines of scientific evidence and will be a challenge to the critical thinking skills of biology undergraduates at any University of California campus. In this text, however, the student has been asked in effect to

suspend curiosity and cease inquiring, and instead simply to accept a series of assertions that are neither based on nor consistent with scientific evidence.

This deficiency is further illustrated in Chapter 14 of A Beka, where the text finally turns to genetics in relation to the possibility of evolution, and the authors' purpose becomes clearer and more direct. Addressing the genetic phenomenon of mutation, which biologists understand to be a major mechanism for offering positive variations for natural selection, the text fails to present any actual scientific information. On p. 386, under the headline "Mutations: harmful, not helpful," the text simply asserts that "mutations cause genetic information to be lost, not gained." This statement is purportedly supported, not by scientific evidence, but by two irrelevant and misleading metaphors: "You can illustrate this fact for yourself by taking a well-written essay and randomly scrambling letters to see if it improves the writing style;" and "The chance of a random scrambling of a gene improving an organism has been compared to the chance of improving a fine watch by dropping it from the top of a tall building to the pavement below." A similar and equally irrelevant metaphor is employed in BJU: p. 201 contains a photograph of the Trans-America pyramid in San Francisco. The legend says: "The possibility of an organism's evolving by mutation has been compared to taking all the parts of a skyscraper up one mile, dropping them, and having the building assemble itself on the way down."

Both texts are flatly wrong in stating that all mutations are harmful and that all result in the loss of genetic information. Positive mutations need only be rare in order

nevertheless to provide the material for natural selection. By offering false "facts" and by the use of sarcastic and misleading metaphors, the texts discourage students from undertaking a critical analysis of the evidence. In fact it has been demonstrated that randomly generated mutations *are* subjected to natural selection, changing the quantities of traits within a population of organisms – and thus sometimes leading to evolutionary change and even the origin of new species.

The curious fact of anatomic similarities in organs that perform similar functions is treated in A Beka (pp. 383-384) in the following way:

> [I]t is only logical that God would use the same basic plans for many different animals and plants when He created them. God designed these creatures to live under similar conditions, perform similar life functions, breathe the same air, and feed upon similar foods. Therefore, it is only logical that skeletons should have general similarity, that nerves should be designed alike, and that muscles should be essentially the same. . . . Man uses this same technique when designing his own creations. For example, the vast majority of passenger vehicles on the road have four wheels, with an internal combustion engine in the front and a passenger compartment located near the center of the vehicle. . . . Evolutionists, on the other hand, interpret the similarities of comparative anatomy as a 'proof' for evolution.

The analogy between the similarity among the anatomies of various species and the similarity among passenger vehicles is, of course, totally meaningless. The similarity among anatomies is evidence from which scientists seek to infer an explanation for the existence of varying life forms; we know from direct observation that manufacturers make cars in similar ways—that is not an issue for either science or religion. The use of this silly analogy is another example of the use of misleading similes, metaphors and analogies to deflect the student's attention from the need to perform real analysis. Similes, metaphors and analogies can, if formulated properly, be useful devices for teachers to facilitate student understanding of complex biological phenomena. But in searching chapters on physiology and other sub-disciplines of biology, I found no such uses. One of the objectives of good science teaching is to instill a respect for, and to encourage the practice of, logical thinking about the facts that are presented. In employing irrelevant but misleading metaphors to deflect students from considering real analytical alternatives, the texts fail this test.

In Chapters 14 and 15, there appear a number of statements that present, as truths, alternatives to the theory of evolution. A number of statements in this section deal with this general theme: "no new kinds are formed." Several examples of natural selection are presented in which, while population ratios were varied, there is no evidence for the formation of a new species. The text, however, ignores compelling evidence of the formation of new species, such as the emergence of new plant species by polyploidy and the well studied cases of island speciation. Not only does the text choose examples

selected because they are exceptions; it employs conclusory statements that are plainly contrary to the scientific facts:

> p. 384: "The great scientists of the past . . . have always seen similarity of design as evidence of a single Creator."
>
> p. 388: "Much variety within the human race has developed from the eight people who left the Ark."
>
> p. 403: "For example, there is no sign of a change in plant life, evolutionary, or otherwise."

The authors of the A Beka text have particular difficulties when they attempt to explain the scientific evidence for the evolutionary history of early humans. The paleontological evidence for the existence of the early hominin, *Homo ergaster* (= *erectus*), fossil remains of which have been found in enough places to trace its migration out of Africa and into East Asia, is simply ridiculed by identifying several supposed discoveries as either hoaxes (only one was) or as depending on insufficient data. The failure of the text to explain the evidence of human evolution is particularly significant in terms of the book's adequacy as preparation for college. Understanding human evolution, as traced by paleontological evidence and by genetic analysis, is important not only for students who expect to continue in science. That scientifically grounded version of human history, like religion and (like religion) whether believed or not, forms a basis for much of modern literature, philosophy, sociology, anthropology and many other disciplines.

VI. Conclusion

In my opinion, the A Beka and BJU textbooks are not appropriate for use as the principal text in a college preparatory biology course intended to satisfy the University of California's "d" laboratory science requirement, for three fundamental reasons. First, these texts do not properly distinguish between what is science and what is not; by relying on explanations based on divine intervention that are not supported by empirical evidence, but without clearly distinguishing those from science, the textbooks are likely to confuse students about the nature of science. Second, the textbooks fail to provide students with an adequate presentation of the theory of evolution and the evidence supporting it, which failure will result in collateral damage to students' understanding of the rest of biology and many other disciplines. Third, the textbooks do not promote critical thinking on the part of students; instead, the books are likely to intercept and deaden students' natural sense of curiosity about how natural systems work—as well as suppressing their desire to discover various truths for themselves. Critical thinking is discouraged by conclusorily allocating much that is interesting and curious about biological systems to the cleverness of a designer. Little incentive is left for thinking up an experiment or doing one, or for undertaking an analysis. What college professors want from students when they arrive from high school is a questioning mind and an appetite for discovering things. But in exploring both the A Beka text and BJU, I found few instances in which students are being introduced to science as a process by using real-world analysis of situations that young people find curious and challenging in nature.

There are the descriptions of what scientists do, abstractly, but these do not provide examples of critical thinking and yield little about ways in which real scientists design or carry out experiments, or analyze and interpret the results of their investigations

VII. Response to Report by Dr. Michael J. Behe

In his report, Dr. Behe compares two widely used secondary school texts with the A Beka and BJU biology textbooks for Christian schools. Much of this analysis, presented in text and a series of tables at the end, entails a comparison of the texts to the California State Framework Standards for the coverage of basic material in the sciences. Here I will comment only with respect to biology.

In general I find these comparisons unhelpful in determining whether textbooks give students adequate exposure to biology. Dr. Behe's comparisons demonstrate that the BJU and A Beka texts purport to cover such basic material as cell structure and function, morphology, taxonomy, and the like. But the textbooks emphasize facts and vocabulary, not processes and syntheses or critical thinking skills. Dr. Behe admits that he did not consider the level of detail or depth of the discussion of any topic, but only whether it was mentioned. His checklist-based methodology thus totally fails to discern whether the texts teach core concepts such as evolution accurately or in enough detail that students

can understand them,[1] or whether the texts help students develop scientific reasoning skills.

By hewing closely to the California State Framework Standards themselves, which focus primarily on factual content, Dr. Behe ignores the fact that UC's a-g standards focus not only on fundamental knowledge but also on the development of critical thinking skills. In doing so, the a-g requirements strive to prevent a common problem – that secondary school teachers often misunderstand how to best prepare their students for college level work. The most recent survey by ACT, the producer of the ACT college-admissions test, shows that two thirds of high school teachers believe that they prepare their students well for college work, but less than one-third of the instructors those students will meet in college agree. In particular, the survey shows that high-school instructors rate science factual content as critical to student success, whereas post-secondary instructors rank an understanding of science as a process and inquiry skills as critical. Thus, even if Dr. Behe's checklist approach were sound evidence of the factual

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[1] With regard to teaching evolution, the California State Framework Standards emphasize:

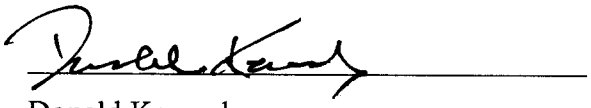
> Students need to understand that the same evolutionary mechanisms that have affected the rest of the living world have also affected the human species.
>
> Students need to understand that a theory in science is not merely a hypothesis or a guess, but a unifying explanation of observed phenomena. Charles Darwin's theory of the origin of species by natural selection is such an explanation. Even though biologists continue to test the boundaries of this theory today, their investigations have not found credible evidence to refute the theory. Scientists have also had many opportunities to demonstrate the gradual evolution of populations in the wild and in controlled laboratory settings. As more populations of organisms are studied at the level of DNA sequence and as the fossil record improves, the understanding of species divergence has become clearer.

(available at *http://www.cde.ca.gov/re/pn/fd/documents/science-framework-pt5.pdf*, p. 237).

content of the texts (which it is not), it would not be instructive about whether they satisfy the a-g requirements.

I also note the flaws in the argument made on pp. 17-18 of Dr. Behe's report. He employs a quotation from the University's "d" certification guidance to the effect that there may be courses that approach biology from a particular perspective (e.g. marine biology and agricultural biology), but which may satisfy the laboratory science requirement if the courses adequately cover the basic biology material. Dr. Behe takes this as permitting wide latitude in the qualification of biology courses. His example attempts to draw a parallel between a course in high school biology that has an "agricultural perspective" and one in a Christian school that has a religious perspective. But the supposed parallel assumes a crucial fact that is not true here – that the course being taught from a religious perspective, like the hypothetical agricultural biology course, adequately instructs the student in the fundamental biology material. Such an agricultural biology course could well teach the nature of science, evolution and critical thinking skills perfectly well; the textbooks at issue here do not.

VIII. Signature



Donald Kennedy

Bing Professor of Environmental Science and President *emeritus*

Stanford University

May 7, 2007

Appendix

DONALD KENNEDY

Center for Environmental Science and Policy
Encina Hall 401 East
Stanford University
Stanford, CA 94305

Tel: 650-725-2745
Fax: 650-725-1992
Email: kennedyd@stanford.edu

Degrees

A.B. Harvard University, 1952
A.M. Harvard University, 1954
Ph.D. Harvard University, 1956

Employment

Assistant to Associate Professor of Zoology, Syracuse University, 1956-60
Assistant Professor of Biological Sciences, Stanford University, 1960-1962
Associate Professor of Biological Sciences, Stanford University, 1962-1964
Professor and Chairman, Department of Biological Sciences, Stanford University, 1965-1972
Benjamin Scott Crocker Professor and Chairman, Program in Human Biology, 1973-1977
Commissioner, Food & Drug Administration, 1977-79
Vice President and Provost, Stanford University, 1979-80
Chair, Board of Directors, Stanford University Hospital, 1981-92
President, Stanford University, 1980-92
Bing Professor of Environmental Science Emeritus, 2002-present
Co-Director, Center for Environmental Science & Policy, 1992-2001
Editor-in-Chief, *Science,* 2000-present

National Committees and Boards of Trustees

Member, National Academy of Sciences
Member, American Academy of Arts and Sciences
Member, American Philosophical Society
Co-chair, National Academy's Project on Science, Technology and the Law
Board of Trustees, Carnegie Endowment for International Peace
Board of Trustees, Packard Foundation

Five Publications

Kennedy, D., "Physical Geography," in *Earth Systems* (G. Ernst, Ed.), Cambridge University Press, 1996

Kennedy, D., *Academic Duty*, Harvard University Press, 1997

Barton, John, John Crandon, Don Kennedy, and Henry Miller, "A Model Protocol to Assess the Risks of Agricultural Introductions: A Risk-Based Approach to rationalizing Field Trial Regulations," in *Nature Biotechnology*, Vol. 15, September 1997, pp. 845-88.

Kennedy, D. (and others), *Environmental Quality and Regional Conflict* Report to the Carnegie Commission on Preventing Deadly Conflict. Washington, DC: 71 pp.

Kennedy, Don, and Marjorie Lucks, "Rubber, Blight, and Mosquitoes: Biogeography Meets the Global Economy," *Environmental History,* 4:369-383.

Five Additional Publications

Goulder, Lawrence and Donald Kennedy, "Valuing Ecosystem Services: Philosophical Framework and Empirical Approaches," *Nature's Services: Societal Dependance on Natural Ecosystems*, Island Press, Washington, DC, 1997, pp. 23-47

Kennedy, D., Foreword, *Stanford Environmental Law Journal*, Vol. 16, No. 2, May 1997, pp. xi-xvi

Kennedy, D. and Richard Merrill, "Science and the Law," *Issues in Science and Technology*, Summer 2000, Vol. XVI, No. 4: pp. 49-52.

Kennedy, D. and Roger W. Sant, "A Global Environmental Agenda for the United States: Issues for the New U.S. Administration," *Environment,* 2000, Vol. 42, No. 10: pp 20-24.

Kennedy, D., "On Science at a Crossroads," *Daedalus*, Summer 2002; *Journal of the American Academy of Arts & Sciences*; pp. 122-126.

Dr. Kennedy's present research program, conducted through the Center for Environmental Science and Policy at the Freeman Spogli Institute for International Studies, entails policy on such trans-boundary environmental problems as: major land use changes; economically-driven alterations in agricultural practice; global climate change; and the development of regulatory policies.

Donald Kennedy, Ph.D.

Data and Information Considered As Basis and Reasons for Opinions

Publications referred to in the report

His 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 and 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, 2006)
- *Biology: God's Living Creation* Teacher Guide, 2nd edition (A Beka Book, Pensacola, 2006)
- *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://nap.edu/catalog/5787.html)

California Department of Education Science Framework, part 5 (*available at http://www.cde.ca.gov/re/pn/fd/documents/science-framework-pt5.pdf)*

ACT National Curriculum Survey 2005-2006
(*available at* http://www.act.org/path/policy/reports/curriculum.html)

Copies Attached

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

- Appendices to report

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.