



Institute For Theological Encounter With Science and Technology

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Technology and Faith: Partners or Adversaries?

A recent Email mentioned an 80th-anniversary commemoration of the beginning of “Vatican Radio” in 1931. The recently acclaimed movie *The King’s Speech* also drew attention to the significance that radio broadcasting acquired in the 1930s. The current turmoil in the Middle East is hard for dictators to suppress because of cell phones and the internet, which enable the opposition to act in a coordinated way. The speed of circulating information nowadays underlines the enormous changes that have occurred within our own lifetimes. Advancing science has driven many of those changes, and just keeping up with the advances in communication technologies is daunting.

High-speed computing has enabled visual images to be made of things inside the human body; think of CT scans and MRI imaging. Who can remember going to the hospital for “exploratory surgery” anymore? Information processing has revolutionized the way health care happens.

Perhaps the most significant visual imaging has been that showing the unborn baby inside the womb, derived via a computer-aided process that begins with gentle ultrasonic vibrations. Such images give incontrovertible scientific evidence of the reality of very small human beings—right down to the level of detail of fingernails. Today many kindergarteners bring to “show and tell” a picture of themselves inside their mommy. Looking at an ultrasound image of her own growing baby is the most successful means of turning a pregnant woman away from abortion. (Which explains why the abortion industry strives to prevent women from seeing such images!)

This scientific advance has changed the outlook of many people about the reality of unborn life. One very visible example of that changing outlook occurs each year at the annual Right to Life March in Washington DC, which now numbers about 400,000 people, where *the majority of the participants are young*. The average age of the pro-life movement has dropped considerably over the last decade, as great numbers of teenagers make the long trip to attend. College campuses, where abortion used to be the standard fix for a Saturday night indiscretion, now are the scene of vigorous debates; the old excuse “just a blob of tissue” doesn’t fly anymore. When the pro-life side shows ultrasound images, the other side is left speechless, so they try to change the subject.

Polling surveys reveal the dramatic shift toward the pro-life position. As a scientist, it’s comforting to realize that a big part of that shift has been driven by the advancing technology of ultrasonic imaging. On a parallel topic, the advances associated with adult stem cells have made embryonic stem cells irrelevant. Our ITEST conference next fall will be looking at that more closely.

Still, it is well to remember that technology can be used for good or ill; and it is our task to channel scientific inquiry along morally superior avenues. The early Christian message that the “two books” [book of nature, book of Scripture] cannot be in conflict because they’re by the same Author comes through very clearly when scientific progress reinforces the wisdom of the Word of God.

Within ITEST, we celebrate occasions when that compatibility becomes clear to the public. Our education programs across all grade levels strive to bring out that unity.

Dr. Thomas P. Sheahen
Director, ITEST

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Announcements

Spring Webinar for College Students and Campus Ministers

Join us online at www.faithscience.ning.com April 1-22, 2011 for a webinar entitled "Faith and Media," the second offered by the Institute for Theological Encounter with Science and Technology.

Under the leadership of Dr. Sebastian Mahfood, O.P., Associate Professor of Intercultural Studies at Kenrick-Glennon Seminary in St. Louis, and Rev. Mr. Kevin Vogel, transitional deacon for the Archdiocese of Omaha, the webinar will follow for its first two weeks three conversation tracks concerning propaganda, ethics, and chastity in preparation for the live talk through WebEx hosted by Rev. Mr. Jason Signalness, transitional deacon for the Diocese of Bismarck on Thursday, April 14, at 3:00 pm CST/4:00 pm EST. The webinar will conclude with a final week of plenary discussion as the three conversation tracks merge into one.

Sign up at www.faithscience.ning.com and prepare to join us beginning April 1, 2011.

Updates to the ITEST Web Sites

Bill Herberholt our web master has completed the updates to the ITEST web sites: On the www.ITEST-faithscience.org we have added new links, uploaded Volume 41, Nos. 1-4 of the ITEST Bulletin, updated the News and Events category and made some cosmetic changes. You may have to refresh your browser before you search for the updates. Once you access the ITEST web site, go to "VIEW" and then scroll down to "REFRESH." Click on that and your browser will be updated. The other ITEST site contains all the Pre-K—Grade 4, faith/science lessons in Exploring the World, Discovering God, (EWDG) at www.creationlens.org

Evelyn Tucker, our EWDG project manager and Cheryl Harness, our administrative assistant, have sent notices (e-blasts) to principals of all English speaking Catholic and Christian schools worldwide alerting them about the additional lessons created for Pre-K through 4. The e-mail invites the teachers and administrators to view and download the free lessons. We have already noted from our Stat Counter an increase in downloads since the e-blasts went out.

Annual ITEST Conference Slated for the Fall

The annual ITEST conference this fall will deal with progress in early life medical technology, including its ethical and moral implications. Focus will be on stem cell research and will include other issues surrounding the beginnings of human life. Recent advances pertaining to adult stem cells, notably re-programming to the earliest stages, have far outstripped developments in embryonic stem cell research. ITEST's intent is to give participants an updated grasp of the issues of the debate. This conference will be under the leadership of Fr. Kevin FitzGerald, SJ, PhD, a nationally well-known expert in this field from Georgetown University. Professor Donald Sparling of Southern Illinois University at dsparl@siu.edu is coordinating the structure of the program. Presentations will include both invited papers and contributed papers. To have your paper considered, send ITEST an abstract (<250 words) by July 1, 2011. The location will be in the St. Louis area. We are working on setting specific dates for the symposium but are anticipating that it will occur in late September to early October.

New Book of Note

Looking Beyond the Individualism and *Homo Economicus of Neoclassical Economics*, Marquette University Press, 2011, addresses the need to reconstruct mainstream economics principally by re-examining the way economists represent the economic agent.

This collection of ten essays, dedicated to the late Peter Danner, pioneer of personalist economics, examines in detail the basic defects in homo economicus who according to the mainstream way of thinking is a simple machine employing a pleasure-pain calculus to maximize personal net advantage—a never-changing and predictable economic agent essential to the mainstream's claim that economics is a precise science. Hardcover. List price: \$20. Book order information available at www.marquette.edu/mupress/

Online Teleseries Offered

Free online teleseries: "The Advent of Evolutionary Christianity: Conversations at the Leading Edge of Faith." www.evolutionarychristianity.com. The web site invites you to "...join some of today's Christian leaders and scientists for a dialogue on how an evolutionary worldview can enrich your life... and deepen your faith"



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Human Influence on Climatic Change

by Benjamin F. Abell

(We proudly and unapologetically reprint this essay written by Professor Abel for the 1990 ITEST workshop, The External Environment. Not only does Abell address the questions of the environment from the perspective of 20 years ago, but, his insights apply equally as well to the situation we face today in 2011. With the exception of a few references this paper could as easily have been written and published today. [Eds.]

The climate of the earth has changed from probably the earliest geological ages, four and one-half billion years ago when the earth was either formed or severely metamorphosed, down to the present. This climate change will presumably continue for many ages yet to come. Both the paleoclimatic record and the more recent historical climatic record produce evidence of climate change.

Paleoclimatic evidence of climate variation is available from ice cores and marine sediments combined with radioactive dating techniques. Tree ring data, particularly from stress species such as the bristlecone pine, yield a continuous record of climate variation dating back 5000 to 8000 years. Paleoclimatic evidence become fragmentary and ultimately disappears for the oldest geological periods. Some evidence enables one to draw conclusions concerning extremes of climate over the last one million years. A relatively continuous paleoclimate record is available over the last 100,000 years. This record yields quantitative estimates of a number of climate variables.

Meteorological instrumentation has been available for more than 200 years. Synoptic records have been available since the last half of the 19th century. Prior to meteorological instrumentation, manuscripts record information regarding crop yields, drought, winter severity and variation of inland sea level.

Climatic Change

We live in an unusual epoch of earth's climate history. There is considerable ice in both polar regions. Although there is fragmentary evidence of extensive continental glaciation 600 million year ago and again 300 million years ago, the poles were ice free during most of the earth's history. The earth was considerably warmer 65 million years ago than it is today.

The last ice age was at a maximum 20,000 years ago. At that time, the North American ice sheet extended as far south as the Missouri River. Isostatic studies estimate that there was 5,000 feet of ice over what is now Toronto, Canada and 8,000 feet of ice over the Hudson Bay region. While the

ice in both hemispheres has spectacularly retreated to its present limits, there have been several retreats and advances of the ice sheets since the last extensive glaciation. These variations have both responded to climate change and contributed to further climate change through feedback mechanisms.

Four epochal climate changes have occurred since the last ice age. The post glacial optimum, which peaked between 5000 and 3000 B.C., was a warm epoch. The extent of land ice and sea level were similar to today. Interestingly, the minimum land ice probably occurred around 1500 B.C. when the warm epoch was on the wane. Evidence of ancient plant and bog growth indicate warmer sea and land temperatures in high latitudes. Vegetative belts thrived at higher latitudes and altitudes. The European snow line was 300 meters above its lower limit today. The storm tracks and resulting precipitation belts shifted further poleward. Fluvial erosion in Antarctica dates to this period.

This was followed by a cold period which is now generally referred to as the post glacial climatic revertance. The lowest temperatures occurred between 900 and 450 B.C. There was a sudden reformation of the Arctic ice pack above 75 degrees North Latitude while the forest in Russia spread southward to the Dnieper River. Many of the present Rocky Mountain glaciers formed at this time.

The secondary climatic optimum from 1000 to 1200 resembled the post glacial optimum in many respects but was thought to be milder. There was no drift ice near the southeast and southwest coasts of Greenland around 1200 as Europeans established colonies on Greenland and Iceland. Vineyards in Europe were established 300 miles

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Ben Abell

Ben Abell has been professor of meteorology in the department of Earth and Atmospheric Sciences at St. Louis University since 1962. He earned his B.S. from St. Louis University in 1960, continuing with his M.S. in meteorology and statistics in 1965. His primary research areas are severe local storms, climate change, tropical cyclones and weather forecasting while his primary teaching areas are climate and humankind in history, mesoscale analysis and severe storms. He served as a volunteer broadcast meteorologist for radio station KWMU-FM from 1972-2007. Upon his retirement from the radio station, as a reward for his outstanding service, he was inducted into the St. Louis Radio Hall of Fame. Professor Abell has been a long-time ITEST member of the ITEST Board of Directors and an invaluable supporter and advocate of the faith/science mission and ministry

farther northward and there is evidence of warm droughty condition in the mid and upper Mississippi Valley at this time.

The Northern Hemisphere cooled off again during the Little Ice Age (1430-1850). This cool period was not as severe in the Southern Hemisphere. A large expansion of the Arctic ice pack contributed to the failure of the colonies on Greenland. The relatively high levels of the Caspian Sea around 1800 was the result of many years of precipitation exceeding evaporation over the drainage basins which supply the Caspian. The storm tracks and precipitation belts migrate equatorward during cold epochs and poleward during warm epochs.

There have been several large and many smaller climate changes in the last one million years. Many of these changes occurred simultaneously over the entire earth at irregular intervals. These changes were of unequal duration and intensity. The climate will continue to change.

Natural Causes of Climatic Change

At least six mechanisms are capable of producing changes in the climate without human interference. They are variations in the eccentricity of the earth's orbit around the sun, the precession of the equinoxes, changes in the obliquity of the ecliptic, continental drift and mountain building, volcanic activity, and variations in solar output. The first three mechanisms are collectively referred to as the Milankovich Theory.

The eccentricity of the earth's orbit refers to the shape of the path which the earth describes as it orbits the sun. This eccentricity varies over a period of 95,000 years from nearly circular, as it is at present, to more elliptical then back to nearly circular again. At present, the earth is closer to the sun in January and farther away in July. The difference is about 3 percent of the mean distance between earth and sun, but it can be as great as 9 percent as the earth's orbit becomes more elliptical. Accordingly the variation in the amount of solar radiation received at the top of the atmosphere from January to July will vary from about 7 percent for low eccentricity to 20 percent for high eccentricity. This affects the severity and lengths of the seasons producing opposite effects in both hemispheres at any one time.

As the earth rotates around its axis, it slowly wobbles like a top. This wobble is call the precession of the equinoxes. At present, the earth is closest to the sun in January and farthest away in July. In 11,000 years, this well be reversed and the earth will be closest to the sun in July. After 22,000 years, the earth will once again be closest to the sun in January. Like the variation in the eccentricity of the earth's orbit, the

precession of the equinoxes will affect the severity of the seasons producing opposite effects in each hemisphere.

The axis of rotation of the earth tilts at about $23\frac{1}{2}$ degrees away from a line drawn normal to the plane of revolution described by the earth's path around the sun. In other words, the earth tilts toward or away from the sun at $23\frac{1}{2}$ degrees (the obliquity of the ecliptic). This tilt is not constant but varies from about $23\frac{3}{4}$ degrees to $24\frac{1}{4}$ degrees and back again over a 42,000 year period. A small tilt would produce less seasonal temperature variation than a larger tilt. This would mean milder winters and cooler summers. Despite milder winters, the smaller tilt could encourage glaciation due to higher amounts of precipitation brought about by higher moisture content in milder winter air. Then an interesting positive feedback mechanism could activate, as increased glaciation raises the earth's albedo (amount of incoming solar radiation returned to space by reflection and back scatter). This would promote further cooling.

The current trend of the three mechanisms comprising the Milankovich Theory points toward a cooler earth with increased glaciation and perhaps a new ice age.

The continents are moving—very slowly measured over our average life span. Sections of the Pacific Ocean are spreading apart about 5 cm. each year. Spreading rates in the Atlantic and Indian oceans are less than half that figure. In geologic time, the movement is impressive. The continents were lumped together in a single super continent 200 million years ago. Africa and South America were joined as were North America, Greenland and the Eurasian land mass. The Atlantic Ocean is geologically new.

Not only have the continents changed position, but ocean size varies. Thermal contrast between land and water controls the world's gargantuan monsoonal circulation and influences the position of the mid-latitude jet stream and storm track. Both the monsoonal circulations and jet positions change from year to year and over historic and geologic time.

Erupting lavas and diastrophic movements build mountains, while weathering tends to reduce land areas to a single level. This would not only impact temperatures but would control precipitation and a lack thereof over large regions of the earth. This in turn would influence global climate.

Volcanic eruptions spew both gases and pulverized fine pyroclastic debris into the atmosphere. Volcanic dust can extend into the stratosphere following particularly violent eruptions. Once in the stratosphere, these dust particles may remain for a year or two and back scatter some incoming solar radiation. This cools the earth. Cool weather followed

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the gigantic eruptions of Asama in 1783, Tambora in 1815 (New England's year without a summer), Krakatoa in 1883, and Katmai in 1912. However, the cooling is only evidenced for several years following the eruptions. It would take widespread volcanic activity over many years to produce climate change for a longer period.

Finally, variable solar output could produce a change in climate. Our sun is a variable star. The solar constant is not constant. Of course, it changes due to external (external to the sun's output) influences such as the changes in the eccentricity of the earth's orbit and the precession of the equinoxes. Moreover, variations in both short wave solar radiation and corpuscular radiation from the sun vary over periods of years in cyclic and quasi-cyclic manners. Perhaps the 11-year sunspot cycle is most familiar, but there is evidence for both a 22-year cycle and several 90-year cycles in the last two and one-half centuries. There was little evidence of sunspots from 1645 to 1715. This period of little or no sunspot activity has been labeled the Maunder minimum.

The earth was relatively warm during sunspot maxima in the twelfth and thirteenth centuries. Interestingly, the hot droughty years in the central United States in the 1930s and 1950s coincided with the increasing curve of the second 11-year sunspot cycle within the sometimes elusive 22-year cycle. For years, investigators have been attempting to statistically link climate events with solar cycles. There appears to be something there but it is a very elusive something. Moreover, statistical correlation does not prove physical causality.

During the active phase of the solar cycle, the number of sunspots is relatively high. Sunspots are magnetic disturbances on the surface of the sun. They are cooler than the surrounding solar photosphere. During the active sun phase, solar flares and prominences become frequent. There is a measured increase in solar radiation in the ultraviolet portion of the spectrum eight minutes following a solar flare. This is followed—18 hours later—by an increase in the solar wind (corpuscular radiation). This increase in corpuscular radiation in turn triggers disturbances in the earth's magnetic field and is often responsible for brilliant auroral displays.

Temperature, density, and ionization increase in the heterosphere high above the earth's surface during the active sun phase. In fact, the atmosphere expands and bulges outward. The picture becomes murky when a cause and effect association is attempted between changes in density, heat and chemistry in the upper atmosphere and responses in the complex thermal and pressure fields in the lower 50 km. of the atmosphere. It appears that longer term

warming is associated with an active sun and cooling with a quiet sun.

In addition, the standard theory holds that the sun has increased its luminosity at a fairly constant rate over the last four and one-half billion years. Periodically, this steady increase may be interrupted by abrupt changes in luminosity amounting to as much as 20 percent. The calculated interval between these abrupt decreases in surface luminosity is 300 million years, which corresponds to the time scale of the epochs of glaciation on the earth.

There could be many primary causes of climate change. The six major natural causes, reviewed in the preceding sections, could trigger feedback mechanisms which could either accelerate or dampen the change. An example of climatic feedback is increased glaciation which then increases the earth's albedo and further lowers the earth's temperature stimulating additional glaciation.

The Human Factor

Most human climate modification is subtle and difficult to evaluate against the background of natural climatic fluctuation. Local climate modification by human activity can be dramatic. Some examples would be increasing temperatures caused by urbanization and industrialization and regional changes brought about by soil mismanagement or destruction of a natural resource such as forest or grassland. Evaluating human influence on large scale climatic fluctuation is an entirely different matter. The four human activities capable of producing climate change, which are most often cited by present day investigators, are the expansion of the urban heat island, increasing the atmospheric greenhouse effect, increasing the back scatter of solar energy due to particulate pollution, and deforestation and desertification.

Urban industrial centers often create a local climate which differs from that of the surrounding countryside. This is called the heat island effect. A city retains more of the day's heat than the surrounding suburban and rural areas. The nighttime temperature contrast between city and country is greatest under clear skies and low wind. This difference disappears under overcast skies and/or windy conditions. Sensible heat is also added to the atmosphere in an urban-industrial complex due to energy consumption and industrial processes. Local climates are spectacularly and irreversibly changed by increased urbanization, but the contribution to global climate change is miniscule.

In the late 1800s, the average temperature of the Northern Hemisphere began to rise. This temperature rise continued through the first half of the twentieth century and was

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more noticeable in mid and high latitudes than in tropical regions. The generally accepted magnitude of temperature rise ranges from 0.5° C to 1.0° C. Scientists began taking a long hard look at this trend in the 1950s and many of them settled on the well established 15 percent increase in the atmospheric carbon dioxide content as the primary cause. Carbon dioxide is transparent to short wave solar radiation but it selectively absorbs long wave terrestrial radiation. This increases the atmospheric greenhouse effect and should produce a rise in the mean temperature of the earth.

The world climate refused to cooperate with this theory and began cooling around 1955. The cooling trend accelerated in the 1960s and made up about half the ground lost during the earlier warming period. The carbon dioxide greenhouse theory began to fall into limbo. Some scientists sought to explain the cooling in terms of increased back scatter of solar radiation due to an increase in particulate pollution. The cooling trend leveled off in the 1970s. The temperature trend has shown considerable year to year and region to region fluctuation since 1975, but the overall trend appears to be one of renewed warming. As a result the carbon dioxide greenhouse theory is experiencing a resurgence.

What is the bottom line? Atmospheric carbon dioxide content has increased about 17 percent over the last 100 years. Scientists are now turning their attention to increases in atmospheric trace gases such as methane, ammonia and several of the chlorofluorocarbons which may also increase the atmospheric greenhouse effect. These conclusions appear theoretically sound, but there are some serious problem areas with this theory.

Water vapor, which is extremely variable from one geographical location to another and from season to season within many geographical areas, is also transparent to solar radiation and selectively absorbs terrestrial radiation. The water vapor content of the atmosphere is several orders of magnitude greater than that of carbon dioxide, and the carbon dioxide content is much greater than that of the combined aforementioned trace gases. If water vapor content changes, its greenhouse effect would dwarf that of carbon dioxide and the trace gases.

Is the water vapor content of the atmosphere changing? It is difficult to say. If an increase in carbon dioxide triggers a small temperature rise, one could reason that the resulting temperature increase would promote more evaporation and, therefore, more water vapor. This could contribute to runaway warming. However, an increase in atmospheric water vapor should lead to more cloudiness and precipitation. This would increase the earth's albedo and lead to global cooling. Perhaps the increase in atmospheric carbon dioxide is not the monster that many of the modern

prophets of doom say it is.

Combustion due to human activity contributes to climatic change in another manner by adding aerosols to the atmosphere which increase the earth's albedo. Although most atmospheric particulate matter is the result of natural processes such as weathering, the human contribution has an impact. While dark aerosols such as soot may actually absorb more solar radiation, light colored particles reflect solar energy. Both dark and light particles back scatter incoming solar radiation. The overall effect appears to be an increase in the earth's albedo. Aerosols may also absorb some terrestrial radiation, but the cooling due to the albedo increase should predominate.

Finally, human modification of the earth's vegetative cover can have a dramatic impact on microclimates and regional climatology as well as some input on global climate. The greatest impact is realized through desertification and deforestation. Deserts continue to spread. This often results from overgrazing mainly carried out by practices of nomadic cultures in the Third World. When overgrazing is combined with periodic drought, the desert migration into semiarid regions accelerates. The tragic events in the African Sahel during the 1970s and 1980s is a dramatic illustration of desertification. Left alone for many years, an area could rebound. Sadly, most desertification is irreversible.

Modern societies clear forested areas in order to increase agriculture and logging, drain swamps, stimulate herding and improve chances in war. This often ruins a landscape over large regions. The most widely used and effective tool in the human arsenal for land clearing has always been and still is—fire.

Wildfire due to lightning is one of the oldest of natural phenomena. Many ecosystems not only tolerate but encourage fire. It is the dominant selective force for determining the relative distribution of certain species, and it stimulates and actually feeds effective nutrient recycling. Humans adopted fire as a land clearing tool thousands of years ago. Originally, people brought their fire to North America across the land bridge from Asia. The next wave of fire practice came to the New World from Europe.

When Europeans crossed the Appalachian uplands to settle in what is now the central United States, they encountered an immense sea of grass, the prairie. They should have seen vast forests. Climate will support widespread grasses in only two regions. One is located in the broad belt between the great low latitude deserts and the equatorial rain belt or in a monsoon region, where a lengthy dry season promotes tropical savannah growth. The other regions which can

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naturally support widespread grasses, are the mid-latitude semi-arid areas produced by rain shadows in the lee of mountains. Sparse precipitation in these areas produce short grasses and scrub.

The prairie was the result of annual late summer and fall fire setting by the hunting and gathering native Americans. Europeans continued the practice in order to promote agriculture. Forests have made a comeback in some areas where Europeans replaced native Americans. This is an example of human modification of vegetative cover on a grand scale. The regional climatology responds to the changing albedos brought about by the new vegetative cover.

Both desertification and deforestation increase the earth's albedo over large areas and this immediately changes the regional climate and eventually world climate by altering the location and intensity of precipitation belts.

Societal influence on *regional* climate change is profound and in many situations irreversible. Societal influence on *global* climate change is another question. The impact is simply not known. Certainly, immediate attention and corrective measures should be brought to bear on desertification and deforestation, but there is no evidence of runaway global warming due to increasing carbon dioxide content in the atmosphere. Perhaps the combination of increasing carbon dioxide content and particulate pollution is resulting in a climatic standoff.

Making Sense of Evolution

by John F. Haught

Reviewed by Thomas P. Sheahan

In this short and very readable book, John Haught offers a fresh understanding of evolution as a means of God drawing creation toward Himself. This stands in sharp contrast to the often-cited view that God created everything in the past and now sits back to watch as the system runs.

There is a widespread public perception that science opposes religion; atheists have bullied many believers into accepting their premise that being a scientist demands abandoning any type of faith. Evolution is their favorite battleground, the place where you're expected to choose one side or the other. Enroute to rejecting atheism, plenty of Christians have therefore turned away from science, thus reinforcing the either/or perception. The great value of *Making Sense of Evolution* is that it exposes this false dichotomy, and explains how theology and science each contribute to a deeper level of understanding.

In several previous books, Haught has examined the influence of Darwin upon our understanding of God [*God After Darwin, Deeper Than Darwin, God and the New Atheists*]. Here he presents his picture with exceptional clarity, and unifies several concepts that stood in isolation previously. Brevity makes it easy to digest and comprehend the topic of each chapter before going on to the next.

Among other things, Haught explains that *both* the atheists and the creationists are making essentially the same mistake, although they are poles apart. Therefore, this book will not make any friends in either group. Haught shows that materialism (*evolutionary naturalism*) is just as much a religion as standard religious ways of thinking.

The book begins by proposing a conversation to which Darwin is invited. In the introduction, Haught is very clear about his own stance: "...specific concepts—such as design, descent and diversity—whose theological interpretation must now undergo drastic revision in the light of evolution. Christian theology, I firmly believe, cannot responsibly take refuge in pre-Darwinian understandings of these concepts." He identifies the major problem that many religious people regard Darwinism as synonymous with atheism—a consequence of the inordinate publicity given to popularizers of Darwinism such as Richard Dawkins and others. "Dawkins and Dennett have misled students, professors and the public into thinking that Darwin was an enemy of all things theological." Throughout the book, Haught first cites one of those authors and then carefully compares the specific and limited scientific reality underlying evolutionary facts with the sweeping generalizations to which the proponents of atheism leap.

In the first two chapters, Haught carefully defines certain terms and emphasizes that science should not strive to replace theology. Darwin himself never heard of Mendel, so genetics is absent from Darwinism. The subsequent combination of Darwinism with genetics became known as the "modern synthesis" or "neo-Darwinism." "Scientific Naturalism" is the creed which holds the belief that, as far as science is concerned, nature is all there is and that the search for supernatural explanations is not part of scientific inquiry." Haught explains how Darwin's thinking

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developed over time and how *Origin of Species* was written and published.

A key theme is enunciated sharply when Haught makes this distinction (p.18, ch. 2) : “...many Darwinians today, the chief being Dawkins and Dennett, do not stop with science. Instead they operate as cryptotheologians by insisting that natural selection is a substitute for the traditional theological accounts. ... they too are still theologians at heart. ... They believe that in the quest to find a foundational understanding of design, science and religious faith are locked in a contest to the death.” Haught perceives their energy is misplaced.

Darwin himself always had theology on his mind, which affected his way of thinking about nature. Darwin eventually “traded in” theology in favor of scientific naturalism. In a particularly insightful paragraph (p. 19, ch. 2) Haught points out the way in which confusion about the proper roles of science and theology caused the conflict: “By trading in theology directly for science, many evolutionists today are also making another kind of blunder, the underside of the first. They are assuming that theology has for centuries been nothing more than a primitive attempt to do science in a pre-scientific age, and that it must now give way to a more reliable kind of science, especially Darwinian biology. Here again the fundamental assumption is that science and theology are playing the same game, trying to provide information about the natural world, and that modern science has proved to be much better at it than traditional theology.” Haught establishes that both atheists and creationists are making the exact same mistake this way.

Early on, Haught explains the fallacy of trying to substitute science in place of theology— a pivotal point of this book. Some questions have different answers on quite different levels, which do not conflict with each other, because they’re not responding to the question in the same sense. For example, says Haught, to a question about what the words on this page mean, you can give one answer about ink and paper, another answer about the meaning of the author, and a third answer about the intent of the publisher. That’s an example of answering on different levels. A familiar expression of this principle is “Science asks ‘how’; philosophy asks ‘why’”.

Throughout the remainder of *Making Sense of Evolution*, this attention to different levels of answering questions recurs. In chapter 3 we read “To make God the answer to scientific questions is to shrivel what infinitely transcends nature into something small enough for mathematical equations to capture. This is bad theology as well as bad science.” Also: “I want to emphasize again that if both scientists and theologians could become open to the idea

of layered explanation, the phrase “rather than” would not show up as often as it does in contemporary discussions of faith and evolution. Neither science nor logic compels us to make an either/or choice. Life’s design and diversity are the results of both evolution *and* divine creativity.”

Once the reader accepts this viewpoint, a lot of things come into better focus, and many seemingly contradictory situations are resolved quite clearly. In fact, seeing through the lens of non-conflicting levels may be why so much is covered in only 150 pages.

In Chapter 4, Haught squarely addresses the body-soul dichotomy: “This picture of matter giving rise by small steps to life, then to mind, morality, religion, art and culture, has not been easy for all Christians to embrace.” Subsequently he reminds us “Believers can have a sense of being grasped by the divine mystery, but they cannot grasp it themselves. They can speak in symbolic terms about the God from whom all the lower levels of being descend, but they cannot know God with clarity.” Next, Haught advances to consider the role of *information*, which undercuts the reductionism that has been a cornerstone of *scientific materialism*: “What I am proposing here, however, is that an awareness of the informational dimension silently at work in the universe offers at least one way to understand how different levels of being and value can descend from earlier developments in evolution without being completely reducible to them.”

In chapter after chapter, Haught perceives different levels where others have previously seen total conflict between science and religion. Chapter 5 is entitled “Drama,” and first hints at a concept that will later become clear: God acts from the future, drawing evolution forth toward Himself: “Why is the natural world endowed with the exquisite blend of indeterminacy, lawfulness, and temporality, giving it the dramatic substructure that allows an evolutionary story to occur at all?” Haught refuses to enter the entire arena of disputes about design between atheists and advocates of *Intelligent Design*, because he wants to examine evolution at a deeper level. And he goes on in later chapters to demonstrate compatibility on that deeper level.

Chapter 6 is about *teleology*, the concept that there is a direction to evolution. This is the longest chapter, still only 19 pages. Haught concedes that evolutionary biology and biochemistry won’t discern any direction, because they don’t operate at the right level. “Meaning or purpose simply cannot show up at the level of scientific analysis.” and the atheist view “... is a belief for which there can be no scientific evidence, and it is one that demands from science a kind of insight that it cannot in principle ever provide.” The atheist’s limitation is described: “It scarcely

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occurs to them that their idealized divine conjurer would produce only artifacts suitable for a display, not a drama featuring the struggle of life and the transformation of the entire universe into more interesting, if dangerous, modes of existence.”

Having shown the inadequacy of the atheist viewpoint, Haught offers an alternative that never contradicts biology, but offers an explanation that includes four components, notably a release from lifeless and mindless determinism; and introduces a new formulation: “A Christian theology of evolution may assume that God enlivens and gives meaning to the world not by pushing it forward from the past, but by calling it into the freshness of an always new future.”

This moves completely beyond the familiar public arguments of the past, where the concept of *teleology* was either rejected or embraced. That featured an “either/or” split, a confusion of levels, and a very restricted picture of God; all of which *Making Sense of Evolution* rises above.

In Chapter 7, the reader is urged to leave behind the simplistic views of either atheists or creationists, and instead “look down further into this abyss” (caused by Darwin). Haught draws primarily upon the insights of Paul Tillich, who perceived clearly that treating God as an intervenor or designer diminishes our perception of God. That limited perception is what atheists and creationists are fighting about, but Tillich looked deeper. “But belief in such a diminished deity, Tillich insists, can no longer survive, nor does it deserve to survive, especially in the age of science.” “The fact that believers persist in linking God directly to special events in nature is one of the main reasons so many scientists find Christian faith incompatible with evolution.” “It is not only scientifically but also theologically objectionable, Tillich would add, to make God play such a reduced role. Situating divine action anywhere within a chain of natural causes means denying God’s transcendence. Doing so is both scientifically self-defeating and religiously idolatrous. Thinking of God as a kind of cause that can eventually be replaced by scientific explanations is one of the main reasons for the rise of modern atheism.” In asking the reader to probe to greater depth, Haught calls attention once again to the different levels addressed by scientists and theologians. He ends the chapter: “The fact that nature has an inexhaustible depth allows both science and theology to comment on the drama of life without coming into conflict with each other.”

“Death” is the subject of Chapter 8, and again the emphasis is on distinguishing between levels that don’t conflict. “It is not the job of theology to justify death by situating it solely within the context of a purely naturalistic understanding of the universe. Instead, theology asks whether the naturalistic

point of view as such is intelligible.” Clearly, theology attends to a level that goes beyond the confines of science. “Theology is critical of evolutionary naturalism ... because the latter makes such an easy settlement with death. Even though death may be intelligible to science as part of nature, nature itself remains unintelligible to theology when considered apart from its eternal ground and depth. Consequently, the present chapter makes no attempt to make sense of death by staying within the cramped confines of a naturalistic worldview.” “To Christian theologians, the challenge after Darwin is to think of the universe as a place of promise and purpose...” Haught draws upon the work of Whitehead, which leads to these observation: “Modern scientific materialism ... has unfortunately rigidified nature by trying to fit it fully into spatially measurable models.” and “An unfinished universe is one in which awareness of God comes only in the mode of promise rather than conclusive comprehension.” God remains hidden from us.

Chapter 9 examines the assertion that morality developed only as an evolutionary adaptation: “The typical Darwinian explanation of every level of ethical aspiration nowadays comes down to the same hypothesis: genes are trying to get into the next generation.” By taking careful note of four parameters of the evolutionary naturalists *own* code of ethics (especially their insistence upon the high moral value of adhering to scientific knowledge), Haught reveals their inconsistency and the self-contradiction inherent in attributing their ethics only to evolutionary adaptation. “A purely evolutionary explanation of virtue, I am arguing, cannot justify taking seriously the evolutionary naturalist’s own highest ethical ideal, that of seeing truth for truth’s sake.” Ridiculing primitive religion (which atheists commonly do) does not survive sophisticated inspection. After demonstrating that naturalism alone cannot account for morality, Haught reaches this now-familiar plateau: “In our layered understanding of explanation, there is no inherent contradiction between a theological account of morality as a response to God on the one hand, and an evolutionary account of the gradual emergence of morality on the other.”

Where does the religious inclination of humans come from? In Chapter 10, again making distinctions with precision, Haught shows that the scientific materialist position is every bit as much a *belief* as any theist’s position. Scientific materialism “... has its origin in an even more fundamental devotion: *scientism*, the belief that science is the only reliable guide to truth.” And “... the ‘empirical attitude’ of science is the sole reliable road to right knowledge and that ultimately reality is reducible to mindless matter. But this belief is itself incapable of empirical confirmation or

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scientific demonstration.” Haught critiques materialism as a belief system, a surrogate religion, and concludes it is a “self-subverting worldview.” He adds the quip that they “may themselves be merely adapting to the contemporary intellectual environment, one in which embracing a naturalistic brand of devotion is at times a necessary condition for academic survival.” Haught dryly adds “... it seems prudent to ensure that our grounding beliefs are not self-contradictory, and evolutionary materialism fails to pass this test” because it “is compelled by the logic of its own belief system to make cosmic mindlessness the ultimate foundation and explanation of the human mind.” Haught quotes Darwin’s own worries about the uncertainty of trusting his own mind.

In the final chapter, Haught assembles all these pieces *to make sense of evolution*. He draws primarily upon the work of Pierre Teilhard de Chardin, who formed a synthesis of faith and science that presented a coherent picture of evolution, not merely up to the present, but projected into the future as well. He observes “... Teilhard’s work has been misunderstood and increasingly ignored by scientists and Christian theologians alike. This is unfortunate as far as any significant theological conversation with Darwin is concerned. ... it will be essential to distinguish carefully between Teilhard the scientist and Teilhard the theologian.” Haught does that quite well, and in very few pages presents an excellent summary of Teilhard’s most important insights, which may very likely motivate the reader of *this* book to read Teilhard’s original books. He also displays how Teilhard’s

view is both Christian and yet compatible with Darwinian science, going beyond and looking toward the future, from which God is calling us forward. Haught shares this future-oriented outlook with this entirely optimistic final sentence: “Even though Darwin himself seemed oblivious to the potential his discoveries have to stimulate theological, spiritual and ethical renewal, his theory of evolution is a great gift to Christian theology and spirituality as they seek to interpret Jesus’ revolutionary understanding of God for our own age and future generations.”

Making Sense of Evolution distills the essence of a dozen previous books by John Haught into a clear exposition of the compatibility between theology and evolutionary science. It does so by discerning different levels on which questions can be answered, and by demonstrating the error in assuming that an “either/or” outcome is required. It reverses the old notion of God’s role as a clockmaker, offering instead the more open (and optimistic and hopeful) concept of God calling forth an evolving universe from the future.

Who should read this book? It is not “specialized” at all. Professor Haught teaches undergraduates, and this text is entirely accessible at the undergraduate level. Church book-discussion groups will find it easy to move through one chapter a week. I highly recommend it to any scientist who is open to the idea that science might not encompass *all* possible knowledge; and any Christian who is open to the idea that evolution might actually be God’s method of creating.

A Seminar with Stanley Jaki (1924-2009)

*An ITEST workshop, October, 1991
(from an oral presentation)*

(In 1991 ITEST was fortunate to engage Benedictine Priest and physicist, Fr. Stanley Jaki for one of its conferences. A 1956 refugee from his native Hungary, Fr. Jaki came to the US where he quickly became a much sought after lecturer. He held the position of Distinguished Professor of Physics at Seton Hall University in Princeton, New Jersey from 1975 to his death in 2009. In the preface to this volume, Fr. Robert Brungs, SJ, director of ITEST at the time, wrote):

“As Christians in science we must never forget that our data base is revelation. Our task, as I see it, is to use science as a means to understand the world that is, as St. Paul said, waiting to be freed along with us in order to enjoy the freedom of God’s Kingdom. Science is not a method nor a body of content by which we are to judge the revelation which God has given us. It is a further task for us to show

that there is no contradiction between the revealed Word of God and the creation that has come forth from his hand. The proper approach is, I believe, the one mentioned by St. Augustine a millennium and a half ago: “whatever they [here scientists, etc.] can really demonstrate to be true of physical nature, let us show to be capable of reconciliation with our Scriptures.”

JAKI “There are two main contributions that modern scientific cosmology can make to the metaphysical cosmological argument: the universe is to be taken for a reality and for a very specific reality at that. But modern scientific cosmology is no proof of the creation of the universe. It is not even proof of the universe. Modern scientific cosmology presupposes the universe as a reality.

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Immanuel Kant had a marvelous though not original insight—in fact Descartes had already stated it—that the three main realities are God, the universe, and the soul. Instead of soul, Descartes used the will. It doesn't matter. It is a minor point. God, the universe, and the soul are metaphysical notions, in spite of what we read in such books as *A Brief History of Time*, which has only one major shortcoming. It is not brief enough. It is an appallingly shoddy work as far as the history and philosophy of science is concerned. It ends with an almost hare-brained claim—in a humanistic wrapping.

“Thus Stephen Hawking says that scientists should try to produce such a simple explanation of the whole universe that every layman may understand it and discuss it. But then he gives away the game because he urges the layman—he doesn't urge the scientist but he urges the layman—to have recourse to the insights of all the great philosophers of the past and in particular to Aristotle and Kant. Now, we can have the insight of one or the other but not those two taken together. Otherwise one would try to mix fire and water.

“The universe—please don't forget this—is a metaphysical notion. And how do we prove its existence? Let me point this out: Christian theology teaches two things about the universe: that it was created out of nothing *ex nihilo*, and it was created in time. “The “nothing” is one of the most fundamental Christian notions. If we throw away “the nothing,” we are finished off as Christians who can claim any rational self-respect. The notion of “nothing” is one of our most cherished possessions. If we let “the nothing”—via Bergson or modern quantum creation or other nonsense—slip through our fingers, we have lost everything.” (p. 80)

A seminar participant, Dr. Robert Collier, asks Jaki: “Is it true that Christianity is not needed to push science forward? Yet you seem to indicate in your writings that Christianity still has a role to play in the discovery process. Can we separate deductive and inductive reasoning in the scientific discovery process?”

JAKI “To the extent that Japanese scientists or Hindu scientists stick to their Buddhism or Hinduism, they will carry an intellectual weight, a burden which will impede their doing creative work in science. If we look at modern Japanese culture or modern Hindu culture, we must ask why so few basic insights in physics have come from Japan during the last 50 years. The total number of Japanese Nobel laureates in physics is two. If we look at India, we see exactly the same problem. To that extent they seem to carry an inhibiting factor in themselves.

“When we talk about the post-Christian culture, we don't mean that it has become radically pagan. There are

a great many elements from the Christian contribution still surviving in the post-Christian world. But they are no longer considered as Christian contributions unless or except when they are subjected to careful analysis as to their provenance. So we are both post-Christian and still Christian in the sense that we behave like non-Christians but in our thinking there are still a great many Christian elements. (p. 131-132)

Fr. Donald Keefe, S.J., asks Jaki to comment:

“Let me return to the question of reductionism. There is a quest now for experimental resolution of the question of whether the universe is in a process of indefinite expansion or in a cyclical type of expansion and contraction over an indefinite period of time. Is this an instance of the desire to reduce physics to a simplicity which is simply unattainable? This seems present in the quest for missing matter. I gather that something 90 percent of the mass necessary for the universe to be in an expanding and contracting mode is missing. But the quest for this is one of the most adamantly pursued in contemporary physics if one reads the popularization in, for instance, the New York Times. Would you care to comment on that?”

JAKI “Well, I think that there we are faced with not so much reductionism as with the pantheistic craving for *eternalism*. It is the other watershed between the Christian outlook on existence and the non-Christian outlook on existence. You remember what I said about creation in time. We know it only from Revelation, St. Bonaventure and some Franciscans notwithstanding. But mainstream Christian thinking keeps asserting with Thomas Aquinas that we know that the universe has been created in time only from Revelation. With this, Christianity brought into modern man's consciousness a problem with which our modern post-Christian mentality, is unable to cope. If the universe started in time, the universe could not have started itself in time. So someone outside the universe had to start the universe in time

“That is precisely the problem of pantheists. Nietzsche, for instance, wanted pantheism's eternal recurrences, because this was a way for him to free himself and mankind from transcendental shackles. If the universe is pantheistic or eternal, to whom are we accountable? To nature? It is very easy to compromise with nature, especially if the sunset is beautiful and your stomach is full. In other words, the whole issue with pantheism is that we are not accountable to anyone; we are our own masters. Unfortunately, many people prefer the idea that we're just bubbles that come and go; no further questions are asked. This perspective is very comfortable as long as we are surrounded by the

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comforts of western technology. Thus, part of our problem in the western world is that we're simply far too well off. This gives us exceedingly strange notions and ideas about human purpose and human existence." (p.133-134)

Gary Menard, SJ, asks:

"Do you think Christians in science have anything special to offer to science as you defined it, or do you think it would be better for Christians to confine themselves to ethics and metaphysics?"

JAKI "Christians in science should talk of what they know best, namely, science. Moreover, they should know the limits of the scientific method. A hundred years ago, Maxwell, towards the end of his life said: 'The greatest test

of a scientific mind is to know the limits of the scientific method.' In other words, let's look at scientists who produce quantitative results. As soon as scientists interpret them in a broader context, philosophical or ethical or cultural, they are talking beyond their competence. Scientists should be aware that this is what is happening. One of the problems we have in scientific education is that hardly a single word is being said about the limits of the scientific method. In fact, students are taught the exact opposite. Endlessly their teachers suggest that science can solve all our problems.

"So, if you want to serve mankind or humanity, in manifold ways, then we must know what we are doing in a particular context and a particular time." (p. 139.)

Easter

Carla Mae Streeter, OP

Who Cares?

"He... saw the linen wrappings lying there, and the cloth that had been on Jesus' head, not lying with the linen wrappings but rolled up in a place by itself." (John 20:6b-7)

This is an account of the most significant event in human history, and we're commenting on grave cloths? Give me a break.

But not so fast. We might just be missing something quite amazing. Nothing is written except for our instruction, for our edification. So in our huffiness maybe we need to pause and stop rolling our eyes in indignation. Why would the sacred writer add this reference to grave cloths? There is not only a reference to the cloths, but a special note about the cloth "...that had been on Jesus' head...rolled up in a place by itself."

Grave cloths are all about death. They are about binding, wrapping, covering. They are about the old Jesus, the Jesus bound in his passion, wrapped in his infancy in the swaddling bands of human limitation – needing to be fed, needing to be carried, needing to be cleansed and changed,

needing... needing... needing... They are all about needing to be buried before one begins to decompose. I think the sacred author is telling us that all this is put aside now. All this human limitation...tiredness, victimization, bleeding, dying...is now past. The former way of being human is over. The new has come.

This is all about the new Jesus. This is all about the preview of coming attractions about us. This is all about what we shall be too, not only Jesus. What are your "binding cloths"? What holds you tight, confines you, restricts you, limits you? Whatever it may be he has joined you there. He deliberately chose to be limited, to companion you there.

But no more. Now he is new. His humanness is different. He is transformed as though the transfiguration on Tabor has suddenly become permanent. He shows them and us a new way of being human, a future for us all. He shows us what physicality looks like when the body becomes transparent of love. Quite a sight. And that business about his head covering...? Well, the lid is off. He is now the cosmic risen One...his headship is cosmic, no longer bound...the Shepherd is back...the sky's the limit...and he holds the future in a radiant pierced hand. Happy Easter!

"Easter Redux"

"Easter, as you know is really an embarrassment of riches. ..Like Christmas, Easter can never be approached except by bits and pieces. One bit circles around the resurrection of the body—Christ's body and our bodies. I for one am a firm believer in Christ's bodily resurrection. 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" (Fr. R. Brungs, SJ 1999).

Post-Normal Science and the Pagan Quest for Power Over Nature — and Mankind

by James A. Wanliss, Ph.D.

Author, *Resisting the Green Dragon: Dominion, Not Death*
(Cornwall Alliance, 2010, 311 pages)

Post-normal science is a corrupted form of science in which the quest to explain how our world works is less significant than the quest to use scientific authority to achieve political goals. One helpful way to understand it is to compare it with Cargo Cults.

During World War II remote tropical Pacific islands like Vanuatu became involved in war efforts when they became part of supply lines. To the natives the arrival of noisy birds was almost miraculous; they brought delicious foods, and other sorts of wondrous cargo.

After the war the birds, and their cargo, left. Into the vacuum returned old terrors of hunger and sickness, and an angry Earth. Superstitious natives copied what they had seen. They made model planes and runways. They had the form right—the outward form of religion—but lacked power. As they had seen, so they did. But no airplanes landed. Anthropologists call this religion a Cargo Cult.

In 1974 physicist Richard Feynman explained how something similar can happen in science. He observed that many scientists go through the motions of scientific rituals yet are not actually doing science. Experiment first, conclusions afterward is the basis of scientific inquiry. Cargo Cult science—including post-normal science—predetermines the conclusions and reverses the order.

The global warming federal-scientific partnership forms the basis for several modern Cargo Cults. For instance, tens of billions of American dollars have been thrown at studying global warming, with prominent scientists failing (or forbidding) to ask critical questions that might challenge cherished beliefs, or threaten the gravy train; annual federal funding to study global warming is around four billion dollars and rising. Scientists and politicians

use this environmentalist Cargo Cult Science to make the most incredible predictions of future doom. It is magical in its ability to explain how almost every environmental calamity—whether hot or cold, wet or dry, calm or tempestuous—is caused by humanity’s insensitivity toward our mother planet.

As discussed in my book *Resisting the Green Dragon: Dominion, Not Death*, for pagans what matters most is power, not truth. So it was in Vanuatu where pagans worshipped the Serpent, as a spirit of evil. They lived in abject terror of his influence, and directed all their worship towards pacifying his rage. In Cargo Cult Science, are we unconsciously returning to the dark age of magic, in which truth suffers and people tremble for fear that their smallest actions may offend an “angry” Earth?

(We invite your letters in response to this article and the accompanying link to the Cornwall Alliance Newsletter. [Eds.].) Reprinted with permission from the Cornwall Alliance Newsletter.
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James A. Wanliss, Ph.D., is Associate Professor of Physics at Presbyterian College, Clinton, SC. His academic research interests are broad, ranging from space physics to pharmacotherapy and human factors psychology. He uses advanced mathematical techniques to create models, which he couples with detailed analysis of data. In space physics, his activities encompass the physics of solar wind turbulence and propagation and the interaction of solar wind with non-magnetized bodies.

Neither our fall into sin nor the redeeming work of Christ eliminates the human responsibility for creation stewardship. Rather, the fall complicates it, as the Earth too suffers the consequences of human sin. But redemption elevates environmental stewardship making it part of the hope-filled task of the redeemed in spreading the kingdom of Christ. (E. Calvin Beisner in ITEST’s *Environmental Stewardship*, 2009).

A Year to Celebrate an 18th Century Jesuit Scientist

Roger Joseph Boscovich, S.J. (1711-1787)

(reprinted from web site of Fairfield University)

Two hundred years ago February 13, 1787, the Croatian Jesuit mathematician Roger Boscovich, SJ died. He developed the first coherent description of atomic theory in his work *Theoria Philosophiae Naturalis*, which is one of the great attempts to understand the structure of the universe in a single idea. He held that bodies could not be composed of continuous matter but of countless “point-like structures.” In this work he states that the ultimate elements of matter are indivisible points “atoms,” which are centers of force and this force varies in proportion to distance. What is remarkable is that his works appeared well over a century before the birth of modern atomic theory.

Boscovich was a physicist, geometer, astronomer and philosopher. He had an older brother, Bartholomew, who was also a Jesuit mathematician. Boscovich taught at the Roman College for 20 years, although the Jesuit General Luigi Centurione, SJ thought his teaching too avant garde. The next Jesuit General, Laurence Ricci, however, valued Roger and chose him as Visitor of the whole Jesuit Society.

He was also a correspondent for the Royal Society of London, and a frequent contributor to the Jesuit *Mémoires des Trévoux*. The famous astronomer Joseph Lalande said there was no scholar in all Italy like Boscovich nor did he know any geometer as profound. On the anniversaries of his publications, his birth and his death, symposia are held throughout the world to honor this amazing polymath. Roger was a creative scientist credited with perfecting the ring micrometer and the achromatic telescope. He was the first one to apply probability to the theory of errors. Later mathematicians such as Laplace and Gauss acknowledged their indebtedness to his pioneering work which led to Legendre’s principle of least squares.

Well known all over Europe, Boscovich was later made a Fellow of the Royal Society of London and today the name Boscovich is found on maps of the moon since a rather large lunar crater was named in his honor. Because of his prominence as a scholar, it was his influence that minimized

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Some Early Jesuit Scientists

José de Acosta, SJ - 1600: Pioneer of the Geophysical Sciences

François de Aguilon, SJ - 1617: Six books on Optics

Christopher Clavius, SJ – 1612: and his Gregorian Calendar

Honoré Fabri, SJ – 1688: and his post-calculus geometry

Francesco M. Grimaldi, SJ – 1663: and his diffraction of light

Francesco Lana-Terzi, SJ – 1687: The Father of Aeronautics

Juan Molina, SJ – 1829: The First Scientist of Chile

Jerôme Nadal, SJ – 1580: perspective art and composition of place

Ignace Pardies, SJ – 1673: and his influence on Newton

Matteo Ricci, SJ – 1610: who brought scientific innovations to China

Angelo Secchi, SJ – 1878: The Father of Astrophysics

Joseph Stepling, SJ – 1650: symbolic logic and his research academy

Pierre Teilhard de Chardin, SJ – 1955: and *The Phenomenon of Man*

Gregory Saint Vincent, SJ – 1667: and his polar coordinates

Nicolas Zucchi, SJ – 1670: the renowned telescope maker.

William Stauder, SJ – 2002: S-Wave studies of earthquakes of the North Pacific,

Robert Brungs, SJ – 2006: Superconductor Properties of Monocrystalline Boron

Go to Links on the ITEST web site for Jesuits in Science showcasing Jesuit scientists around the world, their current research and accomplishments.

the hostility of Catholic churchmen to the Copernican system, and he had such a reputation for honesty, integrity and scholarship that only he was able to persuade Pope Benedict XIV to finally remove Copernicus from the Index of Forbidden Books.

Russian scientists have always shown a strong interest in his work, and more recently western scientists have become better acquainted with his contributions. This resurgence of interest in his works is evident from a host of recent books and articles. His legacy has been preserved in the special Boscovich Archives in the Rare Books library at the University of California in Berkeley. Among the 180 items housed there are found not only many of his 66 scientific treatises but also correspondence (over 2000 letters) with other mathematicians such as Euler, D’Lambert, Lagrange,

Laplace, Jacobi and Bernoulli.

It was assumed then as now, that mathematicians have the practical sense to fix intricate things such as clocks. Thus he was commissioned by popes and emperors to repair the alarming fissures in the cupola of the Milan Cathedral, to reinforce the dome of Saint Peter’s Basilica, to direct the drainage of the Pontine marshes, and to survey the meridian of the Papal states.

After the Suppression of the Jesuits he became captain of optics in the French navy. Born in Ragusa (now Dubrovnic.), Roger lived a long, fruitful life and was one of the last renowned polymaths. Incisive in thought, bold in spirit, and independent in judgment he was a man of the eighteenth century in some respects but far ahead of his time in others.

(The following reflection pieces or prayers composed by Dr. John A. Blaschke, MD, long-time ITEST member and supporter. Dr. Blaschke who received his medical degree from the University of Oklahoma College of Medicine specializes in Rheumatology. Although retired from medicine he and his wife Ruth are surrounded by a large loving family. He defies the stereotypical view of scientist/physician as coldly logical, inflexible, robot-like and data-driven. The following essays are a perfect blend of the scientific and the ‘artistic’ – prayers from a scientist in love with the beauty God created).

Beauty and Photosynthesis

Our condo is on the second floor directly facing the ocean. It overlooks a pool and walkup bar that is dramatized by a continuous flowing sheet of water from a pool on the roof of the bar. The waterfall into the swimming pool is an arresting sight and sound. From our open deck we see the Pacific Ocean framed by coconut palms. At high tide we are less than 75 yards from the shoreline. Thus we are treated to a continuous sound of surf, an ongoing sight of sandpipers scurrying in front of advancing/retreating waves and fleets of Pelicans cruising close to the water, all part of the attraction and mystery of the ocean. The distant line on the horizon, demarcating sky and ocean, air and water, is itself, mysterious. Dark blue of the water contrasts with the light gray blue of the sky. We can never reach this line; it will always retreat into the distance in front of us, even if we were to approach at mach 3 speed.

At sunset, as the sun sets, slowly at first, the rapidly in the final moments, it is this line which provides the seeming watery grave into which the sun disappears. At these moments I am filled with awe and a strong sense of God’s creative power. His power is infinite of course, but what comes to my mind is the delicate balancing of the many forces God has provided for Man whom he loves. The Sun is the epitome of those forces which provide Man with

food, protection and safety. The size of that immense red-orange globe in its final minutes is impressive and inspires ones thoughts that everything in life is dependent on the twelve hour flight of the globe. All plant life in the world is dependent on the photosynthesis powered by the Sun’s photons. The visible light spectrum is just a portion of the vast electromagnetic forces produced by the Sun. But Man and animals are dependent on the foods that arise from photosynthesis in green plants throughout the world. Lord, thank you for photons, light and your orderly plan.

These distracting thoughts cross my mind while at the same time I am almost breathless with the sheer beauty of the moment. The flaming orange orb paints the surrounding sky with every hue of pink, lavender, rose and finally to cool grays. Even when the sun sinks below the horizon in an accelerating fashion and everyone has looked for the green flash, and failed to see it, the sky remains vivid oranges and pinks and lavender and finally the blues. That is when I say a prayer in the secret part of my mind; thank you Lord for the privilege of being here; thank you for the source of energies from the sun on which so much of our material world is dependent; thank you for the beautiful spectacle of the setting sun which lifts our spirits in joyful praise.

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Take Off Your Shoes

The periodic table of the elements is an orderly listing of all the known elemental substances that are the building blocks of every structure, plant and animal on planet earth. For generations high school students have first gazed on this table of the elements in the form of a large chart hanging on the wall of their school science or chemistry class. From the lightest element Hydrogen to the heaviest Lawrencium, the table, first proposed by Mendeleev in 1869, classifies all the elements in groupings according to the atomic number of the nucleus and the electron energy levels which surround it. Mendeleev's genius lay in the fact that he saw the logic of a natural plan in arrangement of the various elemental atoms based on atomic weight and chemical valency. His discovery postulated that some elements not yet described would be found to fill empty spaces in his table. The orderly sequences of the elements each building on a fundamental

atomic core, with atomic weights and mass is evidence of, proof of, and praise for God's creative transcendent power.

When you think about it, every atom, element and molecule is part of a holy and sacred creation. Thus this morning walking the beach, I realized I was walking on Holy Ground. The element Silica, number 14 in Mendeleev's table, is the chief component of a grain of sand. The shore that I am treading today is an unending mass of sand. Thoughts about the immensity and infinite numbers of grains of sand bordering the oceans of earth, and found abundantly everywhere speak loudly to me of God's loving presence.

Further reflection this morning leads me to the conclusion that I am walking on Holy Ground. Like Moses and the burning bush, I hear a whispered voice, "Take off your shoes, you are standing on Holy Ground." Barefooted, I pray, "Our Father who art in heaven...

The New Story of Science by Robert Augros & George N. Stanciu Gateway Editions, Chicago, 1984

(This excerpt from Chapter III reveals how some well known scientists viewed beauty).

"All of the most eminent physicists of the twentieth century agree that beauty is the primary standard for scientific truth. According to physicist Richard Feynman, in science "you can recognize truth by its beauty and simplicity." (p. 39)

...Concerning quantum mechanics in which he pioneered, Werner Heisenberg remarks that it was "immediately found convincing by virtue of its completeness and abstract beauty."

...General relativity is considered by physicists as probably the most beautiful of all existing physical theories. Erwin Schrodinger gives it this tribute: "Einstein's marvelous theory of gravitation...could only be discovered by a genius with a strong feeling for the simplicity and beauty of ideas."

"Far from being unscientific: beauty animates science. And the beauty physicists seek is not the product of private or idiosyncratic emotion. On the contrary, the physicists themselves indicate three specific elements of beauty:

1. **Simplicity is the first element of beauty.** "The different kinds of things it relates" means how the theory harmonizes disparate things. Thus, we may label
2. **the second element harmony.** And the extended applicability is the theory's
3. **brilliance;** that is, how much clarity it has in itself and how much light it sheds on other things." (p. 41)

"Henri Poincare says, 'The scientist does not study nature because it is useful to do so. He studies it because he takes pleasure in it; and he takes pleasure in it because it is beautiful. If nature were not beautiful, it would not be worth knowing and life would not be worth living.'" (p. 46)

"This book, *The New Story*, then, proposes beauty as a standard in science because nature is beautiful. On this view, a beauty-blink scientist would be a poor scientist." (the authors)

From: *Written in Our Flesh: Eyes toward Jerusalem. ITEST Faith/Science Press. 2008. pp. 347.*

Fr. Robert Brungs, SJ (*Here he writes in February, 2006 to a woman religious and retired biology professor about the role of science in religious education and the wonder and religious awe science can inspire*).

"I share your feelings about science in religious education. More, I agree with you about the place for faith in doing science. I can remember an event when I was working on my dissertation. I had made a couple of x-ray pictures of my sample and was watching the images coming up in the developer. I was simply astounded by their beauty and by the thought that I was the first person in the history of the universe to look on the symmetry in a crystal of boron. I must have looked at that picture for a couple of hours reflecting on the beauty that God had put into a crystal of boron. It was an amazing couple of hours." (p. 112)