

Teaching Biological Sciences at an Adventist Educational Institution

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The domination of materialism in the sciences and particularly Darwinism in Biology raises profound questions about church sponsorship of education, the relationship between education and student's religious beliefs and the moral upbringing that parents provide their children. Hidden in the dust kicked up by the creation-evolution debate are more profound questions about Christian¹ parochial education. Some Christian educators may be as eager to incorporate sophisticated Intelligent Design (ID) design arguments into their biology lesson plans as pressure groups like the National Center for Science Education (NCSE) are to ensure that no such thing happens. Are students being molded for a purpose (indoctrination) or prepared to discover their purpose? The thesis of this paper is that a Bible-based understanding of education requires the latter, and that this is consistent with Christian understanding of the nature of humanity and the place of humankind in the creation.

The Christian worldview affects the way science is defined

All education inescapably springs from a foundation within the worldview or philosophy of those who provide it. For purposes of comparison, secular humanism and Christianity represent two contrasting views. Both reason from profoundly different starting points to arrive at their array of beliefs. Secular humanism rejects *a priori* the supernatural, embracing instead ontological materialism: belief that the material world is all that has ever existed. Naturalism, the belief that all phenomena can be accounted for by natural causes, is a corollary of materialist assumptions: because there is nothing outside of the material world to cause what we observe, all that we see must result from natural laws and chance.

Christianity is not constrained by the requirement that everything must result from natural processes. The Christian worldview allows for supernatural intervention in the material world, and thus, depending on which is most logically consistent with the data, either natural or supernatural explanations of nature are allowed. From a Christian perspective, natural explanations are those that invoke only God's continuous action in upholding the universe,² while supernatural explanations would be those that allow God who transcends nature to engage in some special action in the universe beyond His consistent continuous

¹The term *Christian* is claimed by many different groups with a surprisingly wide spectrum of beliefs. In this paper *Christian* refers to those who subscribe to the propositional truth of the Bible when it claims in Genesis 1—2, Exodus 20 and 31, John 1 and many other places that the earth was organized to support life and that life was created on it by God.

² See Hebrews 1:3 and Colossians 1:17 among other verses.

activity.³ In the study of biology this means that, like other theists, Christians have a broader palette of explanations to draw on than do materialists. Not surprisingly, this may mean that Christians are willing to entertain explanations that are anathema to those constrained by materialist dogma. On the other hand, it also means that Christians are not forced by their assumptions to embrace clearly wrong explanations for nature's origin and some other phenomena.

Unfortunately, the willingness of Christians to entertain supernatural explanations for what is observed in nature has been construed as a "science stopper." As Jeffrey Jordan put it, "Theological beliefs can act as a kind of 'science stopper' by making it seem that no naturalistic explanation is needed."⁴

A historical analogy illustrates the fallacy of this position. After heroic efforts, the combined work of several European explorers placed the source of the Nile River at Lake Victoria, bordered by modern-day Uganda, Tanzania and Kenya. The discovery of the ultimate source of the Nile did not bring the science of geography to an end or stop any other science that deals with rivers, how they operate, where they are located, how they can be best managed or why they exist. Discovery of Lake Victoria provided a valuable insight into the nature of the Nile. In the same sense, discovery that God is the ultimate source and cause of life on earth does not bring the study of nature to a halt. In fact, discovering the ultimate cause of phenomena is the "Holy Grail" of science, not because it causes the work of science to cease but because it provides profound insights suggesting new potentially productive lines of research. The idea that allowing intelligent causes as potential explanations for phenomena observed in nature somehow stops science has been thoroughly refuted by many scholars, prominent among them, the mathematician and philosopher William Dembski.⁵

When the long list of sincere Christian believers who have left an indelible mark on science is taken into consideration, the falsehood of the claim that belief in God somehow removes all motivation to study nature is demonstrably false. From Newton to Linnaeus, from Pasteur to von Braun the history of scientific progress is rich with characters who openly professed faith in the Creator God.⁶ Christianity is at its core a quest to know the creator, science is a quest to understand the creation, inevitable synergism exists between the two.

The fundamentally different approaches to understanding nature adopted by Christians and materialists naturally result in different approaches to teaching in the sciences.

³ These actions would be considered miracles by those observing them because the actual mechanism of God's action is not available for study. This does not mean that miracles are necessarily a violation of God's laws as seen in his continuous action upholding the universe.

⁴ Jordan, J. 2003. "Evangelicals and Science Education," in *Science and Religion in the Context of Science Education*, ed. J. Kittleson et al. National Association for Research in Science Teaching annual meeting symposium, Philadelphia, Pennsylvania. PP 17-19.

⁵ For one example, see Dembski WA. 1998. "Science and Design," *First Things* 86: 21-27.

⁶ Many publications have pointed this out. A long list is provided in Morris HM. 1988. *Men of Science—Men of God: Great Scientists Who Believed the Bible*. Master Books, El Cajon, California.

Within the materialist paradigm, only natural causes are allowed; so only natural causes, no matter how improbable they may seem, can be presented in the classroom.⁷ This “materialist rule,” commonly referred to as “methodological naturalism,” may be reflected in the very way science is defined. For example, during 2002 a controversy arose in the state of Ohio over how biology should be taught. The state sets science standards that are to be followed by all state-sponsored schools. In an early draft of these standards, tenth-grade students were to “Recognize that scientific knowledge is limited to natural explanations for natural phenomena based on evidence from our senses or technological extensions.”⁸

Because only “natural explanations” are allowed in this definition of science, it exemplifies a materialist bias and presents a number of philosophical dilemmas. Due to circular reasoning inherent in this definition, the problem of differentiating natural from unnatural phenomena becomes complicated. If something is “natural,” it must have a natural explanation. But what happens when whether something is natural or not is unknown? Determining whether life is “natural”—the product of natural laws and chance alone—is not possible within this definition of science. Instead, life must first be assumed to be natural, and if that is done, it must be explained via natural causes.

Science is an open-ended process of discovery in which the final answers are never in and ultimate answers are not determined before the investigation begins. Christians are liberated from definitions of science burdened by materialist dogma. Emphasizing the process of science allows for a more realistic understanding of how tentative knowledge is gained by studying the empirical world. But while this is clearly a better approach than dogmatically enforcing a specific ideology, Christian educators may find it unsatisfying if they believe that the empirical world reveals the power and wisdom of the Creator God they worship. To address this issue, we must step back and address a more profound question, the purpose of education.

Fundamental questions about the nature of education impact pedagogy

Phillip Johnson presents two questions about education in his book *The Right Questions*:

[1] Should a college education prepare students to understand the ultimate purpose or meaning for which life should be lived and to choose rightly from among the available possibilities? [2] Alternatively, should this subject be left out

⁷Harvard biologist Richard Lewontin put it this way, “We take the side of science *in spite of* the patent absurdity of some of its constructs, *in spite of* its failure to fulfill many of its extravagant promises of health and life, *in spite of* the tolerance of the scientific community for unsubstantiated just-so stories, because we have a prior commitment, a commitment to materialism” Lewontin R. 1997. *New York Review of Books*, January 9, 1997. P 31.

⁸Draft of the 2003 *State of Ohio Academic Content Standards: K-12 Science Grade 10, Scientific Ways of Knowing (Nature of Science)* 3.

of the curriculum on the ground that the choice among ultimate purposes involves only subjective preferences and not knowledge?⁹

There is nothing restricting these questions to only college education; in fact, they are inherent in all educational endeavors. The historical association of education with both religion and government suggests that, at least in the past, education has been a tool for investigation of as well as indoctrination into specific worldviews. The line between investigation and indoctrination has not always been clearly drawn. In modern Western thought, the very idea of indoctrination seems coercive—a denial of an individual's right to make sovereign and informed decisions about the nature of reality and humanity's place in it. This view of individuals' freedom to make informed decisions about the most fundamental aspects of life's meaning has a firm foundation in Christian thinking. The Bible begins with a story of this freedom and how it was exercised: a tree in the Garden of Eden was provided with a warning that "in the day that thou eatest thereof thou shalt surely die."¹⁰ Not only was the opportunity to disobey God offered to humans, they could make an informed decision to do it because they knew the consequences.

Answering the second question posed by Johnson is easy in the context of Christian education: No, the ultimate purpose of life is not based on subjective preferences but is founded in objective knowledge—knowledge of nature and of its Creator, both of which point toward knowledge of the Savior of humanity. In the Christian worldview, meaning is inherent in understanding that humankind was created in the image of God (Gen 1:27; 9:6). Answering Johnson's first question may warrant more consideration.

Informed freedom of choice

If Christian education is to ensure students come to the "right answers," but those "right answers" are decided before the education begins, then this "education" may well turn out to be the very kind of coercion that should be anathema to Christian thinking. Should Christian educators sacrifice the Christian principle of freedom to ensure students only choose to live lives consistent with Christian principles? The story of the first sin and fall of humans tells us that the God Christians worship is not willing to make this kind of compromise. In any case, most experienced educators can recount examples of how this approach may fail, especially with those students possessing the greatest academic potential.

In teaching biology, coercion may take the form of simply providing only evidence pointing to a single conclusion instead of laying out all the evidence and explaining how those starting from different viewpoints might interpret it. Unfortunately, restricting or miscasting evidence to support a single view is an approach commonly used in biology textbooks, particularly when they cover controversial topics like ecological issues or

⁹Johnson PE. 2002. The word of God in education, Chapter 2 in: *The Right Questions: Truth, Meaning and Public Debate*. InterVarsity Press, Downers Grove, Ill. P 68.

¹⁰ Gen 2:17 KJV

evolution.¹¹ Because hidden philosophical agendas make all claims subject to them suspect, Christian educators can and should honestly state their predispositions and should not hesitate to inform students about other perspectives. Possibly most frightening about unrecognized, hidden or ignored philosophical presuppositions is their tendency to leave adherents of a position blind to the true foundation of their beliefs. This should be as disturbing to Christian educators as it should be to those teaching from a materialist perspective.

Bias and openness

Christians start with a particular view of nature and humanity's place in it; pretending otherwise would be dishonest. Christians are not unbiased, and neither is anyone else. Reasoning from the ninth commandment—Thou shalt not bear false witness¹²—Christians value honesty, and that means admitting bias and taking it into account when explaining data. This does not mean that the biases of others should be ignored, and it does not mean that biases should be used as an *ad hominem* argument against the interpretations of others. Being open about one's own partiality is a major advantage when attempting objective analysis, and objective analysis seems to be a reasonable goal when doing science. Pretending no bias exists is a dangerous self-deception.

Risks

Significant risk is inherent in presenting information in a way that allows students to make their own judgment; they may not make the judgment that Christian teachers believe to be correct. For example, when presented with information about the fossil record, a student may conclude that the biblical account of creation is false. This is a real risk. However, the alternative is even more problematic; students who have never learned about the fossil record, only that the beauty of the flowers testify to God's love, may cease to believe in God when their faith in Scripture is challenged with the fossil record—or at least certain aspects of it. When data from nature that are consistent with biblical Christian understanding of history are openly discussed along with that which at first inspection appears inconsistent, the risk is real that students will either never develop or lose their faith. On the other hand, attempting to reduce the risk by keeping students ignorant denies them their God-given right to a free and informed choice, and risks precipitating a crisis of faith when they discover that their faith is based on only a partial picture of reality.

Christian educators are not alone in believing that a certain understanding of history is an objective of biology education. The eminent evolutionist Richard Dawkins wrote, "It is absolutely safe to say that if you meet somebody who claims not to believe in evolution,

¹¹For a detailed discussion of this problem with the presentation of evolution, see: Wells J. 2000. *Icons of Evolution: Why Much of What We Teach About Evolution Is Wrong* Regnery, Washington, D.C.

¹² Ex 12:16 KJV – Note that some may read this commandment to only pertain to false witness about other people, but that does not reasonably follow from the words of the commandment. It seems sensible to include one's self among those whom one should not bear false witness about.

that person is ignorant, stupid or insane (or wicked, but I'd rather not consider that)."¹³ While an educated person may be wicked; stupidity, insanity and ignorance are not hallmarks of education. The product of a successful education will, according to Dawkins, be people who "believe in evolution." Ernst Mayr echoes this sentiment: "No educated person any longer questions the validity of the so-called theory of evolution, which we now know to be a simple fact."¹⁴

Because bias is impossible to eliminate and good teachers endeavor to provide what they consider to be the best for their students, the most that can be achieved is a clear statement of bias so that students can evaluate data knowing that they have been presented by one who wishes to convince them of a certain position. This position may be that God created life, or it may be that natural laws and chance created life. In either case, if students are to make an informed decision about the meaning of what they are learning, there must be full disclosure. This means abandoning the illusion of objectivity, but it also means abandoning a specific view of the teacher's role.

Teachers, particularly in the lower grades, should have more knowledge than their students, but it is vital that the temptation to be "the person with all the answers" be resisted. Having an answer for everything guarantees that some of those answers will be wrong. A brief example from my own experience illustrates the problems with this. *Archaeopteryx* is a putative "missing link" fossil between dinosaurs and birds.¹⁵ During the course of my education at an Adventist school I was taught that, if *Archaeopteryx* is real, it is very strong evidence for evolution of dinosaurs to birds. The professor offered two answers to this conundrum for creationists; 1) *Archaeopteryx* fossils are forgeries or 2) The apparent wings on *Archaeopteryx* fossils were formed when they fell into mud and flapped about during their death throws. When confronted with the London specimen of *Archaeopteryx*, neither answer was tenable and I was left with the conviction that evolution must be true.

My professor had the best of intentions, was a genuine expert in ornithology and was clearly offering the best he had. The problem was that at the time he lacked a good explanation of *Archaeopteryx* and had a weak understanding of the nature of the argument that was being made. In short, the lack of information was something that could not be helped at that time, but the nature of the argument could have been understood and dealt with much more effectively. It would have been much better to admit the existence of tension between the Bible's depiction of the creation and the evidence of *Archaeopteryx* than to succumb to the pressure to dissipate the tension by resorting to cheap answers.

As it turns out, *Archaeopteryx* is no longer viewed as a missing link between dinosaurs and birds, but as a failed branch in the evolutionary lineage that lead to birds. Even this is

¹³Dawkins CR. 1989. A review of *Blueprints: Solving the Mystery of Evolution* by Edey MA, Johanson DC, in the *New York Times*, April 9, 1989, sec. 7, p. 34.

¹⁴Mayer E. 2000. Darwin's Influence on Modern Thought. *Scientific American* 28(1): 78-83.

¹⁵ For a more detailed discussion of this see: Standish TG. 2004. Fossil Birds. *Geoscience Reports*. 37:1-5

not a tenable position; the reasons for this include the fact that the putative ancestors of *Archaeopteryx* and other birds are found in layers of rocks higher in the geologic column. In other words, the rocks show putative birds ancestors appearing after the birds appear, not before them as would reasonably be expected. Further, *Archaeopteryx* is only one of many birds found in rocks thought to be laid down at about the same time. These birds include at least one member of the “modern” birds – Neornithes – which is found in the system immediately above the Jurassic in which *Archaeopteryx* fossils have been found.

Adventist teachers of Biology can probably get away with the immodest conceit that they are ultimate fonts of wisdom on all things, but the natural result of this will be on the one hand, students who idolize them, attempt to emulate them by being “the smartest guy in the room” and ultimately cling to even the most clearly wrongheaded explanations as gospel truth. On the other hand, students who are more independent thinkers will ultimately realize they have been bamboozled and face an epistemological crisis. Some may reject all they have been taught and pass through a crisis of faith for no really good reason. As only the truly dull can relax within an illusory cocoon of metaphysical and epistemological completeness, the best and brightest students will leave disillusioned at best.

So what better pedagogy might there be for Christian biology teachers? Teaching is not only about learning facts and figures, it is about acquiring wisdom; there is a difference. Books, computer disks and other media can contain information, but wisdom involves skill and judgment in using that information. It is this wisdom that is probably the most valuable asset teachers have to convey. Information has become cheap, as a consequence emphasis must shift to how to use and understand information. Yes, there is a certain core set of facts with which all educated people should be acquainted, but what is to be done with those facts? Teachers should be mentors, showing how to take information and use it effectively to arrive at reasonable conclusions. Instead of being ultimate fonts of knowledge, teachers and students are together on a journey of discovery; the most valuable discovery Christian biology teachers have to offer their students is a knowledge of the Creator; both information pertaining to His existence and wisdom in using that information. Once they have that knowledge, it is up to the students what they choose to do with it.

The Christian unity of knowledge

The facts learned in science classes provide a foundation for addressing bigger questions dealing with how life should be lived. Rote memorization of facts and figures, or mastery of techniques can be achieved independently of understanding the principles involved and implications of what is being learned. Thus science teaching can be divorced from the truly big questions faced by all students, but the result is a hollow, uninspiring and brittle understanding of science. Because the humanities help address those big questions that transcend technology and facts, they should serve as vital tools in the arsenal of

Christian science teachers.¹⁶ It would not be overstating the point to say that without the humanities, Christian biology teachers lack essential tools to teach their material. With the humanities, biology education transcends memorization of facts and figures to become a dynamic informed investigation of life and its meaning.

A concrete example may illustrate this point. In college, a student may learn about human embryos, how they are made, how they develop, how they can be manipulated, their dynamic interaction with women's bodies and their basic chemical composition. All of this knowledge is important, but a far greater lesson will be lost if this information is not applied to questions about the basic nature of humanity and the ethical implications of what is being learned. If they only know the what and how of embryology, students are unprepared to think about the implications of producing artificial embryos by inserting the DNA of a human into the egg of a cow,¹⁷ combining human and mouse cells into a single embryo¹⁸ or combining male and female cells to produce "she-male" embryos.¹⁹ In other words, students may know how things can be done, but this does not guarantee they are equipped to ethically apply their knowledge. There is a very tight connection between the knowledge gained in biology and questions of good and evil or right and wrong.

Questions of purpose and meaning

If students are to wrestle with questions of purpose and meaning in biology, the false fact-value or science-humanities dichotomy must not prevail in Christian science classrooms.²⁰ This view is not restricted to a Christian approach to science and science education. As Paul Ehrlich put it, "The idea that science should (or can) be value-free is wrong . . . being steeped in values is part of being human."²¹

Dealing with value type questions may be a powerful motivator for some students who would not otherwise be attracted to the sciences. Teaching understanding of the empirical world within a value framework suggests some techniques for learning and evaluation may be more effective than others. For example, limitations of so-called objective testing in encouraging and evaluating student's analysis of information and its meaning in the context of larger questions are self evident. Multiple-choice and true-false testing may be a quick and dirty way of evaluating whether certain facts or opinions have been memorized, but they do not measure students' integration of this information into a

¹⁶ See: Wiker B, Witt J. 2006. *A Meaningful World: How the arts and science reveal the genius of nature*. IVP Academic, Madison, Wisconsin.

¹⁷"Details of Hybrid Clone Revealed" *BBC News*, June 18, 1999

http://news.bbc.co.uk/1/hi/english/sci/tech/newsid_371000/371378.stm.

¹⁸Wade N. 2002. "Stem Cell Mixing May Form a Human-Mouse Hybrid. *New York Times*, November 27, 2002, P A17.

¹⁹"Creation of Human 'She-Males' Sparks Outrage," *Yahoo Science*, July 2, 2003

<http://story.news.yahoo.com/news?tmpl=story&cid=570&ncid=753&e=1&u=/nm/20030702/sc_nm/health_fertility_she_males_dc>.

²⁰The best available discussion of this subject is in the following book, which is a must-read for all Christian teachers: Pearcey NR. 2005. *Total Truth: Liberating Christianity from its cultural captivity*, Study Guide Edition. Crossway Books, Wheaton, Illinois.

²¹Paul R. Ehrlich PR. 2000. Evolution of an Advocate. *Science* 287: 2159.

global understanding of life and its meaning. Because essay writing has been developed as a means of exploring and evaluating the value and meaning of information, authoring essays in the sciences may be a more effective tool for both learning and evaluation than multiple-choice tests. The problem is that evaluation of essays is a time-consuming process and when first introduced to information, students may not be ready to form an opinion about its meaning. They must first know what the information is before they can evaluate it. Thus, at a practical level, objective testing may be used to encourage and measure mastery of the facts, while essay writing may be reserved for evaluation of the student's ability to apply, assess and use the information.

Practical Application - Should evolution be taught?

Many Christians view arguments to and from design to be a superior framework within which to structure understanding of nature. If ID is better than Darwinism, why not teach only what is best, ID, and ignore Darwinism? Practical and ethical considerations strongly argue against this position. On a practical level, students ignorant of alternative ideas may be ill equipped to deal with them when they do encounter something different from their previous learning. In addition, the strength of any position is best judged relative to the strongest alternative views. Understanding of the robust nature of ID is greatly enhanced when compared with the strengths and weaknesses of the Darwinian alternative. Ethically, ignoring Darwinism is an untenable option because denying students knowledge of alternative views of nature denies them the opportunity to evaluate and choose between options.

Does this mean that students should be taught other views of nature in addition to the Christian and materialistic views? The simple answer is yes, but that does not mean that biology classes must disintegrate into a comparative religion courses. Despite the plethora of religions, there are relatively few views of nature; multiple religions subscribing to each. As biology classes, along with other science classes, focus on nature, it is the different views of nature that is of greatest importance to understand, not the obscure theologies of little-known religions. In addition, some views of nature are more widespread than others and thus warrant greater discussion. Because Darwinism is so widespread and has such a profound impact in biology, it warrants special attention.

The Christian principle of informed freedom of choice dictates that even “bad” ideas must be taught in Christian schools. Phillip Johnson puts it this way, “The way to deal with timidity and self-deception in Christian education is not to try to prevent bad ideas from being taught but rather to ensure that the bad ideas are effectively countered by better ideas in an atmosphere of open deliberation.”²² Students must be given a choice; it is the job of educators to so clearly lay out the information, logic and issues involved that students see the clear advantages of better ideas over those with less merit. In doing this, the impact of the teacher's life as a testament to the power and beauty of Christian living cannot be underestimated. If Christianity truly offers something better than the

²²Johnson, *Right Questions*, p. 59.

alternatives, all the theoretical and practical advantages offered to students cannot outweigh their empirical observation of the work of Christ in the life of the teacher.

This does not mean that logic plays no role in the decisions students make. In fact, to provide the information necessary for students to make informed choices, the personal testimony of a Christian life should include a clear and logical understanding of what evolution is, the philosophical presuppositions it springs from and its epistemological limitations. In short, Christian teachers who want to integrate their faith in the way they teach about evolution must first allow the Holy Spirit to work in their lives and then ensure that they understand the subject at a level that exceeds that given in typical high school and college biology textbooks. Educators must be educated before they can educate! They must model how to effectively think through the issues raised by evolutionary thinking in a way that is reasonable, not by clinging to ignorance or avoiding the best arguments from other perspectives.

Assuming a teacher is already adequately equipped to logically and honestly teach about the neo-Darwinian model from an informed position, how might they go about it? A good first step may be to expose the philosophical underpinnings of Darwinism so that people can evaluate the quality of the arguments made in favor of the theory in the full knowledge of whence it springs.²³ Students first need to understand what science is, its tentative nature, the philosophical presuppositions behind various definitions of science and their implications. A thorough understanding of the scientific method is necessary for students if they are to understand the confidence they can put in scientific conclusions and how Darwinism, ID or any other scientific topic fits into the general model of how science is done. Thus the foundation for understanding theories about the nature and origin of life is laid down long before the topic is introduced. When the origin of life is first discussed, the teacher's bias should be clearly stated. This is not a negative admission, it is an opportunity to evaluate the relative worth of one philosophical approach to science over another.

Along with both a theoretical framework for understanding science, a theological foundation for evaluation should also be integrated into the class before dealing with the difficult question of evolution. This is essential if students are to understand the actual position that Christian educators and materialists are reasoning from. This should help prevent student from becoming easy prey to the straw-man type arguments so frequently employed when debating for materialistic over theistic views of origins. An example of this would be the common claim that "Evolution is controversial not so much because the scientific evidence is in any doubt, but because some people do not like or refuse to accept its implications in a religious or philosophical context."²⁴ Religion and philosophy may serve as a motivation to question Darwinism, but major controversy from the time Darwin first proposed his theory to the present has been rooted in the scientific evidence

²³This has been a consistent theme of Johnson's books and can be found clearly stated in all his publications since *Darwin on Trial* was published. Johnson PE. 1991. *Darwin on Trial* Regnery Gateway, Chicago.

²⁴ Phillips WD, Chilton TJ. 1994. *A-Level Biology*. Oxford University Press, Oxford.

and its logical interpretation. The weaknesses of Darwinism do not have their basis exclusively in religious or philosophical objections, although these may, along with the empirical challenges it faces, be both important and valid.

Another methodological foundation may also be laid; when other subjects are discussed before getting to evolution, questions should be asked about the broader meaning of the information being learned. Students may thus learn to view questions of meaning and purpose as a natural part of science, and specifically biology classes. In addition, students should be encouraged to consider how the information they are currently learning integrates with information learned earlier. For example, students typically learn about osmosis, the movement of water across membranes, early in biology classes. Later these principles may be applied to understanding how kidneys operate. This approach encourages students to see the knowledge they are learning as part of a much larger picture instead of isolated facts to memorize.

When evolution is discussed, the following points should be made: (1) Questioning Darwin's ideas does not imply a lack of respect for him or that his thinking is irrelevant. Questioning other's theories is a normal part of science. (2) The theological implications that make Darwinism unpalatable should be explained. (3) The word *evolution* may be used in a number of distinctly different ways. Some of these meanings are not objectionable. The disagreement is not over evolution per se but over the specific materialist theory of Darwinism. For example, when *evolution* is used to mean only change over time, generally Christians have no problem with this concept. Christians typically do not believe that the earth or the life forms on it are the same today as when God created them.²⁵ (4) Disagreement with some meanings of the word *evolution* do not spring exclusively from theology but from science. (5) Those aspects of evolution that are most troubling arise not from science but from the philosophy of materialism.

Most textbooks present a very similar collection of information supporting the theory of evolution, and do so without critique. If students are to make an informed choice about the value of evolutionary theory, they must engage in critical thinking. This is problematic because sometimes what textbooks present is factually incorrect.²⁶ When errors of fact appear in text books, for example the still commonly used fraudulent embryo drawings by Ernst Haeckel,²⁷ this provides an opportunity to teach students that their textbooks should not be expected to always have all the facts straight. For some students this may be a disturbing revelation that causes them to question the validity of all they are learning.

²⁵ Although some flavors of neo-Platonist may object to some concepts of change.

²⁶ Wells J. *Icons of Evolution*.

²⁷ See, e.g., Miller KR, Levine J. 1995. *Biology*, 3rd ed. Prentice Hall, Englewood Cliffs, N.J. P 283, figs. 13-16. The authors recognized that this illustration does not reflect the reality of embryonic development and discuss it at <www.millerandlevine.com/km/evol/embryos/Haeckel.html>. A more detailed discussion of Haeckel's fraud can be found in Richardson M. K. Hanken J, Selwood L, Wright GM, Richards RJ, Pieau C. 1997. Haeckel, Embryos, and Evolution. *Science* 280: 983 -84.

Awareness of different uses of the term *evolution* helps students evaluate the logic of how various data are presented in support of both ID and Darwinism. Population genetics, changes in allele frequencies within populations, is frequently presented as directly measurable evolution in action. For this reason textbooks commonly place population genetics squarely in the middle of the discussion of evolution instead of in chapters covering genetics.²⁸ This provides an excellent opportunity to ask questions about the nature of the evolution being discussed. Is it reasonable to expect that different environments will favor members of a species that have one genetic makeup while others are selected against? How might this process be related to production of new types of organisms? Does it address the question of where genetic variability that selection may act on came from? Encouraging students to wrestle with and ask questions about the meaning of population genetics, promotes something more than uncritical memorization of the assumptions made when calculating Hardy-Weinberg equilibria.

Understanding that changes in allele frequencies may be caused by multiple factors, one of which is natural selection, but that natural selection does not account for the origin of the alleles that selection may act on, helps students to see that a logical gap exists between empirical investigation of population genetics and the theoretical production of new kinds of organisms. Understanding this “empirical evolution” in populations points out the gap between what is empirical and what is theoretical in science. It also shows that what is empirical does not necessarily conflict with the claim of Scripture that God created the various kinds of organisms or the relatively metaphysically unburdened notion of intelligent design.

Allowing students to evaluate the challenge evolution poses to the Christian understanding of origins does not mean simply dismissing the evidence presented as either false, as in the case of Haeckel’s drawings, or tangential to the central question, as in the case of population genetics. Some evidence is well explained within an evolutionary paradigm. For example, order in the fossil record is clearly something logically consistent with evolution of life from organisms less like those living today at the bottom of the geological column to those more like the living things we know today near the top. It is tempting to try minimizing the significance of order in the record or to argue that it is not real.²⁹ Either tactic would be unfortunate because both seek to bias a student’s ability to gain an informed understanding of reality and ultimately compromises their ability to make an informed judgment about the merits of evolutionary challenges to the traditional Christian view of history. Order in the fossil record does not disprove history as told in Scripture, although students should be able to understand that when reasoning from a materialist starting point it may be better explained, as currently understood, by a process of change over time in which organisms start out different from those living today and evolve into the organisms now extant.

²⁸For example, see Campbell NA, Reece JB, Mitchell LG. 1999. *Biology*, 5th ed. Benjamin Cummings, Menlo Park, California.

²⁹See, e.g., Price GM. 1926. *Evolutionary Geology and the New Catastrophism*. Pacific Press, Portland, Oregon.

Students need to be aware that evolution, when it means common descent, does explain certain classes of evidence, and in some cases may seem a more reasonable explanation than a history involving creation, the fall and a global flood. Having said that, they should not be left to believe that all the evidence is either inconclusive or well explained within the evolutionary paradigm. Because it seeks to provide students with the freedom to make informed choices, Christian education cannot ignore evidence within the fossil record that is consistent with the story of creation as told in Scripture. This may mean broadening the content of courses beyond the information contained in textbooks, and this is certainly the case when discussing evidence relating to evolution. In the case of the fossil record, while it appears to be true that order exists, other evidence appears inconsistent with the concept of common descent. For example, sudden appearance of fossils is also a generally agreed-on characteristic of the fossil record. The sudden appearance of many profoundly different organisms in Cambrian strata is inconsistent with Darwinian predictions but consistent with intelligent intervention.³⁰ The same could be said for systematic gaps between both living and fossil groups of organisms and the complexity evident in the first fossil organisms, whether they be single celled bacteria in proterozoic rocks, jellyfish-like Ediacaran fauna or Cambrian trilobites.³¹

Presented with the best and most comprehensive understanding of what the fossil record is, students can judge for themselves what explanations make the most sense. They should always be encouraged to base their decisions on more than one narrow data set, the fossil record in this case, but also on the much greater set of knowledge gained in previous learning. For example, if they have already learned about the ways organisms and the cells from which they are made work, this evidence can also be brought to bear when evaluating evolutionary theory. Is the neo-Darwinian mechanism really adequate to explain not just the complexity but the specific kind of complexity evident in living things? Going beyond the realm of science and incorporating the humanities, students may be encouraged to ask what theological implications the data suggest: where might tensions exist that should stimulate further research?

Conclusions

Materialism and the Christian worldview of a God intimately involved with the material world logically lead to profoundly different views of science. Inherent within each worldview are ideas about how people can most productively lead their lives. Education is widely understood to be a process in which students are taught not just facts and skills but also about the meaning and purpose of life. Because of this, it is tempting to restrict education to a process of indoctrination into a worldview, but the Christian principle of informed freedom of choice should preclude yielding to this temptation. Instead, Christian educators who seek to integrate their faith into their teaching must provide

³⁰For an excellent discussion of this see: Meyer SC, Ross M, Nelson P, Chien P. 2003. The Cambrian Explosion: Biology's Big Bang. In *Darwinism, Design and Public Education*. Eds. Campbell JA, Meyer SC. Michigan State University Press, East Lansing, Michigan. PP 323-402.

³¹See the video *Evidences II: The Tale of a Trilobite*, IVd Tech and The Geoscience Research Institute, 2002. This video elegantly discusses these issues in understanding the geological column. Also: Chadwick AV. 2007. The Trilobite: Enigma of complexity. Available online at: <http://origins.swau.edu/papers/complexity/trilo/eng/index.html>.

students with the best possible personal example of Christian living, the best information and thinking skills available, and encourage them to apply the information they learn to the larger question of life's meaning and purpose. This means that Christian science teachers are called to greater mastery of their fields and understanding of where their specialty fits with other fields of knowledge, especially those in the humanities.

Within the context of human knowledge, biology presents special challenges to Christian faith. These are best faced by providing a more comprehensive approach to the subject than by avoiding discussion of biological evolution and other challenging areas. This provides an opportunity to better educate students about the value of scientific understanding and a more detailed knowledge of information that bears on questions like the origin and history of life. Thus Christian biology education should be both broader and deeper in its scope than some other approaches. The linking of knowledge with questions of meaning and values may also serve as a powerful motivator for students to acquire biological knowledge. Given these advantages, incorporation of the Christian faith with the teaching of biology provides greater opportunities for both teachers and students than teaching biology under the misconceived notion that it is independent of faith, values and meaning.

Philosophical presuppositions are highly relevant to scientific understanding of nature. On the one hand, ID may be the simple observation that certain natural phenomena are best explained in terms of intelligent rather than natural causes. On the other hand, rationally discussing the possibility of ID requires setting aside cherished presuppositions and replacing them with an ideal that does not answer the question of the origin of life before it is even asked. This is as true for Christian presuppositions as it is for the materialist presuppositions of secular humanists. From this recognition, a cascade of effects logically follows: an interdisciplinary approach to teaching the sciences that honors and incorporates the rich tradition of the humanities, a different testing pedagogy, courage to explore alternative views, a broader understanding of the three dimensional nature of science rather than the caricature so frequently presented in classrooms and in the popular media.

Embracing the ideas outlined in this paper means abandoning well-meaning attempts to shield students from dangerous or wrong ideas and replacing such misguided safeguarding with the aim of equipping young minds to discriminate between good and bad ideas. It also means ensuring that teachers are genuinely prepared to teach science subjects from an informed position and to argue their case for a Christian understanding of nature rather than simply "teaching the facts." This also means that science teachers must take the time and make the effort to understand the humanities and their contribution to our understanding of science and its place in culture. While these are potentially positive things, implementation is another matter; one that might at a very practical level test any claims of divine blessing on Christian teachers.