Faith Integration in the Science Classroom

by Leslie Wickman
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As a Christian instructor of science, I have a passionate desire to help students wrestle through the issues of science and faith that I wrestled with mostly in isolation in secular schools and universities, as well as within the professional working world.

At the "macro-level" my goals as a science instructor within a faith-based setting are the following:

1) to help students develop a strong foundation for spiritual growth and intellectual pursuits;
2) to exercise and stretch students' capacity to think critically;
3) to demonstrate how studying academic subjects enables a greater knowledge of and faith in God;
4) to enable students to see science as a tool for discovering God's creativity and wisdom in the wonders of nature;
5) to encourage each student to develop his/her God-given gifts and abilities to the fullest potential in every aspect of his/her life for God's glory as an act of worship.

I believe that teachers should be encouraging and supportive. I believe that each individual is uniquely designed, and that God has a loving plan to give each one a future and a hope (Jeremiah 29:11). I desire to help each student gain an appreciation for the unique individual that God has designed him or her to be and to encourage each one to develop the full potential of his or her unique design.

I believe there are a wide variety of ways that faith and learning can be integrated in the sciences, including the methods listed below:

1) Excellence: doing everything – including science – to the best of one's ability, as unto God;
2) Ethics: practicing science according to biblical morality (e.g., human dignity, respect for life, freedom);
3) Stewardship: exploring the Christian role as accountable stewards for the gifts with which God has entrusted us (e.g., caring for nature/environment, developing individual gifts and talents);
4) Exploration: investigating the wonders of creation (marveling at the order expressed in the "laws of nature", as well as the design, complexity and comprehensibility of nature; wondering how God did it; trying to grasp the improbability of it all).
5) Hermeneutics: searching out the context and intention of Biblical passages relating to origins and other scientific concepts.
6) Worldview: examining the truth-claims of alternative worldviews vis a vis the Christian perspective relative to efficacy, utility, reason and logic.

Through the thoughtful implementation of each of these methods, students may come to understand that the truth about nature and the truth about nature's Creator must complement, not contradict, each other since the Creator-God is One, and as such is the source of all truth. A lack of understanding about either science or theology can make students feel that they must choose one or the other, but a deeper, more complete understanding of each enables us to embrace both without contradiction. If we can simply begin a discussion with the notion that absolute truth exists about both God and Nature, then most rational people will agree that those absolute truths cannot logically contradict each other. Therefore the more we correctly understand about each topic of study, the better our understanding will be of the entire picture.

Our paths as individuals as well as a society to full knowledge of the truth about God and the truth about nature tend to be iterative: we might take two or three steps forward followed by one or more steps backward. This is in keeping with the scientific method, which when practiced properly holds "truth" tentatively, acknowledging that new evidence might be discovered at any time that would make previous scientific theories, or even scientific laws, invalid.

Take for example the early Greek view of the sun moving around the earth. Copernicus postulated, and later Galileo made observations with his telescope producing evidence that in fact, the earth revolves around the sun, not the other way around as previously held as an obvious truth. This was an example of broadening the human perspective, looking at traditionally held ideas from a larger frame of reference, and working with more information.

A similar thought revolution or paradigm shift occurred in moving from Newtonian Physics to Relativity Theory. I will not digress into a side lecture on relativity here, but suffice it to say that scientific concepts like gravity, time and space itself, which we thought were fairly well understood, all got turned upside down in the process.

In the same way, no one can honestly claim to have God or all of Christianity completely figured out. Certainly Jesus himself presented a paradigm shift to the theology of the Pharisees! As I Corinthians 13:12 reads, "For now we see through a glass, darkly, but then we shall see face to face; now I know in part; but then shall I know even as also I am known." While Paul's words here were meant to apply to our knowledge and understanding of God, I believe they serve as a worthy metaphor for our knowledge and understanding of His Creation as well. On a personal level, as I go through life and do more research and investigation, I continually revise my own understanding of various passages of Scripture, as well as my understanding of nature.

As a scientist, as well as a teacher of science, I find empirical evidence and rational arguments very appealing as well as useful. There are a number of classical, rational arguments for God's existence, each of which can be used in the classroom. They have been called by various names through the ages, but the essentials are summarized in the following four arguments:

1) The cosmological argument
2) The ontological argument
3) The anthropological argument, and,
4) The teleological argument

Allow me to give a brief overview of the first three arguments, then to focus on the fourth, which serves as a consistent template for faith-learning integration in the science classroom.

The cosmological argument, credited to various philosophers from Plato and Aristotle to St. Thomas Aquinas, reasons from the logic of cause and effect: all effects (such as the universe) have causes, and since the universe had a beginning (as both science and the Bible tell us it did; see Genesis 1:1), it must also have had a Beginner.[i]

(*The New Interpreter's Study Bible* commentators take an informative if somewhat mundane approach to Genesis 1:1, pointing out two legitimately recognized yet competing interpretations of the Genesis 1 creation account: either as
[1] beginning with the creation of heaven and earth out of nothing - "ex nihilo" -, or
[2] picking up after heaven and earth are already created – yet formless and void – and imposing design and order on the formlessness and chaos.[ii]
On the other hand, Van Harn's *Lectionary Commentary* illuminates the following more subtle attributes of Genesis 1:
[1] as a confession of faith, "In the beginning God." God has always existed, and without him nothing else would even begin to exist;
[2] as portraying the roles of all three persons of the Trinity in creation, foreshadowing their later roles in redemption of not only humans but all of creation;
[3] as a liturgy for celebrating New Year's Day.[iii])

The ontological argument originated by St. Anselm of Canterbury in the 11th century asserts that the fact that we humans are capable of imagining a perfect God implies that God must exist, because a God who exists is more perfect than a God who doesn't exist.[iv]

The anthropological argument has been credited to 17th century mathematician and physicist Blaise Pascal as well as others, and consists of both (1) moral and (2) experiential components. This argument contends that (1) the absolute moral values (moral conscience or natural law) acknowledged by humans everywhere point to a God who has written the requirements of his law on our hearts (as in Romans 2:15, where *The New Interpreter's Study Bible* commentators mention that the innate human moral sense referred to here provides the basis for the legitimate condemnation of all people[v]); and (2) the fact that people claim to have experienced God must mean that he exists because humans can only perceive that which exists.[vi,vii]

As a scientist, the teleological argument is of particular interest, being perhaps the most commonly discussed argument for God's existence in today's science and technology oriented society. Consider this quote from science historian Frederic Burnham in an article by David Briggs on science, religion, and the Big Bang Theory in the Los Angeles Times in 1992: (the idea that God created the universe is) "a more respectable hypothesis today than at any time in (the) last hundred years."[viii] The teleological argument has been associated with great thinkers from Plato to William Paley. This argument claims that the design and order observed in the natural realm point to a purposeful Creator.[ix]

Article 2 of the Belgic Confession states:

"Moreover, we know God by two means, first, by the creation, preservation, and government of this whole world. For it is before our eyes as a most beautiful Book in which all creatures, from the least to the greatest, are as certain letters and marks through which the invisible things of God can be examined and understood, certainly His eternal power and His divinity as the Apostle Paul says in Romans 1:20. This knowledge is sufficient for convicting any given people and rendering them inexcusable. But He also bears His very self to us, much more clearly and openly, in His holy and divine Word; indeed, as much as is expedient in this life for His glory and for the salvation of His own people." [x]

Sir Francis Bacon, father of inductive reasoning (and at least partially responsible for developing the scientific method), was a contemporary of the Belgic Confession's authors and is often credited with the origin of the "God's two books" analogy.[xi] The "two books" are Creation (or Nature) and Scripture, sometimes referred to as general and special revelation, respectively. If our perfect and truthful God is the author of both books, then they cannot logically contradict each other.

As mentioned in the Belgic Confession, St. Paul wrote in the first chapter of his letter to the Romans (verse 20), "Ever since the creation of the world his eternal power and divine nature, invisible though they are, have been understood and seen through the things he has made. So they are without excuse…"[1] And as King David wrote in Psalm 19 verses 1 and 2, "The heavens are telling the glory of God; and the firmament proclaims his handiwork. Day to day pours forth speech, and night to night declares knowledge." As the commentators for *The New Interpreter's Study Bible* convey, the first of these passages (Romans 1:20) assures us that creation gives everyone on earth a basic knowledge of God. Likewise the second passage portrays the universe as "sounding forth a liturgy of praise" to the Creator.[xii] Surely people everywhere can learn at least something about the Creator by studying his handiwork!

Scientists are perpetually amazed by the intricacy and complexity of everything we study, yet it all fits together seamlessly in a perfectly balanced, synergistic system. As we study the complexity of the cosmos, from the tiniest atom to the frontiers of the universe, we realize that chance is an inadequate explanation of all the incredible order we observe.

Our exploration of space has confirmed that the other planets in our solar system are not even close to being capable of sustaining life of any complexity. The other objects in our solar system are waste lands. For example, Earth's so called "sister planet", Venus, is just slightly smaller than Earth and a little closer to the Sun, but that is where their similarities end. Venus has a surface temperature of about 900 degrees Fahrenheit, an atmosphere so thick with carbon dioxide that its atmospheric pressure is more than ninety times that of Earth, clouds laced with sulfuric acid, and no water. In the other direction we have Mars, significantly smaller than Earth and a little farther from the sun, with very little atmosphere and its only water is frozen, so there is no life-giving water cycle.

[1] All Bible references are from the New Revised Standard Version unless otherwise noted.

The most blatant distinctive fact about Planet Earth is that it is inhabited. Isaiah 45:18 tells us, "For thus says the LORD, who created the heavens (he is God!), who formed the earth and made it (he established it; he did not create it a chaos, he formed it to be inhabited!): I am the LORD, and there is no other." *The New Interpreter's Study Bible* emphasizes the intent of this passage to proclaim the one and only God as the Creator,[xiii] while the *Ryrie Study Bible* mentions that even though the earth was formless and void in the beginning, God intended for it to be inhabited.[xiv] When we consider Earth's unique attributes that make it not only habitable but also hospitable, we see an arrangement and coordination of details that could not have happened by accident. As Isaiah wrote, Earth must be the product of a Master Designer, designed and constructed to be inhabited.

In *The Remarkable Spaceship Earth*, author Ron Cottrell points out nine specific attributes of the Earth that make it habitable[xv]. One of my astronomer friends, Mark Ritter[xvi], has collaborated with me in fleshing out Cottrell's original list of Earth's attributes and their complex, interdependent relationships with the various parts of our biosphere. In the interest of time and space (no pun intended), this list has been relegated to the Appendix.

Even beyond Earth itself, the rest of our solar system bears the marks of design. Saturn and Jupiter, gas giants in the outer region of the solar system, are close enough to protect us from incoming earth-bound comets and asteroids, but not so close as to disturb our perfect but fragile orbit around the sun. And our star, the Sun, is the perfect size, brightness, and age for life. Change anything, and life disappears. Fortunately our Sun appears to be a single star. Most stars have at least one other companion. If the Sun had a nearby partner, our orbit would destabilize and we would ultimately crash into one or the other of our stars.

We see evidence of this life-friendly design not just in our solar system, but throughout the entire universe. For example:

- If the velocity of light were faster, too much radiation would reach earth. If it were slower, we wouldn't be able to see and study as many stars.
- If the electromagnetic force were either stronger or weaker, chemical bonding would be dramatically altered, and we wouldn't have the right elements and compounds available for life.
- If the strong nuclear force were stronger or good for long distances, all the protons and neutrons in the universe would be stuck together in one giant mass.
- If the strong nuclear force were weaker, we'd have no other atoms than hydrogen.
- If the expansion rate of the universe were slower or the mass density greater or the gravitational constant greater, the universe would have collapsed back into itself.
- If the expansion rate of the universe were faster or the mass density lower or the gravitational constant smaller, stars and planets would never have formed.

Another obvious place where amazing complexity is observed is in biology. Just a single living cell contains as much information as 100 million pages from an encyclopedia. Sir Fred Hoyle estimated the odds of getting just the basic enzymes together that are necessary for life (never mind the DNA, or an actual cell) to be 1 chance in $10^{40,000^{th}}$ power![xvii]

For comparison's sake, the odds of picking one particular atom from all the atoms in the universe is just 1 chance in $10^{80^{th}}$ power, and the odds of picking one particular atom from all the atoms in $10^{80^{th}}$ universes is still only 1 chance in $10^{160^{th}}$ power. Most statisticians would assert that probabilities of anything less than 1 chance in 10^50th power are statistically impossible. So the odds of getting just the basic enzymes together that are needed for life are incredibly remote!

Many great thinkers throughout human history have argued that design requires a designer. The only real alternative to an intelligent creator is that the entire natural realm came about by chance. But chance has no power to create order, and with the odds of all the several hundred finely tuned characteristics of the universe coming together calculated at well beyond the threshold of statistical impossibility, chance is not a reasonable explanation.

So convincing and statistically improbable is the evidence of bio-felicity in the universe that currently the only popular argument against the involvement of some type of creative intelligence is the Multiverse Theory. The Multiverse Theory speculates that there may be an infinite number of separate universes, each with a different set of physical laws. Our universe is perhaps the only one among all of them to randomly get the set of physical laws just right so that life can exist. Of course, there is no real way to either verify or falsify the existence of additional parallel universes, so the Multiverse Theory technically does not qualify as a scientific argument (or even a hypothesis, for that matter). And even if we allow such speculation on the existence of additional universes, they still all rely on the existence of some set of orderly physical laws.[xviii]

With a similar sense of desperation, scientists studying planetary formation to learn more about the bio-friendliness of conditions on the early earth are frustrated by the many environmental obstacles to chemical and pre-biological evolution. The only real alternative to creative intelligence under serious consideration within the evolutionary biology community is the Transpermia Theory, which suggests that the building blocks for life (or possibly even actual cells) came to earth from somewhere else in the cosmos. Again, this is pure speculation, and only transplants the problem of abiogenesis to an unknown location that we have even less information about than the early earth.[xix]

Virtually all astronomers and astrophysicists of the current era recognize the Anthropic Cosmological Principle, laid out by J.D. Barrow and F.J. Tipler in 1986, which acknowledges a long and growing list of several hundred universal properties whose magnitudes must fall within a very narrow range of values in order for life to exist on Earth.[xx] Renowned author and theoretical physicist Paul Davies writes, "…the degree of bio-friendliness we observe in the universe seems far in excess of what is needed to give rise to a few observers… If the ingenious bio-friendliness of our universe were the result of randomness, we might expect

the observed universe to be minimally, rather than optimally, biophilic. Note too, that multiverse explanations still need to assume the existence of laws of some sort, so they do not offer a complete explanation of the lawlike order of the universe. Finally, invoking an infinity of unseen universes to explain certain features of the universe we do observe seems the antithesis of Occam's Razor: It is an infinitely complex explanation."[xxi]

So what about the laws of nature? Where did they come from? In the Old Testament book of Jeremiah (33:25), the writer affirms that God "…established my covenant with day and night and the ordinances of heaven and earth…" The physical laws amicably directing interactions between matter, space, energy, and time may seem very arbitrary, but they result in a highly ordered universe that provides the perfect conditions for life on our little planet.

Just try, for a moment, to imagine a universe without fixed physical laws. Without physical laws, the universe would be absolutely chaotic, having no order. There is no natural reason why the physical laws that govern the universe must exist. The physical laws of nature seem so capriciously dictated until we realize how impeccably they work together.

Lydia Jaeger, physicist and academic dean at l'Institut Biblique de Nogent-sur-Marne, writes in her essay, *Cosmic Order and Divine Word*, "The 'law'-like regularity and consequent modelability of natural phenomenon are the unquestioned assumptions that underlie all scientific research… But common to all except for the most extreme relativists is the conviction that there is some basic, deep order in Nature that allows for the emergence of meaningful scientific practice… This view and the refrain of ultimate goodness ('God saw all that He had made, and it was very good') stands in clear contrast to the Babylonian imperial cosmology in which Creation results from warfare in a power struggle between competing gods… In particular, laws of Nature are not self-explanatory. To me, they are most powerfully interpreted as traces of the Creator's handwriting."[xxii]

The physical laws point to a Creator-God of power, order, rationality, and care for creation who, according to the cause and effect logic of the cosmological argument, must exist outside and apart from the created realm of space, time, matter and energy. This much at least can be "read" from the book of nature.

Even atheistic physicists such as Sir Fred Hoyle have made such comments as, "There is a coherent plan in the universe, though I don't know what it's a plan for."[xxiii] And British philosopher, Antony Flew, who recently converted from atheism to theism, cited the motivation for his conversion as "reason, mainly in the form of arguments to design."[xxiv]

The design of the universe, including its physical laws, leads intelligent, spiritual creatures toward the Creator. No one in his or her right mind ever wonders if an airplane, a cathedral, a fine watch, or a work of art just came to be by random coincidence. By the same reasoning, why would anyone think the significantly more complex universe, or any living thing, was any less intentionally designed?[xxv]

Randy Van Dragt, professor of biology at Calvin College, and James Clark, professor of geology at Wheaton College, write in an essay on environmental stewardship:

"In Romans 8:19 Paul tells us that all of creation is looking forward to the salvation of God's people, for therein the creation itself will be relieved of the curse to which it was subjected through the fall of humankind. Personal salvation in Christ eventually translates to the redemption and restoration of all creation. This bears out God's redemptive intent expressed in John 3:16, where Jesus says, 'For God so loved the cosmos [all that He had made] that He gave His only Son…'"[xxvi]

(Van Harn's *Lectionary Commentary* takes the perspective that we believers have little choice in God's redemptive work. Just as babies have no choice in being born, we have little to do with being "born from above".[xxvii] Meanwhile, Brueggemann et al's *Texts for Preaching - Year A Volume* emphasizes the difference between the human weakness in the "flesh" and the renewing, or dare we say, redeeming, power of divine Spirit.[xxviii] What a perfect picture of our impotence and God's power!)

Thus, Jesus was saying in John 3:16 that God loved the entire universe, and everything in it. As we study its complexity, from the most miniscule quark or lepton to the dark energy fueling the expansion of the universe, we have to agree that God must have truly loved his creation. The scale of the universe is beyond comprehension to most of us, yet the more we learn about it, the more we realize that none of it is wasted space.

I view science as the tool that can be used to explore the natural realm and illuminate the characteristics of the awesome God who formed atoms, time, energy and space out of nothing and put it all together. The teleological argument can indeed bear witness to God's existence and divine attributes, perhaps not least for the APU student struggling to reconcile science and faith.

As William Lazareth beautifully writes for the Augustine Institute, "The creation shows forth its Creator's wisdom and power... Notwithstanding its inherent ambiguities, the world bears witness to God's steadfast love and care...The majesty of God, reflected in the creation, is a reason for worshipping and thanksgiving, for trusting and obeying God..."[xxix]

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Appendix

- Earth's distance from sun:
  - If earth's distance from the sun were just 5% smaller, the atmospheric greenhouse effect would raise surface temperatures to 900 degrees Fahrenheit, similar to what we see on Venus.
  - If the earth-sun distance were just 1% greater, earth would experience a continual ice age.
- Earth's size (weight and diameter):
  - If earth's weight and diameter were greater, earth's core temperature would be hotter, which would increase surface temperatures; earth's gravity and atmospheric pressure would also be greater, with more of the lightweight dangerous gases (such as methane and ammonia) being retained. Depending on the amount of increase, life would be at the very least threatened, if not altogether impossible.
  - If earth's weight and diameter were smaller, its gravity would be weaker, and our atmosphere (including our essential oxygen and water vapor) would be too light to be retained; and, decreased surface temperatures would result in a wasteland, similar to what we see on Mars.
  - The deadly gases methane (CH_4) and ammonia (NH_3) have molecular weights of 16 and 17 grams per mole respectively, and are fortunately too light to stay in our atmosphere, while life-giving water vapor (H_2O) at 18 grams per mole is just barely heavy enough!
  - Interestingly, the weight of molecular oxygen, also vital for life, is 32 grams per mole. But it is only that heavy because oxygen predominantly exists in our atmosphere as a diatomic molecule (O_2; two atoms stuck together). Otherwise its weight would only be 16 grams per mole, and like methane, if would not be heavy enough to stay in our atmosphere!
- Earth's atmosphere:
  - Earth's atmosphere viewed from space has been described as a "thin blue line" since it appears almost insignificant next to the earth.
  - Yet our atmosphere insulates us from the extreme temperature ranges from day to night in space;
  - And protects us from harmful solar and cosmic radiation.
  - The ozone layer in our stratosphere further protects us by absorbing high energy radiation from space.
  - If there were less ozone in our stratosphere, biological life would be destroyed by the excess radiation.
  - If there were more ozone in the stratosphere, biological life would not receive enough of the sun's energy for photosynthesis and vitamin D synthesis.
  - Our atmosphere's composition is perfect, with 78 percent nitrogen, 21 percent oxygen, 1 percent argon, and other trace gases. More or less of either nitrogen or oxygen would ultimately result in death.
  - The small amount of carbon dioxide in the atmosphere is just enough to hold in some heat, but not enough to create a runaway greenhouse effect.
  - The small percentage of water vapor in our atmosphere also helps hold in some heat, in addition to providing us with rain as a vital part of earth's water cycle.
  - On average, lightning strikes somewhere on earth once each second. More than that and we'd have too many grass and forest fires. Less than that and not enough nitrogen from the atmosphere would get converted into nitrates, essential for plant growth.
- Earth's magnetic field:
  - Our magnetic field protects the atmosphere by repelling charged particles from the solar wind, which might otherwise tear it away, molecule by molecule, from the earth.
  - The small amount of solar wind that creeps through the magnetic field at earth's north and south poles produce the aurorae, which serve as reminders of how the magnetic field protects us.
  - Migratory animals such as honeybees, butterflies, homing pigeons, tuna and dolphins all have magnetite in their brains which acts like a compass needle, enabling them to sense the orientation of the earth's magnetic field and make their seasonal migrations northward and southward within it.
- Earth's 24-hour rotation rate:
  - A slower daily rotation rate would cause longer days and nights, and plant life could burn up during the longer days or freeze during the long nights.
  - A faster daily rotation rate would drastically alter earth's climates: the tropics would get warmer while the poles would get colder, reducing the livable areas and possibly bringing about another ice age.
- Earth's axial tilt:
  - The 23.5 degree tilt of earth's north-south polar axis as it revolves around the sun gives us seasons, and actually doubles the available crop growing land area.
- Earth's only natural satellite (our Moon):
  - Our moon has not only helped ancient people keep time, but also is largely responsible for our ocean tides.
  - If it were bigger or much closer it would cause tidal waves, submerging continents on a regular basis.
  - If it were smaller or much further away there would be no tides, and shoreline waters would quickly stagnate.
  - The moon is also just the right size to stabilize earth's rotation axis at a 23.5 degree tilt, as well as to slow the earth's rotation rate to 24 hours per day.
  - If the earth had more (or less) than one moon, our tides, daily rotation rate, and tilt would all be affected.
- Earth's crust:
  - Earth's geological crust ranges from four miles thick in ocean basins to thirty miles thick under some mountain peaks.
  - Yet if the earth's crust were just an average of ten feet thicker, the metallic elements within the crust would have combined with all the free oxygen in the atmosphere, making it unavailable to support life.
  - Conversely, if the earth's crust were any thinner it would be less stable, and there would be much more seismic and volcanic activity.
- Earth's liquid water:
  - Earth is the only place in the universe yet known to have liquid water, which is necessary for life.
  - Simply put, where there is water, there is life. Without water, there are wastelands.
  - Water is a basic building block and perfect solvent for other chemicals needed for life; it is probably the most important compound on earth. Its relatively low boiling point allows it to be easily purified on an on-going basis as a part of Earth's life-sustaining water cycle.
  - Another important yet bizarre property of water is that unlike other substances it becomes less dense when it freezes and floats on top of liquid water, acting as an insulating blanket. Without this strange characteristic, it would act like other liquids, becoming denser and sinking as it freezes, allowing more ice to form on top of the surface. In this scenario, rivers, lakes, and oceans would freeze essentially solid during the winter. In the summer, only the top of the ice would melt. Earth's water would exist as masses of solid ice with surface slush, and biological life would not be possible.