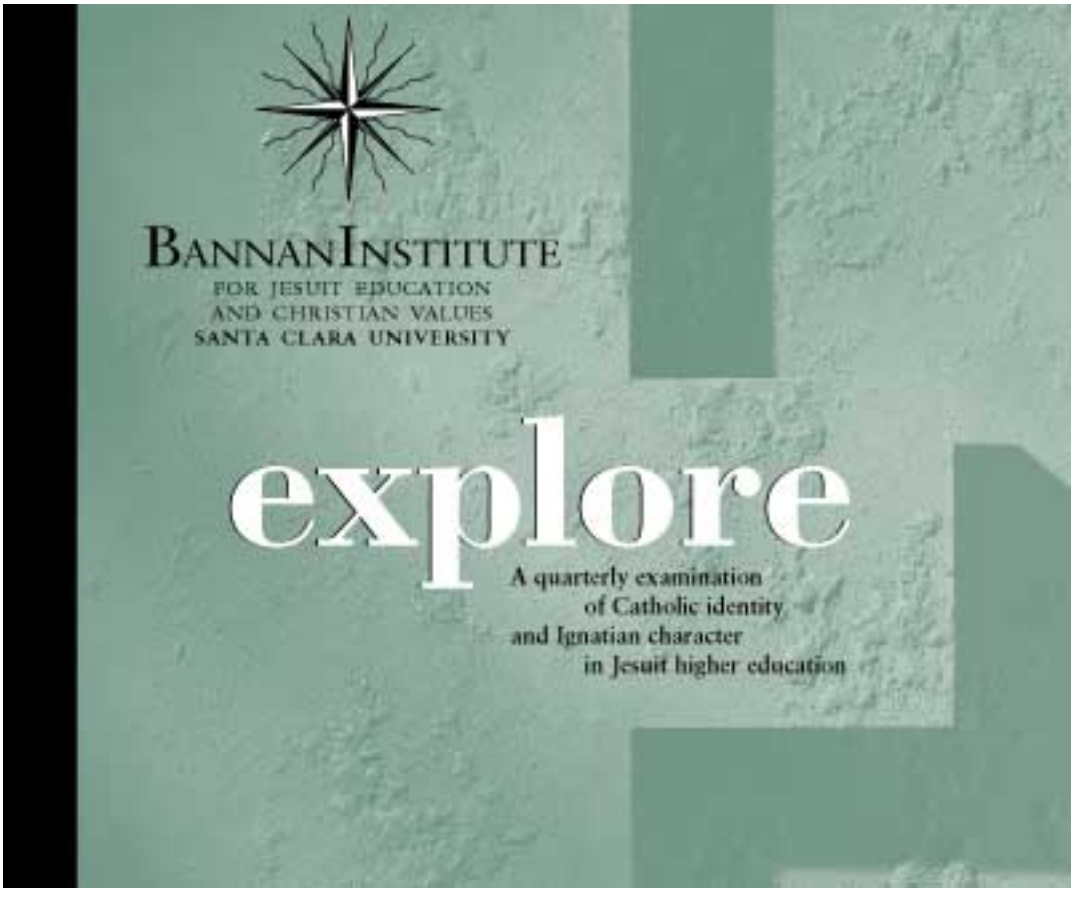
Spring 1998

explore, Spring 1998: Jesuits and the sciences

Ignatian Center for Jesuit Education



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Bannan Institute for Jesuit Education and Christian Values

We are happy to present the current, revised version of our mission statement. We published an earlier draft in the fall issue of explore*. This revision has been greatly helped by the many insightful comments we received from individuals both on and off campus. Thanks very mut to all of you!*

- Robert Senkewicz, S.J.

Our Mission

The Bannan Institute for Jesuit Education and Christian Values at Santa Clara Univeristy endeavors to assist the University in maintaining its Catholic and Jesuit character at the center of the educational enterprise.

The Institute offers faculty, staff, students, and friends opportunities to explore the implications of Ignatian and Jesuit spirituality and mission in the ongoing life of the contemporary University.

Core Values

The Institute roots itself in four aspects of the Ignation and Jesuit vision:

1.) TO SEEK AND FIND GOD IN ALL THINGS

For the founder of the Uesuits, Ignatius of Loyola (1491-1556), all of reality was an arena of God's self-revelation.

2.) CURA PERSONALIS

This Latin phrase("care of the person") has been a characteristic of the Jesuit education. It recognizes the full individuality of each person, and seeks to integrate the intellectual, aesthetic, moral, spiritual, affective, physical, and social.

3.) THE SPIRITUAL EXERCIESES

This way of Christian prayer, developed by Ignatius, is premised in the

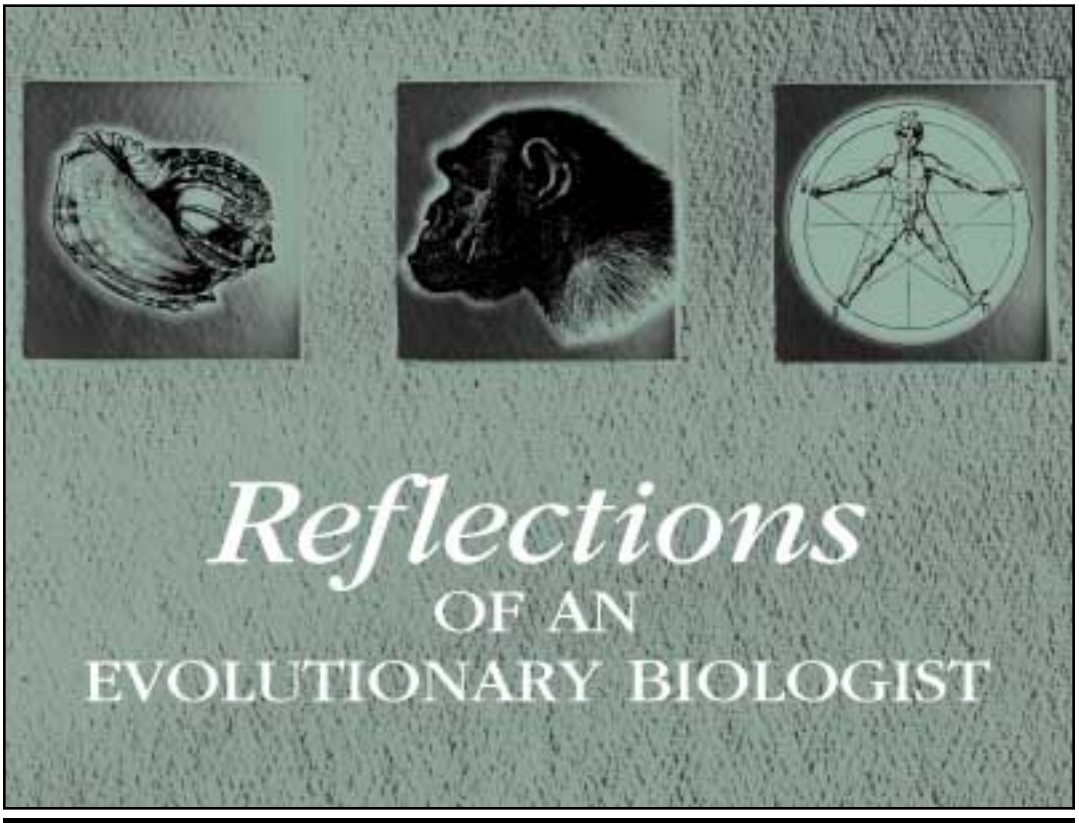
belief that one can discover God's presence in one's life and the freedom to respond to that presence through a series of prayer exercises and personal conversations.

4.) THE SERVICE OF FAITH AND THE PROMOTION OF JUSICE

The intellectual aspect of fait in God inevitably drives beyond iteself. It necessarily seeks an engagement with persons prevented from fulfilling the divine purpose of full integration by oppressive social systems and unjust structural realities.

The Institue is premised on the belief that all members of the University community, regardless of the religious affiliation, can make important contributions to the evolving Catholic and Jesuit identity of Santa Clara.

The root meaning of the word "Catholic" is "universal". Thus, we invite all constituencies of the University to assist in developing the Institute's potential.



By Dennis R. Parnell, S.J.

I am often asked how, as a Jesuit priest, I can teach and do research in the area of evolutionary biology. The unspoken assumption is that I must be conflicted when it comes to my religious worldview and my professional activities. Nothing could be further from the truth. I find the relationship between evolutionary biology and religious belief to be very harmonious. The discoveries in my field are, to my way of thinking, perfectly compatible with my faith. The perception of conflict, in my experience, arises most often because of misunderstandings either about the purpose and nature of Scripture or about the relationship of evolutionary studies to philosophy and theology. I would like to take this opportunity to discuss briefly these misunderstandings as a way of discussing how my professional life has contributed both to forming and sustaining my faith.

Scripture was never intended to be a reference book for the empirical sciences. The questions that concerned the writers of the sacred texts were not those of present-day cosmologists and biologists. For example, the account of creation, including the origin of the human

race, in the first chapter of the book of Genesis was not intended to be an alternative hypothesis to the Theory of the Big Bang or to modern evolutionary theory. Rather, it was written as a reaction to the quite negative Babylonian theology of both the creation and nature of the universe. When the work was written, the Israelites were captives of the Babylonians. The Israelites' priestly leaders, for reasons of cultural and theological integrity, wanted to distance their people from their captors as well as from all that they held about their gods, especially the primacy of the god, Marduk. What has become the first chapter of Genesis is a clear theological statement about the God of Israel. The scripture scholar, Fr. Lawrence Boadt, has summarized the key points of the first chapter of Genesis as follows:

> (1) there is one God, without sexual Gender, alone from the start, (2) who created from [God's] goodness and wise plan a world of order, (3) in which matter is good and not the result of whim or magic, (4) but God's word decrees what is to be and establishes limits; (5) [God] gave humans a place of honor, made in his own image; (6) they were to have responsibility over what was created, (7) and share divine gifts of pro-creating life, sharing [God's] sabbath rest and knowing God personally.

I frequently receive a surprised reaction from people when they realize I do not consider the Bible to be a textbook for "creation science." For example, Roman Catholics who do not have a background in Scripture studies and science will often ask: "Isn't your interpretation of Scripture contrary to the teachings of the Church, and doesn't it forbid the teaching of evolution?" My response is to quote Pope John Paul II who, in an address to the Pontifical Academy of Sciences on the subject of evolution, spoke of "the need of a rigorous hermeneutic for the correct interpretation of the inspired word." He went on to say, "It is necessary to determine the proper sense of Scripture while avoiding any unwarranted interpretations that may say what it does not intend to say. In order to delineate the field of their own study, the exegete [i.e., Scripture Scholar— brackets mine] and theologian must keep informed about the results achieved by the natural sciences.

With regard to the theory of evolution itself and what might be in

conflict with the Church's teaching, the pontiff states, "new knowledge has led to the recognition of more than one hypothesis in the theory of evolution. It is indeed remarkable that this theory has been progressively accepted by researchers following a series of discoveries in various fields of knowledge. The convergence, neither sought nor fabricated, of results of work that was conducted independently is in itself a significant argument in favor of this theory."3 The Pope accurately points out that the several theories of evolution are the result of various explanations for the mechanism of evolution and the different philosophical approaches on which they are based. Some theories, notably those that are grounded in reductionist and materialist ideologies, are indeed incompatible with the Church's understanding of the human person. One of the most prominent evolutionary theories is known as neo-Darwinism, in which evolution is described as the change in gene frequencies in biological populations. Small changes in the genes (i.e., mutations) lead to small structural or biochemical changes in an organism. Those organisms who are best suited to the environment because of their genetic makeup will produced the most offspring (i.e., natural selection). The accumulation of these randomly occurring mutations over long periods of time accounts for the rich diversity of life found on our planet today. The Oxford biologist and master popularizer of evolutionary theory, Richard Dawkins, has been a longtime champion of this position:

> I'm a Darwinist because I believe the only alternatives are Lamarckism [a discredited nineteenth-century theory of evolution—brackets mine] or God, neither of which does the job as an explanatory principle. Life in the universe is either Darwinism or something else not yet thought of. There is only one general principle in biology, and that, of course, is Darwinism.

Furthermore, the reductionism that is inherent in neo-Darwinism leads to Dawkins' well-known position:

> The animal is a survival machine for its genes. The animal is a robot that has a brain, eyes, hands, and so on, but it also carries around its blueprint, its own instructions.... The only genes that get through the generations are the ones that have managed to make their robots avoid getting eaten and succeed in living long enough to reproduce.

This is the idea of the "selfish gene" that Dawkins champions in his immensely successful book by that title.

The Harvard paleontologist and equally successful popularizer of evolution, Stephen Jay Gould, has rejected neo-Darwinism:

> Darwin's canonical form of [selection]—that is selection operation on individual bodies via the struggle for reproductive success—just isn't capable, by extrapolation, of explaining all major patterning forces in the history of life.

He also makes the complementary point:

> A crucial argument in Darwinism—namely, that you can look at what's happening to pigeons on a generational scale and extrapolate into the immensity of geologic time—really doesn't work, that when you enter geological time there are a whole set of other processes and principles, like what happens in mass extinctions, that make the extrapolationist model not universal.

Specifically, with regard to the type of reductionism that Dawkins champions, Gould responds:

> As soon as you have emergent characteristics due to nonadditive interaction among lower-level entities, then you can't reduce to the lower level entities, because nonadditive [i.e., qualitatively different—brackets mine] features have emerged. These features don't exist until you get into the higher level.

Although methodological reductionism and materialism (i.e., analyzing the whole in terms of its parts) are among the tools of all natural scientists, their use does not imply the validity of reductionist or materialist ideologies (i.e., the whole is nothing but its parts).

Gould's own understanding of the evolutionary process is based, in large part, on the observed pattern of the fossil record, which includes gaps rather than transitional forms between putative ancestral groups and their derivatives (e.g., amphibians and reptiles) as well as the sudden appearance throughout the fossil record of fully diversified major phyla. Gould's response to these observations was to propose, along with Niles Eldredge, the theory of punctuated equilibria. This theory was a strong acknowledgment that the neo-Darwinism and its inherent gradualism was not an adequate tool for interpreting the fossil record. Gould and Eldredge proposed that processes in addition to natural selection, not all of which have yet been identified, are responsible for the evolutionary pattern found in the fossil record. Rather than lineages gradually splitting over time in response to environmental pressures (phyletic gradualism—assumed by neo-Darwinism), long periods of time with little or no observable change in lineages are interrupted by rapid periods of species formation (punctuated equilibria). These evolutionary episodes occur in small isolated populations away from the main populations of the lineage in question.

Data from the diverse fields of paleontology, anatomy, embryology, cellular physiology, biochemistry, and population genetics are the foundation of all evolutionary theories. The interpretation of these data can, as the differences between Dawkins and Gould demonstrate, lead to very different conclusions. What all of these theories do have in common, however, is the identification of a pattern of intelligibility in the biological data. When I step back and reflect on my professional work, several questions arise. What is the significance and meaning of this intelligibility? Is there an invariable structure to the universe and if so, how do we come to know this structure? Finally, what is the origin of this structure? From my perspective, scientific questions give rise to philosophical questions which in turn give rise to theological questions. The methodology and approach for each successive discipline will be different. Furthermore, one discipline is not reducible to another. I am very much indebted to the Jesuit philosopher and theologian, Bernard Lonergan, whose writings have been very influential in my thinking on these matters.

For me, it is very important to understand how evolution proceeds. I have devoted my professional career to this question, but the answers to the question about that process are not going to settle the

philosophical and theological questions about the existence of a personal God. The work of evolutionary biologists is to understand evolution, which—I have no question—has occurred and is still occurring. New mechanisms of evolutionary change may be discovered which will complement those that currently fill the evolutionary biologist's theoretical arsenal. There are many unanswered questions about how the evolutionary process or processes work, but the ultimate answers to those questions will not prove or disprove religious belief and in particular, belief in an intelligent, omniscient, and benevolent God.

Richard Dawkins does not share this point of view. His position, grounded in a militant atheism, is unequivocal: "Darwin [and by extension neo-Darwinism—brackets mine] made it possible to be an intellectually committed atheist."9 On the other hand, Gould, who identifies himself as an agnostic Jew, does not share Dawkins' interpretation. A comment he made in a slightly different context indicates his view on this issue is much more benign:

> Unless at least half of my colleagues are dunces, there can be—on the most raw and empirical grounds—no conflict between science and religion. I know hundreds of scientists who share a conviction about the fact of evolution and teach it in the same way. Among these people I note an entire spectrum of religious attitudes—from devout daily prayer and worship to resolute atheism. Either there is no correlation between religious belief and confidence in evolution—or else half of these people are fools.

Jesuit spirituality has at its heart the desire "to find God in all things." This desire is for me more than a slogan; it forms my basic approach to life. God, I am convinced, is found in the diverse experiences that form the fabric of my life. By reflecting on these experiences, big and small, I separate the woof and warp of my life, and God's presence is revealed to me, not in forced coincidences or questionable sightings, but rather by confronting questions of ultimate meaning and ultimate concern. This confrontation has resulted in being offered each day the blessings and challenges of my faith. My career as a evolutionary biologist has in itself been rewarding and successful, but it also has in its own unique way contributed significantly to my conviction, so aptly

stated by Saint Paul: “In God we live and move and have our being.”

By Dennis R. Parnell, S.J.

A remarkable characteristic of the Society of Jesus during the period of its first founding (1540-1773) was the involvement of its members in the sciences. The reasons for this interest in scientific study can be found in the nature and mission of the order itself. Saint Ignatius Loyola considered the acquisition of knowledge and the performance of mundane labor as spiritually profitable tasks, and this fostered in the Society an action-oriented, utilitarian mentality sympathetic to scientific study. In addition, the role of the Society as the "schoolmasters of Europe" meant that the pedagogically (and scientifically) useful principles of rationality, method, and efficiency were highly valued. The tight-knit organization of the Society created among its members habits of cooperation and communication, essential for the gathering and exchange of scientific information. Finally, mission work in Asia and the Americas gave the Jesuits opportunities and impetus to study and record the phenomena of these new worlds.

Editor's note: So often, words first appear on the printed page, and then on the web. The fascinating notes on Jesuits and the scientists that follow have been gleaned from the extensively annotated and illustrated web site of the The Science Library at Loyola University of Chicago. We thank them for the permission to reprint both text and pictures from their site, and we encourage all those who would like more detailed information (and a wonderful bibliography) to visit: www.scu.edu/BannanInstitute/

JESUITS AND THE SCIENCES, 1540 - 1620

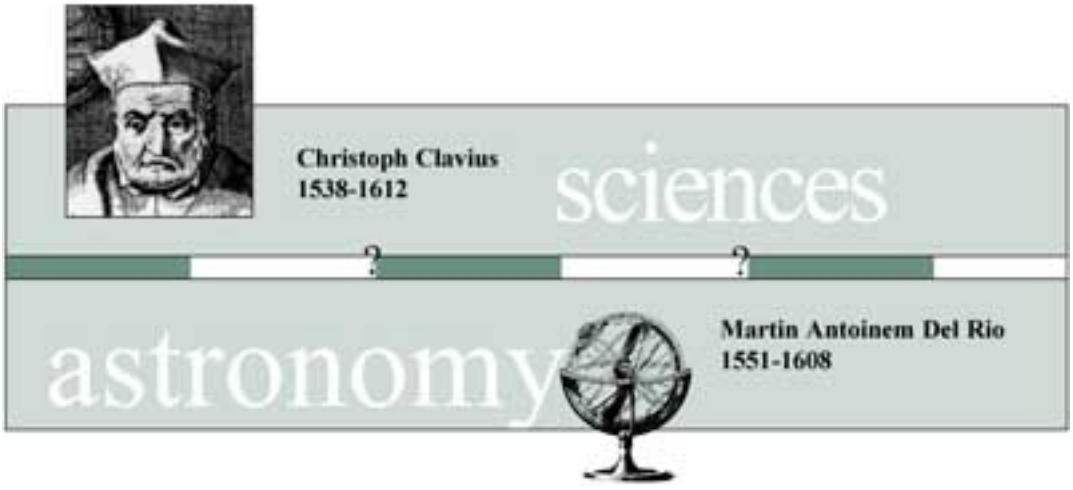
Early Jesuit scientific investigations were for the most part conservatively grounded in Aristotelian natural philosophy and the "classical" sciences of geometry, astronomy, optics, statics and mechanics. Jesuit science during the period 1580-1620 is characterized by commentaries on Aristotle, Euclid, and other ancient writers, and by the mathematical and astronomical works of scientists such as Christoph Clavius. Works by Jesuits against magic, demonology, alchemy, and astrology are also common at this period, some reflecting a belief in these practices, others written in an attempt by members of the Society to differentiate superstition and pseudo-science from true scientific investigation.

Christoph Clavius, 1538-1612

A professor at the Roman College, German-born mathematician Christoph Clavius was known for his writings on arithmetic and algebra, and for his work on Gregorian calendar reform. He was a friend of Galileo, but in a commentary on medieval mathematician and astronomer Joannes de Sacro Bosco, Clavius condemned the Copernican theory of a sun-centered solar system as both physically impossible and as contrary to the Scripture.

Martin Antoinem Del Rio, 1551-1608

In the early seventeenth century the modern distinction between science and pseudo-science was not always made, even among the educated. Condemnations of magic and astrology by Jesuit writers such as Del Rio, although generally written from a theological rather than a scientific point of view, were instrumental in discrediting these practices.



JESUITS AND THE SCIENCES, 1620-1659

European scientific thought during the period 1620-1660 was dominated by the revolutionary investigations of Galileo and others into the nature of the solar system, and Jesuit writers such as Malapert and Grandami played no small part in the ensuing debate. As the chief proponents of traditional Aristotelian cosmology, and hailed by many as the intellectual champions of the Catholic Church, the philosophical and Scriptural arguments of Jesuit writers against the Copernican theory of a sun-centered solar system had influence.

Christoph Scheiner, 1575-1650

Scheiner wrote a comparison of various ancient and modern theories of the solar system, with an emphasis on the new and controversial ideas of post-medieval astronomers. Although he refuted the Copernican system, Scheiner praised the observations of Galileo. His work contains one of the first illustrations of the telescope, and an early map of the moon, with topographical details.

Charles Malapert, 1581-1630

Malapert used his observations on the comets of 1618, as well as the movement of the stars in the Southern sky to refute the hypotheses of Galileo and Copernicus.

Jacques Grandami, 1588-1672

In an attack on the Copernican theory, Grandami used his own theories about terrestrial magnetism in an attempt to prove the immobility of the earth. It was probably inspired by Galileo's *Dialogo dei massimi sistemi*, which was published in 1632. The author taught literature, natural philosophy, and theology at various Jesuit colleges in France.

Jean Ciermans, 1602-1648

Ciermans wrote an outline and celebration of the twelve major mathematical disciplines, with fanciful emblematic engravings illustrating the practice of geometry, arithmetic, optics, and astronomy.

JESUITS AND THE SCIENCES, 1660 - 1719

Jesuit scientific writing during the second half of the seventeenth century was dominated by the work of Athanasius Kircher and his followers. Kircher wrote on an astonishingly wide range of scientific subjects, including medicine, acoustics, geology, astronomy, and mathematics. Although Kircher's philosophy—a blend of science and superstition combining empirical observation with magical and religious elements—seems strange to modern eyes, it was seriously noted and discussed by many eminent scientists of the time, including Descartes, Boyle and Leibniz. Although not in the mainstream of seventeenth-century scientific thought, the works of Kircher and his Jesuit contemporaries typify the complexity and diversity of scientific writing of the period.

Athanasius Kircher, 1602-1680

In one of his works Kircher used the narrative device of a fantastic voyage through space to discuss his theories of the solar system. Accompanied by the "music of the spheres," the two protagonists (Theodidactus and Cosmiel) travel through the void to other worlds, and converse with the intelligent life forms they find there.

Another of Kircher's works investigates the nature of bubonic plague, prompted by an outbreak of the disease in Naples during 1656. After examining the blood and urine of plague victims under a primitive microscope, Kircher hazarded a guess that a living organism (contagium animatum) might play a role in plague infection, but he stopped short of propounding an actual germ theory of disease.

Juan Eusembio Nieremberg, 1595-1658

Nieremberg's writings on "occult philosophy" and aspects of natural magic, such as the sympathy and antipathy of objects, were a major influence on the thought of Kircher.

Gaspar Schott, 1608-1666

Gaspar Schott taught moral theology, mathematics, and natural philosophy at Palermo, the Roman College, and Wurzburg. Schott was Kircher's assistant at the Roman College, and his work on monsters and deformities reflects some of Kircher's more bizarre ideas about zoology.

Francesco Lana Terzi, 1631-1687

Although the concept of Terzi's "ship carried on air" is based on a fundamental error in physics and is completely impractical, it is nevertheless an interesting early attempt to design a flying machine.

JESUITS AND THE SCIENCES, 1814-1900

Throughout the 18th century, absolutist monarchies suspicious of Jesuit loyalty and fearful of their influence over the population implemented measures limiting the Society's power and legal standing. In 1773, Pope Clement XIV abolished the Society in response to increasing political pressure from France, Spain, and Prussia. The Jesuits lost most of their colleges and universities, many of which were turned into government offices, barracks, factories, or simply allowed to fall into disrepair. A few members of the Society were granted refuge in Russia but the Jesuit community vanished from Europe. Jesuit scientific research suffered accordingly.

In 1814, Pope Pius VII, appreciative of the Jesuits' contributions to education, sanctioned the re-establishment of the order. Over the next forty years, surviving members and new recruits struggled to rebuild Jesuit traditions and institutions. Scientific education and research re-emerged as core values of the "New Society."

Angelo Secchi, 1818-1878

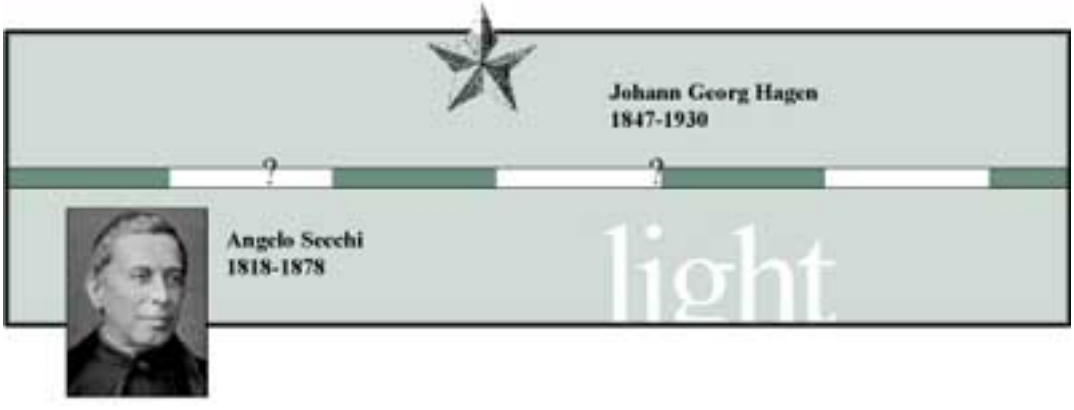
Secchi was born in the Lombardian town of Reggio in 1818, just four years after the restoration of the Society of Jesus. Ordained a priest in 1847, Secchi planned to continue his training in Rome but went abroad following the tumultuous liberal revolutions of 1848. Traveling to

Stonyhurst, England and Georgetown University, Secchi taught natural science while pursuing his own interest in astronomy.

In 1849, Rome offered him the directorship of the observatory in the Roman College, the position previously held by Clavius and Boscovich. Secchi quickly implemented the latter's plan to build a new observatory on top of one of the supporting pillars of the dome of the Church of St. Ignatius. Secchi's accomplishments include the re-discovery of Biela's comet in 1852; photographing the solar eclipse of 1860; using spectroscopy to learn the composition of distant stars; and the measurement and description of many binary stars and nebulae. He also invented the meteorograph, an automated device for recording barometric pressure, temperature, wind direction and velocity, and rainfall.

Johann Georg Hagen, 1847-1930

Hagen was director of the Georgetown College Observatory, Washington DC, from 1888 to 1906. In 1907, he was appointed Director of the Roman College Observatory, a position he held until his death in 1930. During his directorship numerous improvements were made to the observatory. Hagen is noted for his observations of light and dark nebulae and his unproven theories about the latter.



JESUITS AND THE SCIENCES, 1901-

During the late 19th and early 20th centuries, the modern network of scientific societies, research centers and government agencies began to take shape. Jesuits participated in many of these groups and created their own research organizations.

In 1911, Frederick L. Odenbach of St. Ignatius College in Cleveland established the Jesuit Seismological Service. This network of stations reported earthquake data via postcard to the central office. In 1925, the Jesuit Seismological Association was formed during a meeting of Jesuit geophysicists at Loyola University of Chicago. The Association cooperated with other national and international organizations to report and study seismic activity throughout the world.

Johan Stein W.J.A., 1871-1951

Stein studied physics and astronomy at the University of Leiden from 1894 to 1901. After completing his doctoral dissertation on the Horrebow method for determining latitude, he taught mathematics and physics at St. Willebrord's College. From 1906 to 1910 Stein was assistant to J. G. Hagen, director of the Vatican observatory. During that time, he published several papers concerning variable and binary stars. In 1930 Stein became director of the observatory and oversaw its transfer to it current home at Castel Gandolofo.

James W. Skehan, 1923-

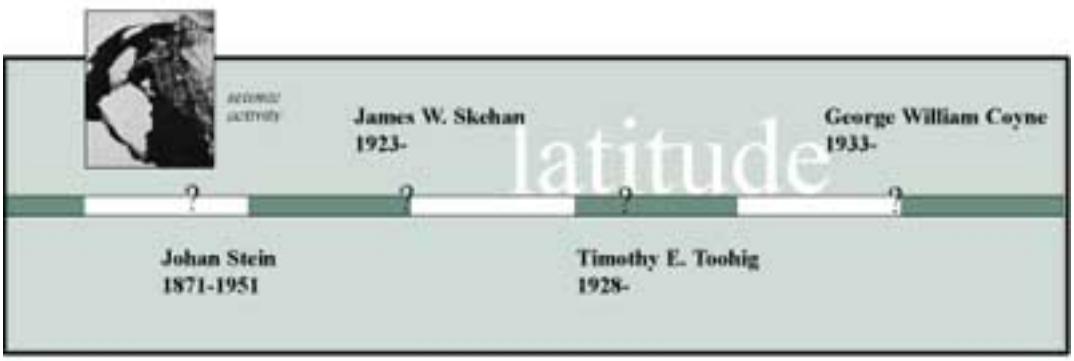
Geologist

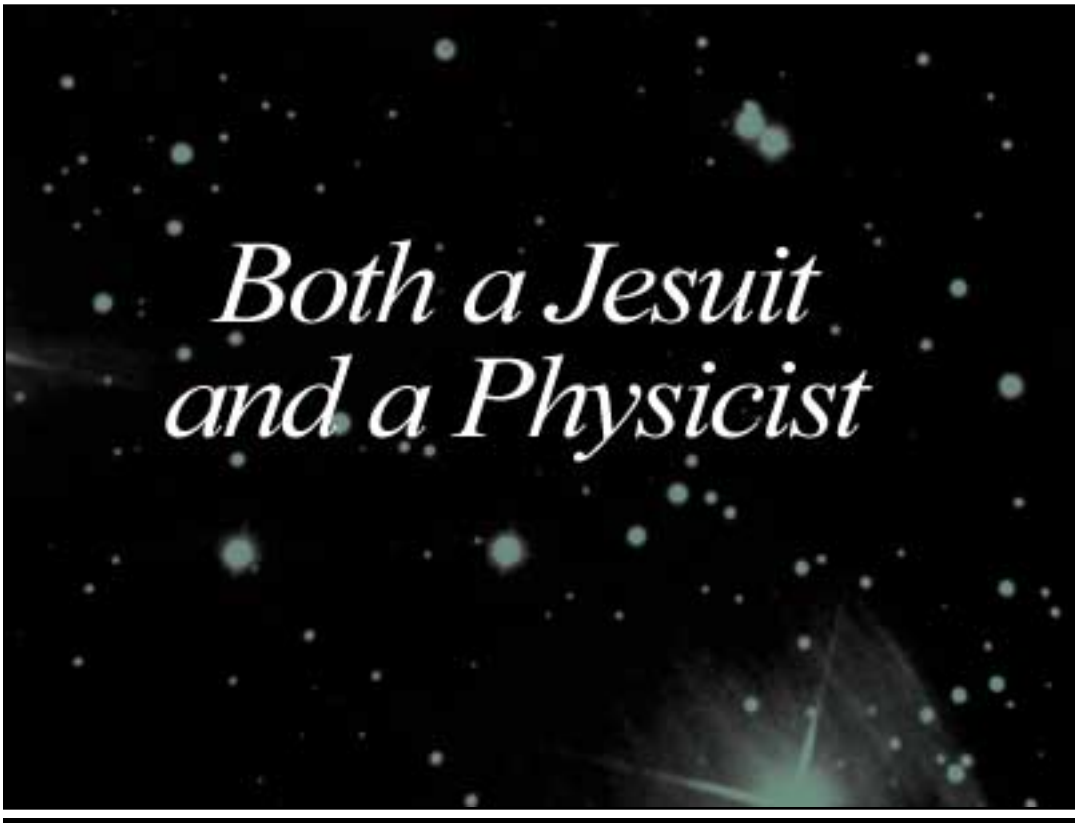
Timothy E. Toohig, 1928-

Physicist

George William Coyne, 1933-

Astronomer





By Carl H. Hayn, S.J.

Having taught physics for nearly fifty years, I now enjoy looking back to recall my experiences and the many fine students whom I have been privileged to introduce to the discipline. In the classroom or office it has always been a pleasant experience to see the faces of students light up when they begin to understand a new concept presented to them. It has also been gratifying to see the success that our graduates have had. Many have pursued careers in science, engineering, medicine and other health-related professions. Some have obtained their doctoral degrees in physics. Two dozen or more of our graduates are currently teaching physics in universities and high schools throughout the country. Several of our physics graduates have entered the legal profession and many others are employed in a variety of industrial positions.

Where and how did my own interest in physics begin? It is hard to say. Maybe it was the little crystal set that I and other boys commonly made when we were young. With these simple devices we were able to hear radio programs by using headphones and placing a little “cat’s whisker” at an appropriate place on the face of agalena crystal. At the

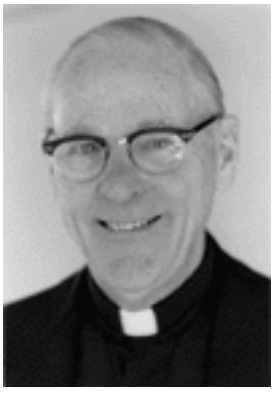
time a growing number of people were buying their first real radios. Television was unheard of.

After beginning my teaching of physics, I once had the occasion to speak with an executive of a large corporation. In the course of the conversation I was somewhat stunned by his surprise that I, a Jesuit, should have majored in science. Unfortunately he was laboring under the misconception that the Church was opposed to science. Nothing, of course, could be further from the truth! Since then I have encountered a number of people who also had this conviction. They were not aware of the fact that the Church played a major role in the development of science, especially in the seventeenth and eighteenth centuries when science was in its infancy. In fact, many of the science textbooks at that time were written by Jesuits. The Church has consistently encouraged the study of science as seen even today by the existence of the Papal Academy of Science, which numbers among its members many well-known scientists including Nobel laureates.

Recently I had the pleasure of speaking with a man who reacted quite differently and even enthusiastically upon discovering that I am a Jesuit and a physicist. He spontaneously voiced his opinion that a priest-teacher and a career in physics is an ideal combination.

Some might question the apostolic character of science teaching. Admittedly this activity is not as clearly or directly apostolic as, for example, that of missionaries, pastors, or teachers of sacred scripture or theology. But another way to lead people to God is through an appreciation of His handiwork. By pointing to the manifold wonders in the world and studying the underlying laws of nature, one can share the fascination of science with others. Dr. Ralph Overman, one of my professors at the Institute of Nuclear Studies, once said that as scientists, we have a responsibility to show the love of God by pointing to the myriad benefits that we now enjoy. I certainly concur. A priest-scientist is in a unique position to lead others to God by dispelling scientific illiteracy and communicating a true sense of wonder at the manifold marvels of His creation.

Physics aims at uncovering secrets that lie hidden in nature. It searches for a fuller understanding, appreciation, and respect for the world in which we live. This should inevitably lead all to a knowledge of the omniscient, omnipotent and beneficent Creator. Such a search is indeed a noble pursuit and totally consistent with the Jesuit apostolate.



Carl H. Hayn S.J.
Professor of Physics,
Santa Clara University

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Majoring in Physics: The Reward and the Risk

By James W. Felt, S.J.

If you want to understand this great book of the universe, wrote Galileo, you have to understand the language in which it is written, and that language is the language of mathematics. Though Galileo would hardly recognize the mathematics of modern physics, he proved himself a prophet nonetheless, for modern physics is mathematics in action. So if you ambition to be a physicist, you need to be good at math.

The prize you reach for—much more important than a good job—lies in coming to a better understanding of this universe in which you live and of which you are a part. The universe radiates reason in its intelligibility, and that intelligibility is largely mathematical. In grasping the mathematical structure of the universe, the physicist glimpses God, its author.

There is a risk, however, that goes with this reward. It is the danger of coming to suppose that the aspects of the world recognized through the mathematical eyeglasses of physics are the only aspects that there are. This may be compared to supposing that a photo taken on ordinary film reveals everything there is to see about its object, whereas in fact, quite different features are revealed if we photograph the same object with film sensitive, say, to infrared wavelengths.

So too, the lenses of physics that reveal the mathematical intelligibility of the universe tell us nothing about its other aspects, such as value, beauty, freedom, responsibility, or friendship. They tell us nothing about how we should relate to one another, or even about how the different ways of human knowing relate to one another. Yet it is possible to become so carried away by what you learn in physics that you forget there are aspects of the universe and of yourself that physics tells you nothing at all about. Physics can go to your head, so that you think of yourself as a robot human being operated in a robot-like world.

But the reward is worth the risk, especially if you have some common sense. Though there are more things in heaven and earth than are dreamt of in physics, physics is eminently worth pursuing for what it does tell us about the universe that is our home.

James W. Felt, S.J., Professor of Philosophy at Santa Clara University, earned an M.S. in Physics as well as a Ph.D. in Philosophy at Saint Louis University.

By Elizabeth M. Kelley '93

"One of the things that drew me to family practice was the notion of being, in a large sense, a pastor to people," says Dr. Marc Tunzi '80, a family physician, the Assistant Director of the Family Practice Residency program, and the Chairman of the Ethics Committee at Natividad Medical Center in Salinas, California. While some may find the images of a pastor and a doctor incompatible, Dr. Tunzi points out that "a good family physician has always been the gatekeeper, shepherding people through the medical system."

Dr. Tunzi originally planned to go into research, but when he discovered how much he enjoyed connecting with his patients, he "started emphasizing that part of it instead of the research," he says. "Being a physician enables me to talk to lots of different people. I get the privilege of hearing a lot about people that they don't tell many others," he says. "It is just amazing what some people have gone through in their lives. It helps me understand there really is something larger than all of us.... It has broadened my own idea of faith."

In addition to seeing patients in his practice, Dr. Tunzi spends a considerable amount of time teaching future doctors in the resident education program. "The residents are very, very busy and sometimes

they just want the answer," he says. They often ask him questions about medication—how much, which one, or how often—and other times they need him to consult on a patient. In this way, the residents use him as a reference, Dr. Tunzi explains: "It could be me or it could be a book." But there are other times when he experiences what he calls "a teachable moment." "Somehow we connect at more than a technical level, and there is more than the transaction of information taking place, and it dawns on me that this person is catching on." Dr. Tunzi describes these connections in a spiritual way, saying, "I don't think it is just me at that moment."

"One of the things that I like to try to do is teach some of the parts of medicine that are hard to teach, such as ethics, and how to incorporate psychology and family dynamics," Dr. Tunzi explains. "Science and art are always mixing when you are taking care of an individual patient. There is the physical thing that is happening with somebody, and then there is how it applies to a particular person at a particular time, and then there are other factors, psychological, social, and political factors."

While most people will agree that medicine is both a science and an art, controversy arises when religion is added to the mix. Aren't science and religion incompatible? Aren't many scientific facts in conflict with religious teachings? "Religion and science are not polar opposites," says Dr. Tunzi. "They should not be incompatible. They are approaching the human condition in different ways. One is relating to the feeling part, and the other relies on the rational part of human experience," he explains. "Science is never going to completely explain the absolute beginning of the world," says Dr. Tunzi. In the same way, religious beliefs cannot be proven or explained: "Faith is faith," he says. "You can't prove a feeling—you can't prove you are in love."

New medical technology, such as cloning, or the latest machine that can artificially prolong life, frequently cause rifts between the scientific and religious communities. "Is the technology bad?" Dr. Tunzi asks. "No. God gave us a brain, and I assume he wants us to use it," he answers. Then he asks a more challenging question: "Is the application bad?" Dr. Tunzi feels that "it is not a question just for the scientists," and it all depends on the situation. "What God wants us to do is make good decisions with what we know. It is not the science anymore, it is what we do with it."

"Science and art are always mixing when you are taking care of an individual patient. There is the physical thing that is happening with somebody, and then there is how it applies to a particular person at a particular time, and then there are other factors, psychological, social, and political factors."

- Dr Marc Tunzi

REVIEW OF DAVID NOBLE

The Religion of Technology: The Divinity of Man and the Spirit of Invention

By Tim Healy

ADAM AND EVE ATE OF THE FRUIT OF THE TREE OF KNOWLEDGE OF GOOD AND EVIL, AND FOR THEIR SIN THEY WERE CAST OUT OF THE GARDEN BY THE LORD GOD WHO SAID:

> CURSED BE THE GROUND BECAUSE OF YOU;
> IN TOM YOU SHALL EAT OF IT ALL THE DAYS OF YOUR LIFE;
> THORNS AND THISTLES SHALL IT BRING FORTH TO YOU,
> AND YOU SHALL EAT PLANTS OF THE FIELD.
> IN THE SWEAT OF YOUR BROW YOU SHALL EAT BREAD,
> TILL YOU RETURN TO THE GROUND,
> SINCE OUT OF IT YOU WERE TAKEN;
> FOR DUST YOU ARE AND UNTO DUST YOU SHALL RETURN.

It seemed at the time that Adam and Eve, and all of us, were condemned to wander the dusty roads of the earth until we died, despairing of ever seeing again the Garden which was our first home. Or did God relent? Did He, in one great Promethean gesture, allow us the gifts of fire, of tillage, of animal husbandry, of shaping the metals we found in the dust and of shaping, in time, a world of our own creation, a world formed by what today we call "technology"?

Is technology God's gift through which we can create our own path back to the Garden, through which we can find our way to the immortality that God always intended for us, or is technology the work of the devil, destined to hold us in life's thorns and thistles, and perhaps in time to end all human life on earth?

David Noble makes the case for God's gift, or at least for human interpretation of that supposed gift, in *The Religion of Technology: The Divinity of Man and the Spirit of Invention.*

It is Noble's thesis that the apparent divergence of the paths of religion and scienceltechnology is in fact illusion, that the two have followed common paths for thousands of years, and that it is only in the past century or two that they have seemed to go in different ways. And even now, Noble finds in the great technological thrusts of our day -- space travel, computers, and genetic engineering -- reflections of age-old yearnings; for salvation and transcendence of the gloomy human life foretold in Genesis.

While the first book of die Bible saw humanity cast out of the Garden, it is the hat book, the Book of Revelation (Apocalypse), that offers hope for a new Paradise:

> And I saw an angel coming down from heaven,
> having the keys of the abyss and a great chain in his hand.
> And he laid hold of the dragon, the ancient serpent, who is the devil and Satan,
> and bound him for a thousand years.
> And he cast him into the abyss, and closed and sealed it over him,
> that he should deceive the nations no more,
> until the thousand years should be finished.

Noble argues that religion and technology were inextricably bound in the search for the new millennium for almost two thousand years. He gives us tens of religious persons who showed a strong interest in technology, from Augustine to Erigena to Theophilus, to the Cistercian and Benedictine monks who saw the fruits of technology as stepping stones on the path to salvation. He gives us scores of scientists and technologists who were deeply involved in religion, from Francis Bacon to Newton, Galileo, Boyle, Priestly, Faraday, and on up to many of the astronauts and computer scientists of our day.

But it is when Noble gets to our century -- when he talks of outer space, and of computers, and of genetic engineering -- that he gives us the most to consider. Should we find religious significance in the yearning of human beings to leave the surface of the earth, albeit for relatively short periods of time, or is that too fanciful a suggestion? Noble is intrigued by the fact that the Army's first planned project to put a man in space was called "Project Adam." In another place he quotes Wehrner von Braun (should we call him the "godfather" of

space?):

> Here then is space travel's most meaningful mission. On that future day when our satellite vessels are circling Earth; when men manning an orbital station can view our planet against the star-studded blackness of infinity as but a planet among planets; on that day, I say fratricidal war *01 be banished from the star on which we live. Humanity will then be able to enter the second phase of its long, hitherto only Tellurian history-the cosmic age.

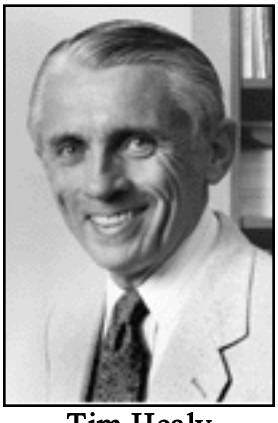
Space travel can lift us from the surface of the earth, to which we were once bound, but computers, and in particular, Artificial Intelligence (AI), have the potential to take a giant step beyond this. Artificial Intelligence may someday have the ability to create new entities, new machines, with intelligence. Will we choose to create a new species, a " machina sapiens"? Will we have a choice? These are some of the questions that Noble raises toward die end of this work. And he asks further, if we do this, will this be our ultimate triumph, as man become God, or will it be our death knel'l? The most radical priests of the AI movement offer views that most would find chilling. Rudy Rucker puts it this way: "The manifest destiny of mankind is to pass the torch of life and intelligence on to the computer."

No less challenging is the vision that Noble offers of the role of genetic engineering. We have seen only in very recent years that we have the ability to done a number of kinds of animals. There is certainly every reason to believe that we may someday done human beings. This may be one route to the conception of human beings without the union of man and woman. We may also be able to create new forms of living beings, new species which we cannot foresee. Does this make us like gods, or does it anticipate the end of our species?

Genetic engineering is also close to offering major advances in medicine that may allow us to live much longer than we do today. Should we see this as a kind of salvation? Are we about to transcend the decaying body which limits the time our minds and souls have on this earth? Or is this a cruel trick.? Is the millennium about to end, and the angel about to unleash the devil?

In conclusion Noble points out, as he did in much more detail in an excellent earlier book, World Without Women (Knopf, 1992), that women have played a relatively small role in the development of both science and technology. He does not suggest that this is due to any limitations on the part of women, but rather that technology is to a large extent, in the vernacular of the day, a "guy thing." In an interesting appendix to the book, Noble muses about the "mysterious marriage Reviewed by between men and machines."

Has Noble made his case? Are religion and technology inextricably bound, or has he simply found a number of historical and contemporary connections that suggest such a tie? Readers will no doubt debate the answer to that question. While I certainly did not find Noble's case to be overwhelming, it did give me some new and useful ways to reflect on some of the important technological and religious questions of our day.



Tim Healy
Professor,
Electrical Engineering,
Santa Clara University

Announcement of Visiting Appointments

The Bannan Institute for Jesuit Education and Christian Values will fund two types of visiting appointments to Santa Clara University.

All campus departments are invited to participate by identifying and hosting qualified visitors whose scholarly, teaching, or professional experience is closely related to the goals of the Institute.

Bannan Visitors

These are persons who visit the University for a brief period of time, ranging from a few days to a week. While on campus, they engage in activities that assist the campus community to reflect on various aspects of the Institute's mission. Examples of such activity would include:

A. They serve as visiting instructors or discussants in classes. The classes are chosen by the sponsoring department, in consultation with the Institute and other interested departments or programs.

B. They discuss their research, teaching, and/or spiritual or practical expertise in faculty and/or staff development sessions.

C. They act as resources for student organizations, or for faculty and stalf through tthe giving of retreats, workshops, or mentoring.

The activities of any particular Visitor will be determined by the hosting department, with the agreement of the Institute.

Bannan Fellows

These are persons who spend one, two, or three quarters at Santa

Clara. They engage in teaching or scholarship or other educational activities on campus, in an area related to the mission of the Institute.

The activities of any particular Fellow will be determined by the hosting department, with the agreement of the Institute.

For the academic year 1998-1999, the Bannan Institute will concentrate on bringing to campus Bannan Visitors. Departments that have possible candidates for this position should contact the Institute's Director, Robert M. Senkewicz, S.j., at extension 6850, or the Institute's Program Coordinator, Bernadette ProuIx, at extension 1951.

Bannan Visitors

Spring, 1998

EDWARD J. O'BOYLE is a social economist whose work is grounded in a personalism that affirms the dignity of every human being, and that asserts that the central purpose of any economic system is to meet human material need. His books include *The Social Economics of Human Material Need* (editor), *Social Economics: Premises, Findings, And Policies* (editor), and *Personalist Economies: Moral Convictions, Economic Realities, and Social Action* (author). His articles have appeared in the *Review of Social Economy*, the *International Journal of Social Economies*, and the *Forum for Social Economies*, amoung others. He has served as a visiting professor at the National University of Ireland in Galway and at the Poznan (Poland) School of Management. He is a graduate of DePaul University and Saint Louis University. His professional work includes more than fifty site visits to private companies in Louisaiana to evaluate their programs to improve quality and productivity and help them inplement innovation in the marketplace and in the workplace.

A major part of Professor Edward O'Boyle's intellectual agenda is to demonstrate ways that injustice undermines the longterm health of an economy, while exploring ways that social justice promotes economic vitality. His work has theoretical implications both for economies and for sociology.

For more information you can reach Dr. O'Boyle at his homepage address: http://www.cab.latech.edu/cab/faculty/~oboyle.htm

Fall, 1998

Dr. Jon Fuller, S.J., is a family physician and Jesuit priest who has been providing care to persons living with HIV/AIDS since 1983. He serves as Assistant Director of the Clinical AIDS Program at Boston Medical Center, is a member of the faculties of the Boston University School of Medicine and the Harvard Divinity School, and is coordinator of AIDS, Ethics and the Church, an international project of the Jesuit Institute at Boston College. In the spring semester of this year, he returned to the Weston Jesuit School of Theology as the Margaret Pyne Professor of Moral Theology. He was founding president of the National Catholic AIDS Network (USA), and since 1991 has been a member of the International Working Group on HIV/AIDS of Caritas Internationalis (Rome).

Dr. Fuller is particularly intersted in the Church's interface with the HIV/AIDS epidemic. This includes not only her pastoral response, but also the social analysis of factors that increase HIV risk and the moral evaluation of HIV prevention efforts.

Dr. Jon Fuller S.J.

Contributions of German and American Jesuits to Economics: The Last 100 Years

By Edward J. O'Boyle; Bannan Bisitor, Spring 1998

Any account of the contributions of German and American Jesuits to economics over the past 100 years must begin with the German economist Heinrich Pesch and Rerum Novarum, wherein Pesch's work originates. As his thinking on economic affairs matured, Pesch established a small study group where two other German Jesuits—Oswald von Nell-Bruening, S.J., and Gustav Gundlach, S.J.—played key roles. These two Jesuits are reported to have written the original drafts of Quadragesimo Anno. At least two laymen in this group—Goetz Briefs and Franz Mueller—immigrated to the U.S., where Briefs joined the faculty of Georgetown University and Mueller joined the faculty of St. Thomas College in Minnesota. Both played a role in the establishment in 1941 of the Catholic Economics Association.

Two American Jesuits, Thomas Divine, S.J., and Bernard Dempsey, S.J. (neither of whom were formal students of Pesch's), are regarded as the founding fathers of the Association. Oddly, these two men—both trained in economics—saw things much differently. Divine was closely allied with mainstream economic thought. Dempsey, on the other hand, was powerfully influenced by Pesch's economic thinking, which at that time and for some time afterward was known as "solidarism." Eventually, Divine's view became the dominant perspective within the Association.

Dempsey and Divine were joined by several other American Jesuits including Leo Brown, S.J., and Joseph Becker, S.J., both of whom

specialized in labor-market problems: Brown in labor-management relations and Becker in employment security. Both became leading experts in their respective domains and probably are the most influential of the American Jesuits in practical economic affairs. Brown became a major labor mediator and arbitrator; Becker became the most outstanding student of unemployment insurance of his time. There are several other American Jesuits who are noteworthy, including Richard Mulcahy, S.J., who published The Economics of Heinrich Pesch to bring Pesch's ideas to those who do not read German; and several American laymen/women who were trained and inspired by the Jesuits. Here I include among others Josef Solterer, William Waters, Peter Danner, Stephen Worland, Gladys Gruenberg, Louis Buckley, Arnold McKee, Charles Wilber, and Catherine Knoop.

I propose a much more detailed survey of the contributions of the German and American Jesuit priest-economists and Jesuit-trained and inspired lay persons in the U.S. and Canada over the past 100 years. Today only a small number of American Jesuits are more or less active in economics or economic affairs. Five come to mind: Gerard Stockhausen, S.J., at Creighton University; G. Paul Peterson, S.J., at Fairfield University; William Neenan, S.J., at Boston College; President John Piderit, S.J., at Loyola University-Chicago; and Edward Boyle, S.J., at the Institute of Industrial Relations.

Most unfortunate is that there is not a single Jesuit university in the U.S. where a doctoral student in economics may study in this tradition and complete his/her work with a dissertation in this area. Literally every department now insists that only mainstream economics has any relevancy. For all intents and purposes today's students of economics, whether graduate or undergraduate, have not heard of Pesch, Gundlach, von Nell-Bruening, Divine, Dempsey, Brown, Becker, Mulcahy, Solterer, Briefs, Mueller, Waters, Danner, Worland, Gruenberg, or any of the rest. This legacy has been buried for some time by an economics profession that accepts only main- stream thought as having any authenticity.

Two developments over the past 20 years, however, are encouraging. First, in spite of their very small numbers, the Saint Louis Jesuits revolutionized sacred music in countless parishes in the United States. It is conceivable that something similar could take place in economics if some of the remaining American Jesuits in economics were centered in one place, as they were for many years at the Institute for Social Order at Saint Louis University and later at the Jesuit Center for Social

Studies at Georgetown University.

Second, John Paul II has articulated a magnificent vision of economic affairs driven by a different set of premises than the individualism that governs Western economies and contemporary economic thought. There is much work to be done in re-thinking economics with these different premises and in finding various ways to apply this thinking to current economic affairs and problems—a worthy undertaking for any economics faculty free to explore beyond the confines of mainstream economic thought.

Second Cycle of Grants Available from the Bannan Institute

The Banan Institute for Jesuit Education announces scholarly and pedagogical grants for Santa clara Faculty, staff, and students.

These grants are designed to support scholarship and pedagogy that further the mission of the Institute. The mission is: "to assist the University in maintaining its Catholic and Jesuit character at the center of the educational enterprise." Within this basic mission, the Institute offers faculty, staff, and students opportunities to explore the implications of the Ignatian and the Jesuitspirituality in the ongoing life of the contemporary University.

The Institute takes its foundation from four aspects of the Ignatian and Jesuit vision: the goal of "seeking and finding God in all things" of Ignatius of Loyola (1491-1556), the founder of the Jesuits; the practive of "cura personalis" (or "care of the person") developed by 16th century Jesuit educators; the *Spiritual Exercises* developed by Ignatius; and "the service of faith and promotion of justice" which defines the contemporary life of the Society fo Jesus. Proposals for both types of grants should explain how the proposal is consonant with the overall mission of the Institute or is related to the exploration of one of these four foundational themes.

SCHOLARLY GRANTS may be used to support or develop a scholarly project that relates to the Institute's mission. Research assistance, travel, scholarly resources, and theconferences of some types of activities the grants will support.

PEDAGOGICAL GRANTS may be used to support or develop a pedagogical project that relates to the Institute's mission. Course development or enhacement, the support or decelopment of co-curricular activities that further the Catholic and Jesuit character of Santa Clara, and faculty, staff, or student development workshops are some of the types of activities the grants will support.

Grants may not be used to replace full-time faculty in the classroom. Monies must be used within one year of the time of the grant is awarded.

Proposals should be written in the normal manner prescribed for University internal grants. Guidelines are available at the Office of the Bannan Institute.

The Institute will seek to award roughly $20,000 in these grants over the course of the current academic year. There are two cycles of awards: in the fall and in the spring. The next application deadline for these grants is May 1. Proposals should be submitted to the Office of the Bannan Institute in Campus Ministry. Applicants are encouraged to consult with the Insitute's Director or with any member of its steering committee before submitting a proposal.

Grants will be announced on June 1.

The Bannan Institute CONGRATULATES the Fall Grant Recipients:

JEANNE GUNNER, the director of Core Curriculum in the English Department, received a grant to edit an enhanced issue of *WPA: Writing Program Administration*, the national journal for composition directors and others interested in writing program development. In this issue, Professor Gunner will focus on collaborative administratoin and leadership and the ways in which a creative writing program can engage and represnet the community it serves. She will also explore the process of designing a program that is democratic, responsice to local conditions, concerned for the welfare of its students and faculty, and collaborative in its efforts to serve the interest of students and institution alike.

THOMAS G. PLANTE, Associate Profesor of Psychology, received a grant to create a conference at Santa Clara entitled: "Contemporary Issues in Formation and Education of Priests: Understanding Boundary Conflicts." Plante plans to bring together the leading experts in the United States and Canada to discuss boundary conflicts that arise between Roman Catholic Priests and lay people. Through the confeence, Plante hopes to develop a program of research and intervention to assist both the Catholic church as well as the mantal health of the community to better educate priests.

The conference will produce a book, with chapters contributed by several leading experts, that will help research and clinical professionals better understand the issues relevant in the research, diagnosis, treatment, and prevention of boundary conflicts in the priesthood. The book would also seek to outlin a research and clinical agenda for professionals interested in this topic.

Authors will be invited to Santa Clara University for a two to three day conference during the spring of 1998. In addition to meetings amoung these authors a panel discussoin will be offered on Friday, June 5th, at 3pm in Alumni Science 102. All faculty, staff, students, and other interested persons are welcome to attend.

TRACY KAHAN, Associate Professor of Psychology, received a grant to unertake an experiential and theoretical/psychological comparison of three spiritual traditions that emphasize contemplative practice: Zen Buddhist and Christian -- Trappist (monastic) and Jesuit (non-monastic). She will conduct and extensive Literature review as well as experiential research on: Zen "mindfulness" practice, Ignatian 19th-annotation retreat, and Christian Contemplative Practice in the Trappist Tradition.

As a result of her retreat experiences and study, Professor Kahan expects to develop a new psychology course entitled Psychology of Consciousness. This upper-division course will be a theoretical, empirical, and experientail investigation of the psychology of consciouseness, with special emphasis on cognitive, developmental, and social perspectives. The class will integrate selected readings, analysis of the paradigms used to investigate consciousness, and personal experience with "mindfulness practice" as a tool for directly experienceing the nature of "mind."

In addition, Professor Kahan palns to author an analysis, "cognitive-psychological/experiential analysis of contemplative practices in the Jesuit,Trappist, and Zen-Buddhist traditions," in which she will assimilate her retreat experiences on both the personal and theoretical levels.

LECTURE SERIES

Fall 1998
**FRIENDS OF GOD AN DPROPHETS:
COMMUNITY ON EARTH AS IN HEAVEN**

Lecture by Elizabeth A. Johnson, C.S.J., Distinguished Professor of Theology at Fordham University. Professor Johnson's latest book, *Friends of God and Prophets: A feminist Theological Reading of the Communion of Saints*, was recently published by Continuum.

Sunday, October4, 1998 at 7:30pm Recital Hall of the Center for the Performing Arts

Winter 1999
TITLE TO BE ANNOUNCED

Lecture by Klaus Porzig, M.D., a leading oncologist with South Bay Oncology Hematology Partners, as well as a teacher for Standford University Mediacl School.

Date and time to be announced later.

Spring 1999

"THE COMMON GOOD IN DIVIDED SOCIETY

Lecture by David Hollenbach, S.J., the Flatley Professor of Catholic Theology at Boston College.

Sunday, April 18, 1999 at 7:30pm Recital Hall of the Center for the Performing Arts

next issue:

As we conclude our last issue for this academic year, we want to thank you, dear reader, for your insightful comments, and helpful suggestions, during this inaugural year.

We have already begun gathering articles, essays, and topics for our next year's issues, and we would like to invite your contributions. What about **explore** have you enjoyed the most? What else would you like to **explore**? What might be good topics for us to **explore** together? We welcome your letters, e-mail, and voice mail!

And, once again, thanks for your continuing support. See you again in the fall.