Institute For Theological Encounter With Science and Technology

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Opening Message

Has the tomb of Jesus of Nazareth and his family been found? Posed largely as a statement, rather than a question and loudly trumpeted over radio, television and the internet a few months ago, this "discovery" gave rise to a general uneasiness in some, a temporary loss of faith in others and a premature vindication still in non-believers. A majority of Christians, however easily dismissed this claim treating it like a pesky infestation of gnat-like disturbances easily gotten rid of with a few þicks of the hand. Of course, theologians, scripture experts and other academicians quickly labeled the claim as "old hat" while supporting their stance with scholarly research. What does science say about this discovery? All science can say is that ñthe DNA extraction from human residue found in two of the ossuariesò dates to the First century. We leave it to the enthusiasts to speculate and enlarge upon that.

Father Brungs, in his 1999 Easter Message to ITEST members, speaks passionately about the meaning of the ñbodyò in the whole schema of the incarnation, death and resurrection of Jesus. Here he focuses on the meaning of the body and its relationship to the faith/science ministry.

ñEaster, as you know, is really an embarrassment of riches. The preacher knows that, like Christmas, Easter can never be approached except by bits and pieces. One bit, of course, circles around the resurrection of the body ï Christôs body and our bodies. I, for one, am a ýrm believer in Christôs bodily resurrection ï a proposition not always acceptable to all scripture scholars, But it is certainly acceptable to all who take the trouble to read the Scripture and pray over it.

ñWhat has that got to do with science in general or the life sciences/faith apostolate in particular? Everything! If Christ did not rise bodily from the dead, if the tomb is not empty, it is a waste of time to worry about the body and its meaning. It would have no meaning. If the way we enspirit matter is meant for this life only, then it has no intrinsic meaning and no future. Itôs as if we are imprisoned in the body for a time and then liberated to live a higher existence. That is not the teaching of Christianity in the Creeds or in the tradition where the teaching talks about óthe resurrection of the bodyô.ò

Over the years this conviction of our ñembodimentò in Christ grew stronger in Fr. Brungs daily, even as his own body became weaker and weaker. Yet he never wavered in the belief that we too, in sharing in the resurrection, will be rid of suffering forever. What a glorious prospect!

Celebrate this Easter Season with exuberant joy. Celebrate the beauty of the body waiting for its resurrected glory. Follow the lead of Gerard Manley Hopkins who sings,

"Let Him easter in us, be a dayspring to the dimness of us, be a crimson-cresset east"

S. M. Pastiglione, CSM

Acting Director: ITEST

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Announcements

1. **ITEST TO CELEBRATE ITS 40TH ANNIVERSARY 2008:** Our actual date of incorporation and birthdate is September 16, 1968. What should we be addressing on the occasion of this important anniversary in 2008? Some thoughts from Tom Sheahen: 1) International technology and conflicting interests, among them, export of manufacturing and white collar jobs, church endorsement of capitalism, church "preference for the poor"; 2) Immigration and balance between effective technology and compassion and 3) Alcohol as a fuel – technology makes alcohol from corn or from cellulosic biomass, concerns of the church – do these processes deprive poor nations of food necessary for survival?

The dates have already been set for the combined celebration and workshop, September 19-21, 2008 at Our Lady of the Snows Conference Center. The ITEST Board has discussed some tentative suggestions for topics, in addition to those cited above but we welcome your thoughts as well. More to come on the anniversary celebration!

2. Please remember to mark your calendars for our exciting and timely weekend conference, September 21-23, 2007 – *Astronomy/Cosmology Breakthroughs and the God Question.*. (See the Winter Bulletin, Volume 38, No. 1 for a detailed description of the conference, including essayists/presenters Neyle Sollee, MD, Stephen Barr, PhD and Brother Guy Consolmagno, SJ, PhD.) Since we have limited capacity at the venue for the weekend at Our Lady of the Snows Conference Center, Belleville, Illinois, we urge you to register as soon as possible. The invitations and registration materials will be sent to all ITEST members in the Spring. Because some members don't like to part with the entire cost of the registration in one fell swoop, they may register early and pay a deposit:

Early registration: June 1 – September 1, 2007 $75.00 (non-refundable). Balance due on September 21

If you wish to register early simply contact S. Marianne Postiglione, RSM by phone or letter and your registration will be secure. We accept Visa and MasterCard only. We have 35 rooms at the hotel. Those who register early will qualify for a single room. The fee for the weekend, exclusive of meals, except for breakfast is **$225.00 for members**; $250.00 for non-members and $140.00 for students. Scholarships will be available for those students who qualify.

3. The St Louis Review, the official archdiocesan newspaper, featured the ITEST faith/science interface modules, *Exploring the World, Discovering God* (EWDG) on the front page of the February 9th issue. For an on-line view of the article click on www.stlouisreview.com Read the progress report in this issue of the bulletin for more information on recent developments within this project funded in large part by a generous grant from the *Our Sunday Visitor Institute*.

4. Father Fred McLeod, SJ, a longtime and faithful member of ITEST and theology professor emeritus at St. Louis University, will offer Mass one day each month for all the living and deceased ITEST members. The ITEST Board of Directors wanted to continue this tradition begun by Father Brungs many years ago.

5. Father McLeod, SJ will also be the presider at a Mass celebrated at the Cardinal Rigali Center in St Louis on the first anniversary of Fr. Brungs' death and rising to new life. Although the actual date of his death is May 8, we will have the Mass – open to all who wish to attend – on **Monday, May 7, 2007 at 7:00 pm** in the chapel at the Rigali Center. We will have a notice in the May 4th edition of the *St Louis Review* alerting local ITEST members, friends and colleagues to the date, time and location. Join us as we commemorate Bob Brungs' life, his dedication to science and the Church "both of whom I love…" and the many contributions he made to the faith/science apostolate.

6. We have received additional donations to the *Fr. Robert A. Brungs, SJ, Memorial Fund* since December 31, 2006. Special thanks to Dr. Laurinda Harman, Francis E. Cardinal George, OMI and Don and Laura Ouellette.

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The complementary roles of science and religion

Dr. Thomas P. Sheahen, PhD

...in awesome wonder, consider all the worlds Thy hands have made...

These words, taken from the familiar hymn *How Great Thou Art,* convey a very essential point about the symbiosis between science and religion. God is revealed through nature. A corollary of this is that we can learn about God by studying nature. The basic intent of our present endeavor is to show how that can be done.

The idea that faith and science are complementary ways of seeking truth dates back to very early Christianity. For the great majority of the Christian era, scholars were completely comfortable with this unity. Here is a quote attributed to St. Augustine: "The book of nature and the book of Scripture were written by the same author, and they cannot be in conflict." In the 21st century, we need to restore that ancient confidence in the unity of faith and science. Everyone recognizes that we cannot teach *all* of science any more than we could ever teach *all* of theology. Consequently, in this program, the central goal of educating students K-12 must be to convey this sense of confidence, to make students comfortable within both the realms of science and religion.

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Dr. Thomas Sheahen attended M.I.T. and received BS (1962) and PhD (1966) degrees in physics. He is a registered Professional Engineer in Maryland. His professional career in research includes time with AT&T Bell Labs, the National Bureau of Standards, U.S. Department of Energy, Argonne National Lab, and most recently National Renewable Energy Lab; he has worked in the private sector as well, and has his own independent consulting firm. His work has been primarily in energy sciences, especially about ways to use energy efficiently. Dr. Sheahen is the author of the textbook Introduction to High Temperature Superconductivity. He has also taught physics at both the college level and in high school. With Fr. Ernie Spittler, SJ, he co-taught "Issues in Religion and Science" at John Carroll University in 1999. Sheahen currently serves as Vice-Director of ITEST.

1. Prerequisite: Overcoming the "fear factor"

The media commonly assert that science opposes religion, but that's just a way of floating a provocative sound byte. Many excellent authors[1,2] have described the types of interactions between science and religion. For example, Jack Haught[3] defines four easily-memorized categories:

a) Conflict: religion and science are opposed

b) Contrast: religion and science are completely separate

c) Contact: religion and science are distinct but interact

d) Confirmation: religion supports science

Where we are going in this program is a combination of c) and d). However, it is first necessary to address the first two categories.

a) Conflict: From early Christian days until well beyond the Reformation, scholars were comfortable pursuing knowledge, and never really distinguished between science and religion. Only in the 18th century were separate disciplines of knowledge identified, and labels such as *chemistry* or *geology* attached to them. It was not until relatively recently (< 2 centuries) that the perception of science and religion as enemies was asserted. In the audio-CD course *Science and Religion*[4], Lawrence Principe traces the "enemy" notion to two books of the late 19th century. The essential point for our purposes is that it wasn't always this way.

Due to the influence of *scientific materialism*, that "enemy" notion has received very wide publicity, and is commonplace in colleges today. In fact, we find many *Christians* believing it, without looking at the history of Christianity. Out of fear, some deliberately turn away from science, worrying that science might damage their faith. This is very regrettable, because in fact science offers an excellent pathway toward appreciating the glory of God.

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It is very important at this point to remember an educational principle: Unless we overcome the tension and fear associated with faulty perceptions about "enemies," little will be accomplished and students will revert to their old ways quickly.

b) Contrast: This is basically a way of side-stepping the perception of conflict, in which the two camps essentially say to one another "stay off my turf and I'll stay off yours." It is in the nature of a truce, and contains inherent instability. The term *Non-Overlapping Magesteria* (NOMA) was introduced by Steven J. Gould[5] as a label for this segregation. The instability arises because people find it unsatisfactory to hold different blocks of knowledge and never strive to unify them. Nevertheless, a fair fraction of scientists and engineers successfully separate the activities of their professional occupation from their religion, and live with the truce.

The two latter categories c) and d) are much more optimistic, and trust that God wants us to understand His creation. When we begin to direct students to the search for unity between science and faith, we do so based on a commitment to the idea that science and religion have something to say to each other, and can interact constructively.

2. Unity of Science and Religion

Despite enormous contemporary publicity (to the point of hype) about "Science **against** religion," authentic Christian teaching has always considered them partners. We will look at the early Christian perspective first.

a) Early Christian Faith/Science

The foremost expert on scientific matters in the Patristic period was the Church Father St. Augustine (356 – 430 A.D.). Augustine's insights have stood up exceptionally well over many centuries, and indeed he perceived the principle of the unity of space and time, which was long forgotten and only rediscovered as part of General Relativity in the 20th century. I might add my opinion that St. Augustine was the most under-rated scientist in history: under-rated because we've all heard of Newton and Archimedes, etc., but nobody thinks "science" with regard to St. Augustine.

St. Augustine held that nature offers a pathway to learn about God; and that God's creation of nature is parallel to the revealed truth of scripture. His foremost accomplishment was to unify the Christian faith with the pattern of reasoning that had come from the Greek philosophers. That unity is embodied in four major principles[6]:

1. There is a unity of truth – both in nature and in theology.
2. The Book of Scripture and the Book of Nature have the same author, and they cannot be in conflict (when interpreted correctly).
3. However, both books require careful interpretation.
4. While pursuing religious knowledge may be primary, scientific knowledge plays a very important supporting role – even in understanding the Bible.

Augustine stressed the importance of using reason as a tool to discern truth, and was very critical of those who refuse to seek compatibility between faith and reason. He was quite scornful of Christians who wouldn't strive to apply reason to articles of their faith; and he wouldn't settle for compromise where a conflict seemed to occur. Any apparent conflict simply signaled the need for deeper interpretation of *both* science and religion, which would march forward together. Augustine looked at the two slogans "I believe so that I may understand" and "I understand so that I may believe" and insisted that they form a pair, where both are necessary to advance knowledge.

Augustine's emphasis on the need for proper interpretation of *both* books is too easily overlooked. People have a vague feeling of what "Biblical interpretation" means, but generally ignore the fact that scientific observations demand careful interpretation as well. The history of science over the last several centuries is filled with examples of how new ways of interpreting the same data gave rise to better theories and more comprehensive understanding of nature: The Ptolemaic vs the Copernican theories of planetary motion; *phlogiston*; the *ether*; all were part

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of the continuing effort to interpret the book of nature. Contradictions have to be resolved, as Augustine said. It is little-remembered that 19th-century classical physics predicted a contradiction (known as the *ultraviolet catastrophe*), because of which Max Planck introduced the new hypothesis of the *quantum* of electromagnetic energy[7].

Augustine said that God created space and time together[8], and *that* was the beginning. He did so on philosophic grounds, arguing that "the beginning" could not have anything existing *before* time and space came into existence. Here, Augustine did not take the coordinate system for granted, but said that space and time were things God created, together. This was a brilliant leap forward, evidently about 1500 years ahead of his time. Pretty good for a fellow who never heard of the *Theory of Relativity*! In the present day, reason (mathematics and physics) comes around full circle to verify what Augustine first stated on faith.

His insight was forgotten over the ages, and by the middle ages, people assumed that the spatial coordinates of the earth constituted the center of the universe. Newtonian physics was built around the concept that time is absolute and immutable. Only in the 20th century did Einstein rediscover (when formulating the Theory of Relativity) that space and time are interchangeable and comprise a unified coordinate system.

Augustine saw clearly that the familiar question "What was God doing before he created the world?" was a nonsense question, because the word "before" has no meaning in the absence of time. Regrettably, Augustine's brilliant insights were lost, and to this day some people still ask the "before" question – because they still think of time as absolute, and incorrectly believe that God must exist *within* time, and be *subordinate* to time. They are placing a false god before God.

The key point to remember in all this is **not** about Relativity or Quantum Mechanics, but is this: St. Augustine always kept faith and reason together as his knowledge moved forward. When interpreting Scripture, he understood that humankind's ability to absorb what God wants to reveal is limited. That limits the accuracy of what is written down on paper. When interpreting the book of nature, he realized that sensory perception is likewise limited, and only presents the human mind with filtered information about an underlying reality. Hence in both cases there is a need for careful interpretation, using both faith and reason to achieve understanding. Augustine's insistence upon using *reason* enroute to an interpretation took him completely away from Biblical literalism as we know it today. This Father of the Church, writing around 400 A.D., considered the six-day story of creation very far fetched, and dismissed it, because it didn't stand up under even the science of those days. Augustine merged a very high confidence in the combination of faith and reason with a clear acknowledgement of humankind's limitations, and thus reached a high comfort level with both religion and science, knowing full well that both gave incomplete pictures of The Divinity.

With the passage of 16 centuries, can we do very much better? We know a lot more details, but Augustine's principles still stand.

b) Faith and Reason

One person who did not forget St. Augustine was Pope John Paul II, who in 1998 issued the Encyclical *Fides et Ratio* ("Faith and Reason")[9]. In this document, St. Augustine is shown to be highly relevant for today. Pope John Paul II takes on a number of contemporary errors, based variously in too much reliance on faith alone or too much reliance on reason alone. The consistent theme throughout this Encyclical is that faith and reason have to function together in a unified way, or else error is the result.

Remarkably, this Encyclical does not deal specifically with Catholic doctrine. Rather, its central messages are that *human life has meaning* and *there exists an eternal and transcendent truth*. *Truth* is conformity between the intellect and objective reality. Notice that these are "faith-statements," that is, statements which cannot be proven by reason alone, but which nevertheless are held to be true.

Errors on the side of overemphasizing faith include *Fideism,* a blind adherence to faith-statements that rejects the use of reason. In fact, *Fideism* doesn't even demand consistency, a fatal flaw under the light of

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reason. It "runs the grave risk of withering into myth or superstition." *Biblicism* (relying on Scripture alone) is likewise flawed, for several reasons, not least of which is trusting the translators to always get it right.

On the side of too heavy emphasis on reason alone, there are a number of 20th-century errors: *relativism* (no ultimate truth or objective reality; truth determined only by consensus): *nihilism* (no purpose or value to human life); *pragmatism* (no transcendent ideals); and *scientism* (no knowledge exists except that which comes from science). *Scientism*, which is very prevalent nowadays, asserts that all knowledge claims outside of science are nonexistent or irrelevant; it rejects the possibility of ethics, aesthetics, etc. *Scientism* leads to merely economic production, not human enlightenment. What is technically possible becomes indistinguishable from what is morally permissible.

Fides et Ratio points out that all these errors involve their own faith-statements, of a negative kind: "you cannot know [something]"; "you cannot discern truth." All those assertions diminish human culture, human striving, human dignity, human life. In contrast, striving toward ultimate truth is a worthy objective that should not be abandoned. John Paul II says to those positions: abandon your **negative** faith-statement and consider the **positive** faith-statements that there **is** meaning to life, that there **is** such a thing as transcendent truth; and see where it leads you. The Pope's familiar slogan "Be not afraid" comes to mind. His optimism about humanity is apparent.

The "bottom line" of *Fides et Ratio* reinforces St. Augustine once again: Faith does not oppose reason; rather, it guides reason and challenges reason to reach further upward than it could on its own. Working together, faith and reason can bring you closer to truth, and hence to God.

3. Key aspects of Science Education

The central question is: What do we want to teach young people? So far we have dealt primarily with getting the teachers to feel comfortable at the interface of religion and science. That is an essential requirement before any students can become similarly comfortable. Once that is accomplished, teachers can convey the sense of unity between faith and science.

a) Major Themes

Beyond the two cornerstone faith-statements in *Fides et Ratio*, a list of propositions that we want students to grasp would include:

God made a world that makes sense.

God made everything in nature, but He did it in a way that was so clever we cannot readily figure it out.

God reveals knowledge to us on His terms, not ours.

God gave humankind the ability to explain how things (including life) make sense.

Science is an important means of gaining knowledge.

There are limits to our possible knowledge.

It is right and good to push those limits back at the frontiers.

One extremely important proposition is this: There is more to reality than meets the eye. At church we recite in the *Nicene Creed*:

We believe in one God, the Father, the Almighty, maker of heaven and earth; of all that is seen and unseen.

Most of us gloss over that last clause; it isn't even present in the *Apostles' Creed*. The *Council of Nicea* put it in because there were doubts about unseen things like grace, and whether God created everything. Here we are saying that we believe there really **is** an unseen part of life, of the world, the universe. And I don't mean just *dark matter* or *dark energy* out in space. There are realities that exist but are not material: culture, music, interpersonal relations, love, honor, courage, and so on – the entire spiritual realm. We state that we believe that such things are **real**. The *seen* world is that which can be detected with our scientific instruments, via their interaction with our senses. The *unseen* realities are discerned through mental processes like thinking and reasoning – and faith.

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b) Curriculum Content

Working out the details of a K-12 curriculum about faith and science is a very worthy enterprise, well beyond the scope of this essay. Only very general guidelines can be suggested here.

Many scientists cringe at the "gee whiz" form of science teaching that pervades much early science education. A small child may find a rainbow awe-inspiring, so it is natural for a teacher to say that God made the rainbow. A reference to the Noah's Ark story sometimes follows. But to take that example and observe that it shows how God made a world that makes sense, a world that follows *natural laws*, would be foreign to most teachers. Selecting a science curriculum and a religion curriculum that fit together well is not automatic or easy.

If we assume that children's reasoning proceeds from the concrete to the abstract, we really have to concentrate to assemble the pieces of science being taught into a tapestry that displays the way God created it all. The abstract principle to be grasped is that God has a plan, and everything fits together and makes sense. God is not capricious, but caring. Most important of all, every child learns that God is smarter than our wildest imagination.

Somewhere in elementary school, children notice the similarities between animals, and a trip to the zoo reveals the similarity between a monkey and little brother or sister. *Evolution* is right around the corner. Rather than delay or conceal it, the central lesson to convey is about God's cleverness. We don't know how He did it all, but we can be confident that God created living things in such a way that we have a chance at understanding them. Believing that God also created *unseen* realities, we can teach that humankind functions on a higher plane where there is access to those realities, and hence humankind is qualitatively different from the animals.

Studying *ecology* offers children the chance to learn about complex systems, including the Biblical roots of the term *stewardship*. The idea that God would *trust us* with caring for other things he created is a powerful statement about the importance of each person, and reinforces the proposition that human life has meaning.

In both elementary and middle school, the most valuable thing a child can learn is *how to **do** science*. Without being asked to spell *epistemology*, we want children to be able to recognize when they actually **know** that something is true. Being able to tell the difference between a good and a bad experiment is within the grasp of middle-schoolers. However, most teachers of high school (and even of college freshmen) want to have a cookie-cutter lab experiment that gives the "right" answer every time. It is much better for students to confront experimental error and understand the limitations and weaknesses of measurements.

A cornerstone principle of doing science is that *experiment always trumps theory*. Any scientific theory is always subject to revision in case new data should be observed. But with that caveat, theory can take you quite a long way.

Gradually, mathematics is seen to have more and more relevance to nature, and in high school the student discovers the same things Galileo realized 400 years ago: a mathematical description can accurately account for a big fraction of the world around us. This is the opportunity to convince students that rational analysis serves well. Also, we should point out that reason proceeds in directions that are selected by faith-statements, and hence the two are intertwined.

The difference between a *hypothesis* and a *theory* should be learned. A *hypothesis* is tentative, something to be tried out to see how it fits some data; but a *theory* is a comprehensive set of organized statements that unifies understanding and has explanatory and predictive value.

At advanced levels, certain points need to be brought out, because there are scant opportunities later in life to learn them. For example, *Godel's Theorem* is a proposition in logic which shows that there are some statements that are true, and you **know** they are true, but you cannot prove them[10]. This is an important conclusion about human reasoning and provability, and prepares the student for the inevitable college classroom where the elusiveness of any *proof* of God's existence is discussed.

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c) Limitations of Science

In the science classroom, it is important to introduce students to experimental errors, because that teaches them about the limits of accuracy in measurements. Here, however, we address a far more important limitation that needs to be recognized: there are things that simply cannot be measured with scientific instruments.

Whatever **can** be studied scientifically is measured through the senses. Every observation, every instrument involves electromagnetic interactions.[11] This is the root of *sensory perception*. Mathematical knowledge (obtained through the human faculty of reason) is able to **extend** observations into a theory with explanatory power.

For example, a particle accelerator investigating *strong* and *weak* forces still reports out its data via electromagnetic interactions. That is why we believe we know something about elementary particles and their interactions[12]. We trust in the explanatory power of our theory so strongly that we confidently build nuclear reactors. Underlying it all, however, our theory is built upon faith and reason marching along together.

We are accustomed to ways in which the senses give erroneous impressions; an assortment of optical illusions provides entertainment in magic shows, etc. People learn not to always trust their senses, but too many people always trust scientific instruments, and likewise believe that science will eventually answer any question.

A variety of serious societal problems stem from the failure to recognize the limitations of science. The arrogant presumption that science will always provide an answer is more often held by those who don't understand science than by practicing engineers and scientists themselves. When those who hold political power trust in some abstract notion of "science" too readily, costly mistakes result. The famous study *The Limits of Growth*[13] of the 1970s became virtually U.N. doctrine, but in the 1980s, the development of the mathematical understanding of *chaos*[14] showed that the numerical solutions of equations in *Limits of Growth* were complete nonsense, and so were the international growth policies based upon that mathematical model.[15]

Students need to understand the limitations of science, in order to avoid the pitfall of trusting science too much. Science has no means of accessing the unseen world. Acknowledging that "all things seen and unseen" are components of reality is an essential step toward discerning the boundary between science and religion. Science deals with the *seen* world, filtering objective truth through the electromagnetic interaction that reaches the human senses. But science does <u>not</u> deny the existence of the *unseen*. *Scientific materialists* are mistaken when they overrate the importance of science and try to extend it to say "that's all there is."

Once both teachers and students are comfortable with science, appreciating both its powers and limits, it becomes possible to proceed to study science without fear of it disrupting religion. That really is an essential prerequisite. It also becomes possible to study religion without fear of it disrupting science (today, too many religion teachers assert a 6000 year old world). The faith-statement that God created "all things seen and unseen" assures us that **both** science and religion can contribute to human knowledge

4. Appreciating God's Created Universe

a) Beauty in Symmetry

At the deepest foundation of physics, we build theories based on our *belief* in *symmetry principles.* Physicists discern exquisite *beauty* in mathematical symmetries, and cherish a symmetric theory while disdaining any theory that violates certain symmetry principles. As scientists, we put great *faith* in the existence of symmetry principles. The laws of physics are all rooted in symmetry principles.

This theme is developed more fully in the ITEST book *Transfiguration*[16], where the connection between symmetry principles and the laws of physics is explored. There is a symmetry associated with time that says the results of an experiment cannot depend upon whether you set your clock to Eastern or Central time; that gives us the law of *Conservation of Energy*. It also shouldn't matter whether you do an experiment in St. Louis or San Diego; that gives us the law of *Conservation of Momentum*. Each of the major laws of physics derives from another symmetry principle. The mathematics

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here is too advanced for the K-12 curriculum, but the qualitative explanation is convincing. It makes such good sense that nearly all scientists just "take it on faith," which again shows how faith constantly acts as a guide for reason.

Notice that this adherence to symmetry principles is a form of faith-statement. There is no guarantee in logic that there must be mathematical symmetry in the equations governing physics; but it sure seems right to the human mind. Upon discovering a previously-unknown symmetry principle, physicists say "of course! How could it have been any other way!" A child in art class folds and cuts paper to construct a snowflake, and calls it "beautiful." The *beauty* that scientists discern in our equations presents a compelling argument that these equations correspond to objective reality, and hence are *true*. Careful dissection of this reasoning may find it circular, but it does appear that God endowed humankind with an ability to appreciate the beauty of mathematical symmetry. This in turn leads humankind to a better understanding of God's creation.

By contrast, when an equation works okay but symmetry is missing, it is not mathematically beautiful, and scientists distrust it. Our subsequent behavior pattern is reminiscent of St. Augustine's assertion that if faith and reason appear to disagree, then both need to be interpreted better until agreement is achieved. In any circumstance where we fail to recognize an underlying symmetry principle, our understanding is weaker for it. As theory advances, symmetry always seems to stand out when "we've got it right."

From here, it is a not too difficult a leap of faith for a contemporary physicist to say that all God had to do was think up some symmetry principles, and the universe came into being. Obviously that would be a faith-based statement, and surely it would not be the whole story!

b) **Symmetry of Space and Time**

Most people customarily take the coordinate system for granted, but St. Augustine did not. Augustine recognized that absolutely *everything* is created, and taught that God created space and time together. There is no evidence that Augustine appreciated mathematical symmetry; he was led to this insight by careful philosophical reasoning. Augustine also realized that God is totally superior to His creation, and therefore beyond (outside of) space and time. The subordination of space and time to God was a very significant insight. Another insight was that God is present to *all* space and *all* time. Consequently, what we humans perceive as the "passage" of eons of time doesn't bother God at all, because God grasps all time in a unified way.

Still, human sensory perception is an important factor in life, and everything in human experience tells us again and again that time is different from space. This completely ordinary way of thinking is an example of what Lonergan[17] termed *general bias*, and it is very difficult to correct -- because the structure of language, culture and thinking all reinforces the notion. It takes insistence upon mathematics and symmetry to treat time and space as equal dimensions.

By the 17th century, with Augustine long forgotten, Newton's laws treated time as different from space, and no one even thought about any symmetry being absent. It wasn't until Einstein's *Theory of Relativity* that space-time symmetry was restored. Today, the symmetric way in which space and time appear in the equations of physics is a compelling indicator that "we've got it right." Any better theory that comes along tomorrow must retain those symmetry principles.

When we trust in the validity of symmetry principles, especially between space and time, then reason begins to feed back into faith, refining and correcting our understanding. This is exactly the process explained in *Fides et Ratio*. The box titled Reinterpreting Omnipresence (page10) offers an example[18] of how this unfolds.

c) **Faith Within Science**

It often goes unnoticed that faith is used within science a great deal. There are unseen realities at work in science all the time. These factors are drawn from the realm of the intellect and spirit. In fact, it is necessary to make use of these unseen realities in order to do science at all. Trusting in the prior work of others is customary. When publishing scientific advances, the *peer review system* is based on mutual trust, and despite many imperfections, we have no better way to control quality in publications.

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this and ridicule it, and then jump to the assertion that all religion will someday be swept aside by science. Both the scientific materialists and the Christian fundamentalists adhere to extreme positions. They both promote polarization, avoid rational discourse, and convey to the general public the notion that there must be an either/or outcome.

Intelligent Design theory (I.D.)[25] was originally a finite series of statements about how God creates. Regrettably, it has been hijacked by the anti-Darwin contingent and turned into a component of their rear-guard battle against evolution. This is a big mistake, and ID has been tarnished through guilt by association. It is almost impossible for a scientist[26] to explore ID without being held up to ridicule on spurious charges. The battle going on over teaching evolution in public schools has produced the curious effect that the best teaching of evolution takes place in Catholic Schools[4], where evolution is not seen as a threat, but merely as God's way of creating.

The atheistic challenge typified by the Provine quotation above (wherein the random nature of evolution is construed as evidence for the absence of God) was taken on by the International Theological Commission, a team of leading Catholic theologians. The document *Communion and Stewardship*[27] reasons carefully about the nature of contingency (randomness) and reaches the conclusion that true contingency is not incompatible with purposeful divine providence. Anything random can only be random because God made it so. An unguided evolutionary process cannot exist. Quoting St. Thomas Aquinas, the document observes that the causation of God (the first agent) extends to all beings, and God made all the secondary causes. The neo-Darwinians who use random variation as evidence that evolution is unguided are straying beyond what can be demonstrated by science[28].

d) Multiverse

Meanwhile, over in the domain of physics, increasing attention is being given to the *Anthropic Principle*[29]. In its most theological embodiment, this argues that we are not here by accident, that from the outset the universe was created with the intention that we should someday be here. In physics, the ratio of certain numbers is very exquisitely tuned[30] to produce galaxies, stars, nuclear reactions, etc. in such a way that the universe can evolve life. These are sometimes termed "magic numbers."[31] The tuning in one case is accurate to at least one part in 10^{15}. As a consequence of these precisely tuned numbers, the probability of us being here by accident is vanishingly small.

This puts the scientific materialists in a very uncomfortable box. The only way to assert that we are a lucky accident is to hypothesize a *multiverse* – an infinite number of universes – in which we just so happen to reside in the only one that is working right. **And** those other universes cannot be observed. The trouble with this is that it violates the principle of *Occam's Razor*, a very basic canon of science by which you cannot festoon a theory with various features that are unobservable. Any hypothesis that is not subject to being tested is ruled out of physics at square one.

Thus, there is quite a high price to be paid if you want to believe in the *Multiverse* and say that all these very precise dimensionless numbers have no significance -- you have to abandon a basic cornerstone of science! Therefore, the person who assents to the *multiverse* hypothesis thus effectively **disqualifies** himself from being called a scientist. The *Multiverse* is the last refuge of the atheist who is so totally committed to his position that he will give up everything else to hold onto it.

The two features that stand out here are both bad news for the atheistic position. Regarding living things, the *International Theological Commission* has explained that the assertion that random evolution shows the absence of God is a claim that oversteps the boundaries of science. Furthermore, at the most fundamental level of physics, the evidence for God's intentional creation is so strong that the only refuge lies in a hypothesis that is total fantasy, completely disqualified from the realm of science.

6. Conclusion

To study God's created universe is to do science. To study God is to do theology. The two fit together. They advance our knowledge, enhance our participation in God's creative acts, and bring us closer to God.

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When we are comfortable with both science and religion, then we don't have to compartmentalize them, as in the NOMA hypothesis. We can regain the sense of unity of knowledge of which St. Augustine spoke. We can accept Augustine's dictum that sometimes advancing science requires us to re-interpret Scripture[32]. We can enjoy looking at God's creation through the two lenses of faith and science. The principles enunciated in *Fides et Ratio,* that there is value to human life and that there is objective truth, provide guidance through the assortment of modern errors.

Having only partial answers does not disturb those of us who see science and religion as friends. We have confidence that God is in charge and knows what He is doing. We are comfortable with St. Paul's famous admonition that "we see only imperfectly, as if in a mirror; but then we shall see face to face." We accept our position as one of His created entities, and are happy to have a role in the furtherance of evolution. We don't ask for too much all at once.

By studying science, students improve their ability to contribute to the forward progress of humankind. But to do so correctly, it is necessary to bring along religious faith, because that is where moral guidance comes from. The successfully educated student is one who appreciates both faith and science, and how they fit together in a unity of knowledge.

Endnotes

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24 Principe (ref. 4) explains that this viewpoint dates from about 1920, and is not present anywhere in historical Christianity.

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26 see, for example, Michael J. Behe, *Darwin's Black Box* (Touchstone: 1996)

27 *Communion and Stewardship*, International Theological Commission, Cdl. Joseph Ratzinger, chairman (2002)

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29 J. D. Barrow and F. J. Tipler, *The Anthropic Cosmological Principle*, (Oxford University Press: 1986)

30 Martin Rees, *Just Six Numbers*, (Basic Books: 2000)

31 T. P. Sheahen, "Six Magic Numbers in Physics," ITEST Bulletin 34, # 2 (Spring 2003), or in *Readings in Faith and Science* – II www.faithscience.org/en/topics/

32 St. Augustine, *Literal Commentary on Genesis.*

Reflection
The Best Trinitarian Image: Yourself?

Sister Carla Mae Streeter, OP, PhD

Are you surprised? We really need not be, as most of us recall the words very clearly...they trip off our tongues from our catechism days: "...made in the image and likeness of God..."

But we are no longer in our catechism days. We are in a world where profound theological meaning is sought for what we simply learned as true years ago. This search for meaning to the words and finding a way to express that meaning to ordinary folks is the task of theological reflection. Are the folks we meet day by day, the child we bend down to comfort, the dear face gazing at us from the bedclothes at hospice - is this human the very best image of the Triune God?

In each person there is a hidden psychic depth, a storehouse for experiences, smells, tastes, and touch. Feeling memory stores images there to dance before us in our dreams uninhibited. An ache issues from these depths, a longing for intimacy, understanding, acceptance. So profound are these human depths that we do not even understand our own mystery. Yet from these depths comes expression and language. We communicate with others to reveal ourselves little by little, like a child playing peek-a-boo. The more we feel acceptance the more we reveal. We entrust our self-revelation to those we sense are open to us being who we are.

Finally, we not only talk, gesture, write, and sing to express ourselves, we reach out. We hug, we move, we decide, we choose, we act. The deepest ache within us reaches out to make contact...to touch...to hold...to love. This three-fold humanness is so familiar to us that we seldom reflect on it. Yet in this threeness there is an imprint, a pointer designed to reveal the One in whose image we are made.

Our hidden depths are the imprint of that Abba, that "Father" who grounds our very being and longs to reveal Itself. Our wording through language and gesture and song is a chip off the ol' block. We are a word within the Word, never ceasing to express through our humanness just as the Divine Word has bound itself to the sacred humanity of the Christ in a marriage never to be dissolved. And yes, the very sigh that reveals our longing, our every outreach in love is revealing that Spirit which fires us up and cools us down when we are fevered, for action that will heal and build a new earth.

We are it. To ponder this mystery - the mystery of the human person being the most apt image of the Triune God - may help us to speak of it to those ready to reclaim this heart of our faith. For we are indeed the indwelt. We have a guest, and the guest is not temporary. This Divine Mystery has come to stay. Our very humanness is constituted in hiddenness, expression, and loving action. We are indeed made "...in the image and likeness of God..." It's time to reclaim our deepest truth, and then help others reclaim it...God is no longer "out there" somewhere. God is at home in the depths of our humanness.

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