Institute For Theological Encounter With Science and Technology

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Viewpoints — A Minority/Majority Perspective

Michael Crichton stated the following in a 2003 lecture at Caltech: "If it's consensus, it isn't science. If it is science, it is not consensus. Period." So each issue of the *ITEST Bulletin* tries not to provide consensus but rather differing opinions on science. As we examine faith and science, ITEST believes that they are complementary.

For example, an earlier *ITEST Bulletin* examined climate change from various perspectives. The scientists did not provide a consensus. Steven Koonin, in his new book, *Unsettled*, claims the planet's climate is an area of science that is complex and multidisciplinary. He is not a "climate denier." However, the heart of the science debate is not about whether the globe is warmer or if humanity contributed to it. The important questions are about the magnitude of civilization's contribution and the speed of changes. Koonin provides data that supports his assertion. His science credentials are impeccable. He has been a professor of physics at Caltech and served as the top scientist in Barack Obama's Energy Department.

With the increase in social media, many people voice opinions that are being heard. Sometimes people jump on the bandwagon and ideas take off, but this may not lead us to the truth. Thus, the majority may not be correct, but that is the idea that is promulgated. The majority can be loud, and sometimes they are correct. However, the bandwagon effect can create a perception of a false truth, just as the minority can be loud and incorrect, and draw the bandwagon their way.

In this issue of the *ITEST Bulletin*, we make a case for the minority viewpoint being taken into consideration. Ed O'Boyle has written several essays on various topics concerning economic issues. Included is his essay on the minority vs. the majority. The minority is not always incorrect; the minority sometimes has the correct answer. Think about the points being made, and you can decide whether the truth lies more with the minority or majority voice on these issues.

Father Udias describes how Catholic scientists have greatly contributed to our knowledge base. I hope you benefit from reading his extensive article on great scientists.

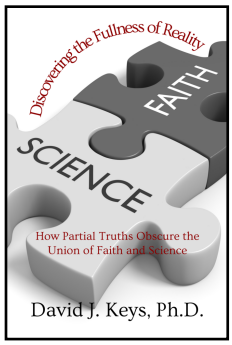
Lastly, we provide a list of popular Catholic scientists. Because we had limited space, we included only 50 scientists in our list, making a deliberate attempt to pull scientists from various disciplines, countries, centuries, and religious orders. If you decide that we missed someone who should be on the list, please let us know. We plan to put the more comprehensive list of Catholic scientists on our website.

Ralph Olliges

Ralph Olliges, Editor

In This Issue...

Announcements



New Book

Discovering the Fullness of Reality: How Partial Truths Obscure the Union of Faith and Science

by Dr. David J. Keys

"Is there a transcendent element to Human Life?" In pursuit of an answer, Keys presents to the reader both things of the world which exist and affirm the teachings of science and things of this world which apparently defy such teaching. Because by definition truth cannot deny another truth, Keys shows that, in the end, apparent contradicting truths can both be true, but true in the sense they both accurately describe an aspect of reality. It is when one considers the **Fullness of Reality**, that apparent opposing truths can be recognized as addressing only a partial reality. It is in this way that science and faith, which many say do not mix, can be demonstrated to not oppose one another; rather, they complement each other.

https://enroutebooksandmedia.com/fullnessofreality/

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Presenter: Dr. David Keys
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Letters to the Editor

ITEST Bulletin Editor, Ralph Olliges, gave an assignment to his "Social Movements and the Impact of Technologies" class at a midwestern secular university. The students were asked to read the articles in the Fall ITEST Bulletin on Climate Change and discuss whether they agree with the various authors. They were asked to explain why or why not. We encourage letters to the editor from all viewpoints. Following are a few of the students' responses.

The real issue with these essays is if we allow ourselves to believe this is a divine action, which I understand it could be, it in theory creates a world where if one acts against climate change, one is in theory resisting the Lord's will. One author views carbon as part of our natural divine process, and another views global warming as directly the Lord's will.

It's difficult to merge science and religion like this. I can understand and I do use Christian ethics and moral systems in my secular life, however I think the merging of the two in this specific way, of seeing scientific data as a large piece of the divine puzzle is complex. They both infer a level of understanding which precludes the other.

Most of these read like early 2000's arguments, about if it exists, rather than how we should deal with it, which may just be a generational issue: I've read a study that describes how gen Z sees climate change as a problem solving question, not a belief one.

— Alexander Hongs

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Institute for Theological Encounter with Science and Technology
Cardinal Rigali Center • 20 Archbishop May Drive • St. Louis, Missouri 63119 • USA
314.792.7220 • www.faithscience.org • E-mail: ITEST@archstl.org

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I am happy to read well thought out and supported articles about a side of the climate conflict that I don't typically hear about. Since I have heard most of the information I know from the media, it is generally tainted by the politics of the climate issue, rather than focusing on the science of the issue. I was glad that most of the articles mentioned how models are not 100% accurate and are susceptible to changes as the climate fluctuates daily in different areas around the world.

In particular, I disagree with the idea that humans are only small contributors to the Earth's climate in general. I think that our actions have a direct impact on whether or not climate change causes catastrophic problems in the future. I also find it hard to believe that our population and industrial growth over time have not had any kind of negative impact on the climate, and that we can continue on this path with our rate of growth without any changes. Also, multiple times they mentioned that carbon dioxide was not the cause for the increasing temperatures in our atmosphere, but they didn't fully explain their reasoning for what is causing this increase in temperature in our atmosphere. I would have liked to read more about what they think is causing the subtle rises in temperature over time.

— Liska Hromnak

I thought the articles were interesting in bringing up various points, some of which I'd never heard. I also wish that climate change would not be politicized; it unfortunately seems as if we are beyond that point. I also think the authors are right to raise the awareness of what we, the public, consume, listen to, etc. as it relates to the issue. Who is the source? Are all the facts actually included? I do think that there are instances, as with other matters, where we are not giving the full information.

I disagree with Thomas Sheahen when he says, "the desire to 'reduce your carbon footprint' or stop using fossil fuels is totally unnecessary." Experts in the field, like climate scientists, have explained how harmful fossil fuels are to the environment. I understand that correlation does not equal causation, but there have been facts presented that shouldn't be ignored. I think the attitude does not necessarily stem from the science and facts themselves, but from the possible ramifications of addressing climate change through things like banning fracking and ending fossil fuel use, etc. Oil and coal industries play an important role in politics and the economy across the world. As we know, they make donations to politicians who then have the ability to address/not address climate change through legislation. There is also the fact that there are many everyday people who work in these businesses and of course would not want to lose their jobs.

Part of the reason why portions of the population are not concerned about climate change is because the issue is talked about as something of the future, to be dealt with in the future. I can understand not wanting to be an alarmist, but we should be concerned about what will happen in the future, as well as now, as a result of climate change. I think humans need to take accountability of how we have harmed the earth and also harmed each other through the environment.

— name withheld upon request

What I liked after reading the article was hearing the different viewpoints on how even computer models can have flaws and that nature is still unpredictable. I agree that climate change and science should not be politicized when there are concrete evidence and facts. Something that I feel wasn't addressed due to our current political climate is trying to find common ground with a side that doesn't believe in science, as we see with the rise of social media and misinformation also now affecting the issue on how to treat this problem. I agree that humans are adaptable and capable of making a lot of change to their current environment, but as stated in the article, climate refugees are going to be a new facet on this issue that we will unfortunately feel the effects of. People who will be feeling the first impacts of climate change will be the poor, while richer people will be able to find ways to sustain their daily routines. I think the articles were a good starting point for these discussions, but I felt many factors were left out or were not mentioned like some issues such as waste caused by big corporations or buying up land to bottle water that add to pollution in the environment.

— Jake Cancino

I think it’s important to err on the side of caution, because regardless of whether or not the detrimental effects of global warming are happening tomorrow is not necessarily the point, and we should be working together to be more sustainable in our living and give back to the Earth that provides for us. I found the part about human resilience to be a very interesting take in the bulletin, as well as how comforting faith can be in times of distress and to help us cope through these hard times. I think that the bottom line is that the climate is changing and we need to be working to preserve our planet the best we can regardless of what proof we have.

— Lindsay Emert

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Several times, uncertainty regarding climate models was discussed. This is often an argument used by climate change skeptics to cast doubt on the science. In reality, proper scientific papers always include sections discussing the limitations of their experiment and areas for further study, and people have taken these sections and used them to assert that scientists have doubts about their models. In reality, there is high confidence in the climate models among the scientific community.

—Carolyn Aughey

Regarding *The Case for Pro-Global Warming* by Dr. Steven I. Parks, this author explains that the rise in temperature will affect us tremendously as human beings, examples being water evaporating from the ocean, the Arctic warming and glaciers melting, etc. Furthermore, as these glaciers/Arctic ice melt, the sea levels will rise, and as the ocean water warms, the water will expand. All of these things have detrimental effects on our livelihood. I appreciate this article because it provides evidence and statistics.

— name withheld upon request

It explained climate change in depth, which helped me further understand this controversy as a whole. I do believe that science is ever-changing and this is something that has to be taken into consideration.

— Kalen Barnett

Silencing the Minority

Edward J. O'Boyle, PhD

One essential condition for democratic rule to enhance authentic self-governance is that the majority may not oppress the minority. Indeed, it is the duty of the majority to protect the minority. Democracy degenerates into despotism when a self-righteous majority takes control of the reins of government.

That's why we have a Constitution with a Bill of Rights. The majority may not use its power to tamper with the minority's right to assemble in public, to petition the government, to express themselves freely in the spoken and written word, to worship their Creator without interference. To bear arms, to be protected from unreasonable searches and seizures, and from having their property seized without just compensation. To a trial by an impartial jury, to be confronted by their accusers, along with other protections gotten not from the government but *guaranteed by the government*. In other words, guaranteed by the majority.

In a constitutional republic the people elect persons to serve as their representatives in Congress to address the needs of the people through legislation that is subject to careful deliberation and agreement which becomes the law of the land with the approval of the president. Any law bearing the president's signature can be submitted to the Supreme Court where it is examined to determine whether it complies with the Constitution or not. The Court's decision is final.

Today we see that this arrangement which dates from the American Revolution and assures authentic self-governance is under attack by a self-righteous majority elected democratically but committed to silencing the minority. Let us count some of the ways.

Impeachment. On February 8 the Senate began proceedings to determine if ex-President Trump is guilty of the crime of inciting an insurrection on January 6 when the very large gathering of persons who attended his speech that day on the Ellipse stormed the Capitol building. These proceedings have the effect, if not the intent, of silencing those who voted for him last year and those who worked in his administration for fear that they too will be scrutinized and attacked by the self-righteous majority.

Filibuster. Any senator who is recognized to speak by the chair of the Senate can, acting on her own, hold the floor and stop the Senate from acting until at least 60 senators vote to silence her. This rule is under attack today by the self-righteous majority who want it re-

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moved because it stands in the way of their legislative agenda.

Expulsion. Certain members of the self-righteous majority are calling for the expulsion of duly elected members of both houses of Congress for what they have said or written. Simply put, their First Amendment rights are being directly threatened.

Executive Order. President Biden is using executive orders to change certain laws and regulations which the self-righteous majority demands because they fear that a Congressional minority might be able to muster enough strength to frustrate their purposes if the issues in those executive orders were debated in Congress.

Pack the Court. Throughout last year's campaign, Biden would not say that if elected he would not increase the number of justices on the Supreme Court. He still has not renounced the idea. Packing the Court likely would have the effect of favorable decisions on issues backed by Biden and unfavorable rulings on issues backed by his opponents.

First Amendment. Simon and Schuster book publishers cancelled plans to publish a book by conservative Senator Josh Hawley of Missouri. Other authors expressing minority views could experience a chilling effect on what they write.

Terrorists Within. Speaker of the House Nancy Pelosi claims that there are domestic terrorists in the present membership of the House of Representatives.

The effort to silence doesn't end with the self-righteous majority in Washington. Take note of the following.

Employment. Forbes magazine chief content officer warned that if a company hires a press secretary who worked for Donald Trump, *Forbes* would consider whatever that company says in public a lie.

Business. The *My Pillow* guy, who openly supported Trump's re-election, has reported that since the election, major retailers of his products have cancelled purchase orders.

Censorship. Twitter is blocking speech on its platform which it considers hateful, violent, or harmful. Those terms, of course, are value-laden which means that *Twitter* has enabled itself to censor whatever content it pleases.

Insurrectionists. Among persons who attacked the Capitol building in January are men and women who have been identified and called out selectively in the media as *Christian Nationalists.* This reporting tends to silence those Christians who otherwise might object that the Biden administration is using their taxpayer dollars in ways that conflict with their deeply held religious convictions.

It's a mistake to consider the narrow margin of Democrats in the House and the even narrower margin in the Senate where Vice-President Harris holds the tie-breaking vote as indicating that President Biden will have to forge agreement with Republicans to get approval in Congress for some of his more radical proposals. In like manner, it's a mistake to line up the two sides as either progressive or conservative. What conservative/Republican representative, for instance, does not readily accept federal dollars to add a runway at an airport in her district, upgrade a sewage treatment plant, or provide broadband access to more of her constituents?

The division that matters most is between Washington insiders and outsiders, between those establishment types inside the beltway who embrace or at least accept big government with entitlements for all and those from outside the beltway, from the rest of America, who espouse limited government with individual freedom and personal responsibility for all.

With the backing of establishment types in Congress and the intimidating methods of the self-righteous majority, Biden clearly has a considerable advantage for pressing ahead with his progressive plans for bigger government. Holding on to the republic our founders handed us requires us to once again, as stated in the Declaration of Independence, appeal to the "Supreme Judge of the world for the rectitude of our intentions."

Biography of Ed O'Boyle

Edward J. O'Boyle, PhD, is Founder and Senior Research Associate of the Mayo Research Institute and a long-time member of ITEST. Ed holds a doctorate in economics from Saint Louis University. Until his retirement 14 years ago, he worked for 10 years in public service doing research and held a faculty position at a Louisiana public university for 30 years. He and his wife Meade, who is a practicing pediatrician, have been married for 50 years. They have 4 children and 13 grandchildren.

Contact him at www.mayoresearch.org or edoboyle737@gmail.com.

Catholic Church and Science in Modern Time

Agustín Udías, S.J. Universidad Complutense, Madrid

Abstract

The Catholic Church and science have interacted for centuries; here we present the relationship in modern times. Contrary to popular belief, a number of the great modern scientists beginning in the nineteenth century were devoted Catholics. The Catholic Church has a special relationship with science with many ecclesiastic active scientists, especially the Jesuits, in universities and observatories. The popes have made known their appreciation for science creating the Pontifical Academy of Science and the Vatican Observatory. Testimonies of modern Catholic scientists are presented.

Nineteenth-century Catholic scientists

Contrary to the conventional wisdom of the alleged general religious disbelief of modern scientists beginning in the nineteenth century, a century considered to be of a widespread anti-religious climate, many of the great scientists maintained deep religious convictions, among them a number in the Catholic tradition. Among the great French physicists, André Marie Ampère (1775-1836) stands out. Educated in the Catholic faith, he writes in an essay about the philosophy of science (*Essai sur la philosophie des sciences*, 1838): "One of the most striking evidence about the existence of God is the marvelous harmony by which the universe is preserved and living beings received in their organization everything they need for life." Searching for arguments in favor of Christianism, he adds: "All kinds of proofs are united in favor of Christianism. To discover its truth, the philosopher only needs to examine how the divine religion simultaneously explains man's greatness and smallness and the idea that Christianity gives of God's relations with his creatures and the care of his Providence." [1]

Similar cases can be also found among scientists from other fields besides physicists, such as mathematicians, chemists, biologists, and geologists. For example, the famous mathematician Augustin Cauchy (1789-1857), one of the great proponents of mathematical analysis, acknowledged: "I am glad to recognize the noble generosity of Christian faith in my distinguished friends Haüy (René Just Haüy, 1743-1822), founder of crystallography, Pelletier (Pierre Joseph Pelletier, 1788–1842) and Laënnec (René Hyacinthe Laënnec, 1781-1826) introducers of many advances in medicine, such as the quinine and the stethoscope and the immortal founders of dynamic electricity Frecynet and Ampère." [2] Cauchy's formal adherence to the Catholic Church brought him problems with the anti-clerical atmosphere in France at that time. The chemist Michel Chevreul (1786-1889), against those who thought of him as a freethinker, affirmed that he was only a scientist; "those who know me are aware that I have been born and raised by Christian parents and I live and desire to die as a Catholic." [3] Louis Pasteur (1822-1895), the father of microbiology, was a devout Catholic all of his life. In these scientists, God is considered often as the warrantor of the order in nature. The study of nature is considered by some of them, as something endowed, in some way, with a certain religious character. They express a rejection of the idea that science can turn away from religion and hold a firm conviction of the opposite. Many of the great scientists of the nineteenth century were religious persons, Christians of different confessions who never thought that there was an incompatibility between their science and their religious sentiment, and Christian beliefs.

Two positions that indicate two different emphases in the relation between science and religion, namely, separation and integration, are found in scientists' strong belief in the Christian traditions.[4] The Catholic Pierre Duhem (1861-1916), a physical chemist and historian and philosopher of science, author of *Physique de Croyant* (1906, *Physics of a Believer*), defends the strict separation between science and religious faith. According to him, physics can be equally practiced by a materialist non-believer as by a devout Christian; religion and metaphysics are irrelevant to work in physics. For him for the physics of a believer is just physics as it is the case for a non-believer. Duhem holds strict positivism in science, as in some way he does also in religion.

Catholic ecclesiastics and scientists

The presence of Catholic ecclesiastics in the natural sciences in the nineteenth and twentieth centuries is not often recognized in a time when they were considered as a secular field often hostile to Christian faith. However, Catholic ecclesiastics and members of religious orders were active and made important contributions in different fields of science.[5] A few examples are given from different countries and fields of science.

Giovanni Antonelli (1818–1872), a Piarist Father, was director of the Astronomical Observatory Ximeniano in Florence. Besides his astronomical works, he contributed to the design of machines of internal combustion which led to the development of automobile technology.

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Lorenz Hengler (1806–1858), a secular priest formed in mathematics and astronomy at the University of Munich among other contributions, put the basis for the development of the horizontal pendulum applied to the measurement of the deviation of vertical in the earth. The horizontal pendulum is used in the design of horizontal component seismographs. Among the first Italian seismologists and vulcanologists, Giuseppe Mercalli (1850–1914), a secular priest and director of the Vesuvian Observatory, stands out for the proposal of his scale to measure the intensity of shaking produced by earthquakes. His scale, known today as the Mercalli Scale, is still used and it is the basis of other modern scales.

At the beginning of the studies on electromagnetism, Francesco Zantedeschi (1797–1873), priest and professor at the University of Padua, worked on the research of the production of electric current by magnetic fields contemporary to the work of Faraday. He was one of the first to discover the predominant absorption of the yellow, red, and green components of solar radiation by the terrestrial atmosphere. Ányos Jedlik (1800–1895), a Hungarian Benedictine professor at the University of Budapest, was a pioneer in the design of the dynamo and the electric motor. He made pioneer contributions to the application of electromagnetism to the auto-excited electric motor. In other fields of science, Hugo Obermaier (1877–1946), a German priest, was a renowned paleontologist and anthropologist for his studies of the human prehistory during the ice age, among them those of the cave paintings in northern Spain. Léon Abel Provancher (1820–1892) was a priest and naturalist with his first studies of the fauna and flora of Canada. He is considered to be the "father of Canadian natural history."

Special mention is deserved of two great pioneer figures of science. Gregor Mendel (1822-1884), member of the Augustinian Order, born in Heinzendorf, then Austria and in the present Czech Republic, was the first to develop the basic principles of genetic heredity with his studies of hybrid plants from which he formulated the laws known today as "Mendel's Laws." With his studies, he opened the way for what is known today as the science of genetics. The other is George Lemaître (1894-1966), priest and professor of physics at the Catholic University of Louvain, who proposed in 1927 the solutions of Einstein's cosmological equations which correspond to a universe in expansion. In 1931, he showed that if the universe is expanding, in the past all matter was concentrated at an enormously dense point, which he called a primitive atom (*L'hypothèse de l'atome primitive*), from which the universe has expanded. In this way, he gave origin to, what is today called the theory of the "Big-Bang."

The presence of Catholic ecclesiastics active in different fields of the natural sciences shows that they did not find any conflict or incompatibility between their Christian faith and scientific practice. Lemaître recognizes this explicitly, stating that nothing in his work, nothing of what he has learned in his scientific or religious studies has made him modify this point of view. For him, there is no conflict between science and religion. Science did not break his faith and religion never led him to question the conclusions to which he arrived by scientific methods.[6]

Jesuit astronomers, geophysicists, and biologists

Among the Catholic religious orders, Jesuits occupy a special place regarding work in the natural sciences. During the seventeenth and eighteenth centuries, their colleges and universities incorporated the teaching of mathematics, astronomy, and experimental science into their teaching which was a novelty at the time. In modern times they continue this tradition. At present, Jesuits manage 133 universities and more than 300 schools and colleges in the world, where a large number of Jesuit professors of science are dedicated to teaching and research, especially in mathematics, physics, chemistry, and biology.[7] From 1825, the Jesuits founded a worldwide network of about 70 astronomical and geophysical observatories, some of them still in operation. Those installed in Africa, Asia, and South and Central America were in many cases the first scientific institutions in these countries.[8] Jesuits at the observatories stand out especially for their contributions to astronomy, terrestrial magnetism, and the study of tropical hurricanes and earthquakes.

Among the Jesuits working at the observatories, some deserve special mention. Angelo Secchi (1818-1878), director of the Observatory of the Roman College (today Gregorian University) is considered as one of the pioneers of astrophysics.[9] His most important scientific contribution is the proposal in 1867 of the first classification of the stellar spectra based on the spectroscopic analysis of 4000 observations. This classification, extended and modified, is the base of the present Harvard Spectral Classification, a basic instrument in astrophysical studies. Stephen Joseph Perry (1833-1889), was director of the Stonyhurst Observatory (United Kingdom) and worked on the relation between the study of solar activity and terrestrial magnetism. His scientific prestige motivated his being placed in charge of four scientific expeditions, financed by the British government and the Royal Society, of which he was a member. Two expedi-

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tions observed solar eclipses, and the other two observed the transit of Venus through the solar disk.

Many of the Jesuit observatories had sections of meteorology.[10] Benito Viñes (1837-1893), director of the Observatory of Belén in Havana, Cuba, made some very important early contributions to the study of tropical hurricanes. He put in practice his knowledge of the nature of hurricanes in the Caribbean to the forecasting of their arrival, saving many lives and material damage.[11] Similar work was done by Federico Faura (1840-1897), director of the Observatory of Manila who applied Viñes' work to typhoons, or cyclones of the Pacific Ocean which each year cross the Philippines Archipelago. Charles Deppermann (1889-1957) continued Faura's studies about the nature of typhoons applying the principles of frontology and the analysis of air masses to their genesis and trajectories.

Another earth science where Jesuits made important contributions is seismology with the establishment of a worldwide network of seismological observatories.[12] James Bernard Macelwane (1883-1956), was a professor at Saint Louis University (Missouri) and a renowned seismologist with his studies of the structure of the earth interior through seismic waves and their application to the discovery of mineral resources. He established the basis of many further developments of seismology.

Several Jesuits devoted themselves to biology, a relatively recent science, beginning in the middle of the nineteenth century. In Germany, Erich Wasmann (1859-1931), an early defender of the theory of evolution, stands out for his work about ants and termites. In Portugal, the entomologists Joaquim da Silva Tavares (1866-1931) and Candido Azevedo Mendes (1874-1943) were the founders of the journal *Broteria*, originally dedicated to the natural sciences.[13]

In India, Jesuits have created a brilliant tradition that continues today in botany with applications to agriculture, the environment, and ecology in many Jesuit universities and colleges. Among the first are the Swiss Ethelbert Blatter (1877-1934) and the Spaniard Hermenegildo Santapau (1903-1970), professors at St. Xavier College, followed by a large group among them Koyapillil M. Mathew (1930-2004) professor of botany at St. Joseph College and eminent taxonomist, devoted to the study and conservation of the shola forests of the subtropical region of the south of India.

The Vatican Observatory

The interest of the Catholic Church in science and especially in astronomy at its highest institutional level is shown by the establishment of the Vatican Observatory.[14] From its foundation in 1774, Pope Clement XIV (1705-1774) had considered the Observatory of the Roman College as something of his own and Pius IX (1792-1878) gave it the title of Pontifical Observatory. In 1870 the observatory was taken by the new Italian government. In a time when the church was accused of being opposed to science, the pontifical observatory was a sign of the opposite. For this reason, Pope Leo XIII (1878-1903) thought it necessary to found a new observatory with the name *Specola Vaticana* (Vatican Observatory). In its inauguration in March 1891, the Pope expressed the reasons for its foundation beginning: "So that they might display their disdain and hatred for the mystical Spouse of Christ, who is the true light, those borne of darkness are accustomed to calumniate her to unlearned people and they call her the friend of obscurantism, one who nurtures ignorance, an enemy of science and of progress, all of these accusations being completely contrary to what in Word and deed is essentially the case." He ends saying: "This plan is simply that everyone might see clearly that the Church and her Pastors are not opposed to true and solid science, whether human or divine, but that they embrace it, encourage it, and promote it with the fullest possible dedication."[15]

The interest of the Catholic Church in science and especially in astronomy at its highest institutional level is shown by the establishment of the Vatican Observatory.

The observatory was first installed in the Vatican in the so-called Tower of the Winds. The first director was the Barnabite Francesco Denza (1834-1894). From its foundation, the observatory participated in international astronomical projects. In 1906, Pius X (1835-1914) named as director the Jesuit astronomer Johann Hagen (1847-1930), and in 1933, Pius XI formally entrusted the observatory to the Jesuits. In 1935 it was moved to Castel Gandolfo, in the palace of the Villa Barberini, with two domes and new telescopes. The Jesuits still manage it today.

In 1993, the Vatican Observatory installed a new telescope of advanced technology in Mount Graham, Arizona in collaboration with the Observatory of the University of Arizona, where research is presently carried out. The observatory is active in a variety of research projects such as properties of meteorites, observation of exo-planets, and groups of stars and galaxies. As the previous director, the Argentinian Jesuit José Gabriel Funes, expressed it: "Like all astronomers our deepest desire is

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to be on the frontier of astronomical research; we share with our colleagues the same excitement in seeking answers to the fundamental questions about the universe: Are we alone? Are there other Earths? How do stars and planets form and evolve? How do galaxies form and evolve? What is dark matter and dark energy? What do we know about the universe in its first instance? Are there many universes? But more fundamentally, our only goal is to do good science; our only commitment is to pursue truth, wherever it is to be found." [16]

It is clear, therefore, the purely scientific work of the observatory and the Church interest is for science itself, outside of any apologetic interest.

Catholic scientists and the problem of science and religious belief

In a more general way, not just regarding the Christian faith, we can still ask the question of whether modern scientists are religious believers. In some publications, the impression is given that, in general, modern scientists are either atheists or agnostics. The great modern physicists, such as Planck, Einstein, and Heisenberg were open to the mystery of transcendency and not alien to the religious thinking, although they cannot be considered as conventional believers, either Christian or Jewish. Antonio Fernández Rañada, professor of theoretical physics at the Universidad Complutense (Madrid), in his book, *Los Científicos y Dios* (1994, *The Scientists and God*), shows the falsehood of the stereotype that scientists are radically and necessarily opposed to the religious experience, since for him the practice of science neither favors nor alienates religious faith.[17] Stanley Jaki (1924-2009), a Benedictine priest and physicist, maintains that it is the rationality of God creator who imposes His laws on nature that then can be known by man.[18] For him, the regularity and intelligibility of nature, a presupposition of science, can only be fully explained by the acceptance by Christian faith of its creation by a personal and transcendent God. According to him, only if the idea of a rational creator God is taken seriously, the basis for a scientific work of an assured success can be established.

A collection of testimonies was published in 1928 in France by the journal *Le Figaro*,[19] with the answers of 45 scientist members of the *Académie des Sciences*, France's most prestigious scientific institution, most of Catholic tradition (6 mathematicians, 8 physicists, 6 astronomers, 7 chemists, 4 geologists, 4 biologists, 5 physicians, 5 engineers). The proposed question was whether science is opposed to religious sentiment. In all cases the answer is negative. The mathematician, Henri Andoyer (1862-1929), answers that rather the scientific spirit implies in some way a certain religious spirit. The famous mathematician Émile Borel (1871-1956) makes clear that there is not any psychological incompatibility between the religious sentiment and what may be called the scientific sentiment, that is, the liking and enjoyment for science. The geodesist Charles Lallemand (1857-1938), president at that time of the *Académie des Sciences*, states that "Science, notwithstanding all the hopes that point its wonders, very probably will always have forbidden the entrance to certain mysterious realms to which reason has not access." The chemist Charles Moureu (1863-1929) ends his contribution saying that religion can satisfy "the desires of the heart … it brings an answer to the supreme question that science cannot solve." Finally, Paul Sabatier (1854-1941), winner of the Nobel prize of chemistry affirms that it is not reasonable to oppose religion and science; this does not have any use and is something proper to people badly instructed in both.

Going from these considerations to more positive positions, the testimonies of present scientists who consider themselves deeply religious believers can be found in the book published in 1989 by Jean Delumeau: *Le Savant et la Foi* (*The Scientist and Faith*) with the testimonies of nineteen scientists, most of them French, who confessed themselves believers, mostly Catholics, and for whom there is no break between their scientific and religious thought.[20]

Among them, there are physicists, mathematicians, astronomers, biologists, geologists, chemists, and physicians. Authors answer that science and faith do not exclude nor contradict each other because they are not on the same level. All of them feel that their faith is not in any way a restraint to their scientific research, and their scientific work is not a danger for their religious faith. Xavier Le Pichon (1937-present), a geologist and one of the initiators of the theory of plate tectonics, admits: "I have often occasion to see opening in me this capacity of worship, even along my scientific explorations". André Lichnerowicz (1915-1998), a professor of mathematics at *Collège de France*, talking about the world, states that it is more reasonable to think that creation is born from the love of God and not from an external and previous nothingness which can only be a phantasmal thought from an absence. A collective chapter titled *How to show today Christian faith by a scientist* signed by twenty-three scientists present, among other questions, how to be a Christian in a scientific setting and the role of scientists in the believing community.

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Agustín Udías, Jesuit, Professor Emeritus of Geophysics at Universidad Complutense de Madrid, has held research and teaching posts at the University of California, Berkeley, Wolfgang Goethe Universität, Frankfurt am Main, and Universidad de Barcelona. Among his books are *Principles of Seismology* (Cambridge University Press, 1999) and *Jesuit Contribution to Science* (Springer, 2015). He has published articles on the topics of earthquake source mechanism, seismicity and seismotectonics of the Mediterranean region and the history of Jesuit scientists. Father Agustin is a long-time member of ITEST.

Science: A Continuous Struggle to Get It Right

Edward J. O'Boyle, PhD April 12, 2021

If expertise is knowing it all, there are no experts. Truly committed men and women of science are forever probing at the edges of what is known for the purpose of expanding the body of knowledge and helping them better understand what they already know but only imperfectly. At times, if they are honest, their continuous probing brings them face to face with hard evidence that indicates clearly their science got it wrong. The body of knowledge has to be reconstructed, a truly difficult task because it means giving up long-held ideas like the earth is flat, heavier bodies fall faster than lighter bodies, and human beings cannot run faster than a four-minute mile.

The plain truth is there are no experts, only specialists. Even so, a scientific and technological age demands experts. Of late we've heard a lot from experts on two subjects of great concern: Covid-19 and climate change. The problem for people who are not experts in either field is who to believe.

Some of the experts are not really experts. They're advocates with no training or experience in either field who have been caught up in the growing support for "doing something." Some of the experts are not experts, they are novices still in training. They lack the experience to be able to tell the difference be-

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tween sound research and shoddy research. Others have the training and experience but are not actively engaged in research.

Some with the necessary training and experience are engaged superficially in research. Through personal friendships and professional contact, they are able to have their names added to research papers without any effort at all. That's one important reason why professionally published papers today have as many as six, eight, even ten co-authors.

Sometimes even the experts don't agree. In economics, for example, there are classical and neo-classical economists, Keynesian, neo-Keynesian, and post-Keynesian economists, supply-siders, monetarists, institutionalists, feminists, Marxists, environmentalists, Christian, Islamic, social economists, and others. What to do regarding policy depends on whom you ask.

As a general rule, believe the man or woman of science who tells you "This is what I know but there is so much more that I don't know." True of climate change, and true for sure with Covid-19.

At times it's best to ask a person who is not actively engaged in research but is extremely well-read in a specialized field because that person is less likely to have some pet theory that she clings to. For a scientist, a pet theory is like a pet dog and her mistress. It's difficult to separate the two. My own passion is personalist economics.

With climate change the science is relatively new. With Covid-19 the science is even newer. There is a body of knowledge associated with climate change, but can we be sure that what we think we know is really true? For instance, *how much carbon dioxide is too much for human wellbeing*? At present the Occupational Safety and Health Administration says in the workplace 5000 parts per million is the permissible limit for 8-hours exposure. A 2019 peer-reviewed article that examined 18 studies of the effects of carbon dioxide on humans concluded that levels below 5000 ppm "may pose direct risks for human health." The 2019 article, which contains language such as "supports the possibility" and "plausible mechanism," and the OSHA limit taken together indicate even to a non-specialist that the science on carbon dioxide's effect on human beings is far from settled.

On the other hand, *how much carbon dioxide is too little for plant life*? At present, carbon dioxide at concentrations below 400 ppm is regarded as a threat to plant life, and because plants are a primary source of food, a threat to human life. In a 2015 lecture, Patrick Moore who is the founder of Greenpeace and holds an earned doctorate in ecology asserted that without the presence of carbon dioxide in the global atmosphere "at a sufficient concentration this would be a dead planet." He argued that carbon dioxide at 2000 ppm would optimize plant growth. In the same lecture, Moore stated that the global ecological system is so chaotic that "long-term prediction of future climate states is not possible." Is he a climate-change denier or a prophet?

The CDC estimates deaths from Covid-19 using a methodology developed many years ago at Johns Hopkins University. To simplify, deaths expected over a one-week period under normal conditions are compared to the actual number of deaths under abnormal conditions such as the Covid-19 pandemic. The difference between those two numbers – the excess number of deaths – provides an estimate of the number of deaths due to Covid-19.

Actually, since we are talking not about actual body counts but estimates subject to revision, the CDC provides two estimates: deaths where Covid-19 is one of several causes and deaths where the virus is the underlying cause. For the week ending January 16, the estimated number of deaths where the virus is one of several causes was 5521. The estimated number of deaths where it is the underlying cause was 5332 (see data.cdc.gov).

These numbers may be undercounts due to delays in the reporting of the raw data sent to CDC by state health officials. The numbers may be inaccurate due to errors made on death certificates. The science of counting the dead is not settled. Even more so, the science used to estimate deaths in the future is not settled.

Most important of all, treatment protocols vary from medical center to medical center depending on the persons who prepare the protocols and their hands-on experience with the virus. Those differences likely account for much of the differences in how Covid-19 patients are treated. Admission criteria, use of oxygen, drugs including steroids, dosage, length of stay. Health care providers are still learning what works and what doesn't. The science that is foundational to treating persons afflicted with the virus is not settled.

Finally, experts make mistakes. Consider these: Thalidomide (1961), Three-Mile Island (1978), Tylenol recall (1982), dot-com bubble (1995-2001), Deepwater Horizon (2010), Boeing 737 MAX (2019). Better to refer to experts as specialists and recognize that at times even science gets it wrong. The principal characteristic of the dedicated scientist is not a moment of genius but a lifetime of hard work. Much better to treat science not as the final source of the truth but as a continuous struggle to get it right.

50 Famous Catholic Scientists

Scientist's Name	Country	Lived	Specialty	Special Recognition
Saint Augustine of Hippo	Algeria	354-430	anthropologist, metaphysicist	developed Western philosophy, Western Christianity
Pope Sylvester II	France	950-1003	astronomer, mathematician	pope, reintroduced the abacus to Europe
Saint Albert the Great	Germany	1193-1280	botanist, zoologist	Dominican, Patron Saint of Scientists
Roger Bacon	England	1219-1292	philosopher	Franciscan, experimental science
Leonardo da Vinci	Italy	1452-1519	engineer, architect, anatomist	revered for his technological ingenuity
Nicolaus Copernicus	Poland	1473-1543	astronomer, physician	priest, heliocentric planetary theory
Georgius Agricola	Germany	1494-1555	metallurgist, mineralogist	father of mineralogy
Galileo Galilei	Italy	1564-1642	astronomer, physicist	father of modern science
René Descartes	France	1596-1650	philosopher, mathematician	Cartesian plane geometry
Evangelista Torricelli	Italy	1608-1647	physicist, mathematician	invented the barometer
Francesco Grimaldi	Italy	1618-1663	astronomer, physicist	Jesuit, free fall, diffraction of light
Blaise Pascal	France	1623-1662	physicist, mathematician	probability theory, Pascal's law
Giovanni Domenico Cassini	Italy	1625-1712	astronomer, mathematician	Jesuit, discovered Saturn’s moons, rings
Blessed Nicolas Steno	Denmark	1638-1686	anatomist, paleontologist	bishop, founder of the study of fossils
Roger Joseph Boscovich	Croatia	1711-1787	physicist, astronomer	Jesuit, precursor of the atomic theory
Laura Bassi	Italy	1711-1778	physicist	first woman university professor
Christian Mayer	Moravia (Czech)	1719-1783	astronomer	Jesuit, pioneered binary star study
Antoine Lavoisier	France	1743-1794	chemist	stoichiometry, identified oxygen, hydrogen
Alessandro Volta	Italy	1745-1827	physicist	invention of the electric cell, volt
Pierre-Simon Laplace	France	1749-1827	astronomer, mathematician	Laplace's equation, Laplace transform
Fausto Elhuyar	Spain	1755-1833	mineralogist, chemist	isolated tungsten, gave name Wolfram (W)
Pierre-Andre Latreille	France	1762-1833	zoologist	founder of modern entomology
André-Marie Ampère	France	1775-1836	physicist, mathematician	Ampère's Law
Amedeo Avogadro	Italy	1776-1856	mathematical physicist	Avogadro’s Law
René Laennec	France	1781-1826	physician	invented the stethoscope
Angelo Secchi	Italy	1818-1878	astronomer	Jesuit, first to state the Sun is a star
James Prescott Joule	England	1818-1889	physicist	Joule's Law
Gregor Johann Mendel	Austria	1822-1884	geneticist	Augustinian monk, Father of Genetics
Louis Pasteur	France	1822-1895	chemist, biologist	germ theory, pasteurization, rabies vaccine
Joseph O'Dwyer	United States	1841-1898	physician	developed intubation, diphtheria treatment
Henry Louis Le Chatelier	France	1850-1936	chemist	Le Chatelier’s Principle, chemical equilibrium
Frederick Louis Odenbach	United States	1857-1933	meteorologist	Jesuit, developed electrical seismograph
Henri Breuil	France	1877-1961	archaeologist, geologist	Jesuit, prehistoric cave art
Alexander Fleming	Scotland	1881-1955	biologist, pharmacologist	developed penicillin
Pierre Teilhard de Chardin	France	1881-1955	paleontologist	Jesuit, discovered Peking Man
James B. Macelwane	United States	1883-1956	seismologist	Jesuit, founded Jesuit Seismological Service
Erwin Schrödinger	Austria	1887-1961	theoretical physicist	quantum mechanics, Schrödinger's equation
Dorothy Garrod	England	1892-1968	archaeologist	first woman to hold chair at Cambridge/Oxford
Georges Lemaître	Belgium	1894-1966	theoretical physicist	priest, proposed the Big Bang theory
John Von Neumann	Hungary	1903-1957	computer theorist	game theory, computer theory
John Eccles	Australia	1903-1997	neurophysiologist	worked on the synapse
Mary Kenneth Keller	United States	1913-1985	computer scientist	BVM, first woman doctorate-computer science
Miriam Michael Stimson	United States	1913-2002	medical doctor	Dominican, DNA pioneer
Stephanie L. Kwolek	United States	1923-2014	chemist	invented Kevlar
Stanley Jaki	Hungary	1924-2009	physicist	Benedictine, contributor to philosophy of science
Venerable Jérôme Lejeune	France	1926-1994	pediatrics, genetics	discovered Trisomy 21, cause of Down syndrome
Edith Marie Flanigen	United States	1929-	chemist	molecular sieve, synthetic emerald
George Coyne	United States	1933-2020	astronomer	Jesuit, directed the Vatican Observatory
Michael Heller	Poland	1936-	theoretical physicist	priest, Copernicus Center-Interdisciplinary Studies
Karin Öberg	Sweden	1982-	astrochemist	first complex molecule in a protoplanetary disk