Integrating Faith and Learning in the Biology Classroom

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Secular humanism and Christianity 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 burdened with 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. In the study of biology, this means that Christians have a broader palette of explanations to draw on than materialists. Not surprisingly, this may mean that Christians are willing to entertain explanations that are anathema within the materialist dogma.

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."[i]

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.[ii]

The fundamentally different approaches to understanding nature adopted by Christians and materialists naturally result in different approaches to teaching in the sciences. Within the materialist paradigm, only natural causes are allowed, so only natural causes, no matter how improbable they may seem, are presented in the classroom. 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 of Ohio 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."[iii]

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 if we don't know whether something is natural or not? Determining whether life is natural is not possible within this definition of science; instead we must assume that life is natural and if we do that, it must be explained via natural causes. When problems inherent in materialist definitions of science were recognized by those writing the Ohio science standards, they wisely modified this part to read:

> "Recognize that science is a systematic method of continuing investigation, based on observation, hypothesis testing, measurement, experimentation, and theory building, which leads to more adequate explanations of natural phenomena."[iv]

This definition of science is not burdened with materialist dogma, emphasizes the process of science and allows for a more realistic understanding of how tentative knowledge is gained by studying the empirical world. While this is clearly a definition of science superior to the materialist one, 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 objection, we must step back and address a more profound question, the purpose of education.

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 of the curriculum on the ground that the choice among ultimate purposes involves only subjective preferences and not knowledge?"[v]

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 religion suggests that, at least in the past, education has been a tool for investigation and indoctrination into specific worldviews. The line between investigation and indoctrination has not always been clearly drawn and in modern western thought, the very idea of indoctrination seems coercive and somehow a denial of an individual's right to make sovereign and informed decisions about the nature of reality and man'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."[vi] 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 Phillip 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 knowledge of its Creator, both of which point toward knowledge of the Savior of humanity. In the Christian worldview, meaning is inherent in understanding that mankind was created in the image of God.[vii] Answering Johnson's first question may warrant more consideration.

If Christian education is to ensure students come to the "right answers" and those "right answers" are decided before the education begins, then this "education" may well turn out to be the very kind of coercion that is anathema to Christian thinking. Should Christian educators sacrifice the Christian principle of freedom to ensure students only choose to live lives consistent with other Christian principles? The story of the first sin and fall of man 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, this 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 this is an approach commonly used in biology textbooks, particularly when they cover controversial topics like ecological issues or evolution.[viii] Before attempting to lay out all the information on a controversial topic so that students can form an informed opinion, Christian educators can and should honestly state their predispositions. Christians start with a particular view of nature and man's place in it; pretending otherwise would be dishonest. Christians are not unbiased and neither is anyone else. Christians are honest, 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 is what science seeks to achieve. Pretending no bias exists is a dangerous self deception.

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 hope they will. For example, a student may conclude that the Biblical account of creation is false when presented with information about the fossil record. 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 is consistent with Biblical Christian understanding of history is 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 the object 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, that person is ignorant, stupid or insane (or wicked, but I'd rather not consider that)."[ix] 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, will 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."[6]

Because bias is impossible to eliminate and good teachers wish 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 suggested in Johnson's second question while embracing the honesty inherent in the first.

If the purpose of education is to "understand the ultimate purpose or meaning for which life should be lived and to choose rightly from among the available possibilities," this suggests that education in the sciences, and specifically in biology, should not be divorced from the humanities. Science is not only about learning the facts as they are currently understood about nature; these facts 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. Because the humanities help address those big questions that transcend technology and facts. they should serve as vital tools in the arsenal of Christian biology teachers. 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 are developed, 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,[x] combining human and mouse cells into a single embryo,[xi] or combining male and female cells to produce "she-male" embryos.[xii] 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.

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. 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."[xiii]

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 type 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 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, it seems that essay writing 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 student's ability to apply, assess and use the information.

So far in this paper, five principles have been established: 1) The Christian worldview impacts the way science is defined. 2) Fundamental questions about the nature of education impact how education will be done and answers to these questions influence answers to the narrower question of integrating faith in the biology classroom. 3) Informed freedom of choice is a Christian principle that should strongly influence the Christian approach to education. 4) No approach to education is without bias and the best way to address this bias is to be open about it, rather than pretending that it does not exist. 5) Asking students to wrestle with questions of purpose and meaning in science classes encourages treatment of the various academic disciplines as part of a coherent whole rather than distinct fields of knowledge, and also suggests certain methods of evaluation may have greater utility than others. How might these principles be practically applied in a Christian biology classroom? Many examples could be chosen, but the most problematic of these has to be the question of biological evolution. Should evolution even be taught in Christian schools?

The Christian principle of informed freedom of choice dictates that even "bad" ideas must be taught in Christian schools. Philip 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."[xiv] Students must be given a choice; it is the job of educators to so clearly lay out the information, logic and issues involved so 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 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. But 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, a Christian teacher who wants to integrate their faith with the teaching of 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!

Teaching Evolution: A Case Study

Individual teachers will have their own methods of dealing with any topic. The following is one approach that is logical and has worked for me. This does not mean that it is perfect or even that there are not other better ways, but it does illustrate one way of approaching this topic in an introductory college class.

Introducing the topic of evolution should not be done prior to ensuring that students understand the tentative nature of science. Understanding of what science is must include awareness of 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 the idea of evolution, or any other scientific topic, fits into the general model of how science is done. Thus, the foundation for understanding evolution is laid down long before the topic is introduced. When evolution is first discussed, the teacher's bias should be clearly stated. In my case, each class started with a text relevant to the topic followed by a prayer; thus, students were aware well in advance that I take the Bible seriously and that I have faith in a God I believe can and does act in the material world.

Both a theoretical foundation for understanding and theological foundation for evaluation were integrated into the class before dealing with the difficult question of evolution. One other methodological foundation was also laid, whenever subjects were discussed before getting to evolution, questions were always asked about the broader meaning of the information being learned. Students were trained to view questions of meaning and purpose as a natural part of the class. In addition, occasionally students were encouraged to consider how the information they were learning integrated with earlier information. Sometimes this was simple and straightforward. For example, early in the course students learned about osmosis, the movement of water across membranes; later the principles were applied to understanding how kidneys operate. This encouraged students to see the knowledge as part of a much larger picture instead of isolated facts to memorize.

On the first day evolution was discussed in class, I endeavored to make the following points: 1) I don't agree with Charles Darwin, but that does not mean that I don't respect him or that his thinking is irrelevant. 2) The theological implications of Darwinism are unacceptable to me because of both what Scripture says and my own empirical experience of the Holy Spirit working in my life. 3) The word "evolution" may be used in a number of distinctly different

ways, some of these meanings I disagree with, others describe my beliefs perfectly. For example, when "evolution" is used to mean only change over time, as Christians we have no problem with this concept. No mainline Christians believe that the earth today or the life forms on it are the same today as when God created them. 4) My disagreement with some meanings of the word "evolution" do not spring exclusively from my theology, but from science. 5) Those aspects of evolution that I find most troubling arise not from science but from the philosophy of materialism.

The beauty of most biology classes is that they adopt approaches placing evolution somewhere toward the middle of the course. I used the molecules-to-biosphere approach to teaching biology. Courses using this strategy start out with a brief survey of chemistry before moving into biochemistry, cell biology, organismal biology, systematics and ending with ecology. Somewhere around the end of organismal biology and beginning of systematics evolution was discussed. The advantage of this is that students come to the discussion of evolution with a profound understanding of the complexity and elegance of even the simplest organisms. In other words, they are already aware of information that should present a significant challenge for the idea of chemical evolution to overcome.

Most textbooks present a very similar collection of information as support for 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 as sometimes what textbooks present is factually incorrect. For example I used a textbook with high school students that contained fraudulent drawings by Ernst Haeckel.[xv] This provided an opportunity to teach students that their textbooks should not be expected to always have all the facts straight. For some students this was a disturbing revelation that caused them to question the validity of all they were learning.

Awareness of different uses of the term evolution helps students to evaluate the logic of how various data are presented in support of evolutionary theory. Population genetics, changes in allele frequencies within populations, is frequently presented as directly measurable evolution in action. For this reason, the college biology textbook I used[xvi] placed population genetics squarely in the middle of the discussion of evolution instead of in the discussion of genetics. This provided 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 on which selection may act came from? By encouraging students to wrestle with and ask questions about the meaning of population genetics, they did more than uncritically memorize the assumptions made when calculating Hardy-Weinburg equilibira and learning the math involved.

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 on which selection may act 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.

Allowing students to evaluate the challenge evolution poses to the Scriptural account 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 clearly 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 record 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. Either tactic would be unfortunate as it would be dishonest. Order in the fossil record does not disprove history as told in Scripture, it is simply better explained, as currently understood and when reasoning from a materialist starting point, by a process of change over time in which organisms start out different from those living today and evolve into the organisms now extant.

Students need to be aware that evolution, when it means common descent, does explain evidence, and in some cases it may be a more reasonable appearing 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 upon characteristic of the fossil record. The sudden appearance of many profoundly different organisms in Cambrian strata is inconsistent with Darwinian predictions, but consistent with the Biblical account of history. The same could be said for the complexity evident in the first fossil animals, like trilobites, as well as for systematic gaps between both living and fossil groups of organisms.[xvii]

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. After discussing the various lines of evidence relating to evolution as presented in their text, I always pointed students back to what they had learned previously about the ways organisms and the cells from which they are made work, emphasizing that this also is evidence that can 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? Generally, I would end with a lecture on the argument from design reiterating the basic tenets of evolutionary theory, mutation and selection, while asking whether they constitute a realistic explanation for the molecular machines and information inherent in all cells, thus reasons to question the Darwinian mechanism were presented along with a positive argument for inferring design. In testing, questions generally revolved around the strengths and weaknesses of the design versus evolutionary inferences from data.

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 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.

End Notes:

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[ii] For one example, see: Dembski W A. 1998. Science and Design. *First Things* 86:21-27.

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

[iv] 2003 *State of Ohio Academic Content Standards: K-12 Science* Grade 10, Scientific Ways of Knowing (Nature of Science) #3. P 147. Approved December 10, 2002.
http://www.ode.state.oh.us/academic_content_standards/ScienceContentStd/PDF/SCIENCE.pdf

[v] Johnson, Phillip E. 2002. *The Right Questions: Truth, meaning and public debate.* InterVarsity Press, Downers Grove, MD. Pg 68.

[vi] Genesis 2:17 KJV.

[vii] Genesis 1:27 and 9:6

[viii] For a detailed discussion of this problem with presentation of evolution, see: Wells J. 2000. *Icons of Evolution: Why much of what we teach about evolution is wrong.* Regnery Publishing, Washington, DC.

[ix] Dawkins, C. R. 1989. Reviewing *Blueprints: Solving the Mystery of Evolution.* By Maitland A. Edey and Donald C. Johanson. Illustrated. Boston: Little, Brown & Company. In the *New York Times.* April 9, 1989, Sunday, Late City Final Edition Section 7; Page 34, Column 2.

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[xi] Wade, Nicholas. 2002. Stem Cell Mixing May Form a Human-Mouse Hybrid. *The New York Times* November 27, 2002.

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[xiii] Ehrlich, Paul R. 2000. Evolution of an Advocate. *Science* 287:2159.

[xiv] Johnson, Phillip E. 2002. *The Right Questions: Truth, meaning and public debate.* InterVarsity Press, Downers Grove, MD. Pg 59.

[xv] Miller Kenneth R. Levine, Joseph. 1995. *Biology*, Third edition. Prentice Hall, Englewood Cliffs, NJ. Pg 283 Figure 13-16. The authors recognized that this illustration does not reflect the reality of embryonic development and discuss it at http://www.millerandlevine.com/km/evol/embryos/Haeckel.html. A more detailed discussion of Haeckels fraud can be found in Richardson, M. K., Hanken, J., Selwood, L., Wright, G. M., Richards, R. J., Pieau, C., and Raynaud, A. 1997b) Haeckel, embryos, and evolution. *Science* 280: 983 -984.

[xvi] Campbell, N. A. Reece, J. B. Mitchell, L. G. 1999. *Biology* Fifth edition. Benjamin Cummings, Menlo Park, CA.

[xvii] The following video elegantly discusses these issues in understanding the geological column: *Evidences II: The tale of a trilobite.* 2002. IVd Tech and The Geoscience Research Institute.