

# Goethals News

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Special Issue on Science and Religion

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## Science and Religion at SXC reaches the milestone with a hat-trick

The number Three has been considered special down the ages with special significance being attributed to it. The triangle, a polygon with three edges and three vertices, is the most stable physical shape. Hegel's dialectic of Thesis + Antithesis = Synthesis creates three-ness from two-ness. Three is the number of dimensions that humans can perceive. There were three functions - of the Prophet, the Priest and the King, performed by Christ. We Humans are trichromatic, the retina contains three types of color receptor cells, or cones. The three *doshas* (weaknesses) and their antidotes are the basis of Ayurvedic medicine in India. In European alchemy, the three primes were salt, sulfur and mercury. Many world religions contain triple deities or concepts of trinity, including the Hindu *Trimurti*, the Three Jewels of Buddhism, the Three Pure Ones of Taoism, the Triple Goddess of Wicca, the Christian Holy Trinity. The examples are numerous. And I invoke the power of three for a reason - in Life, as in Science and Religion, the boundaries are overlapping: where one ends and the other begins, often blur to

the point of being indistinguishable, extending ad infinitum, into the realm of the unknown.

It is with this resolve to dwell in the domain of darkness in search for enlightenment that I present to you this third edition of Science and Religion.

Our endeavour is not to establish the point where one ends and the other begin. We do not seek to be drawn into a debate establishing the superiority of one over the other. Nor is it our agenda to glorify one at the cost of belittling the other. On the contrary, pilgrims that we are, we seek to find the high grounds of commonality, the overlapping areas in the Venn Diagram of creation, for the sake of the illumination, of knowledge, that can be harnessed for the greatest common good of mankind as a whole.



## Science and Religion : The pilgrims reach ashore third year.

St. Xavier's College has always dedicated itself in the pursuit of knowledge, has sought the truth - our long and glorious history being a testimony of this search, a legacy that we carry like the cross. A legacy lived and established by successive generations of Jesuit fathers who have stoked this unquenchable thirst for knowledge, for enlightenment. This search - call it a quest, if you may - is

that of a scientific mind, but is fuelled by a religious fervor. Two sides of the same coin that represent the eternal desire for perfection, for excellence, for establishing the greater glory of God.

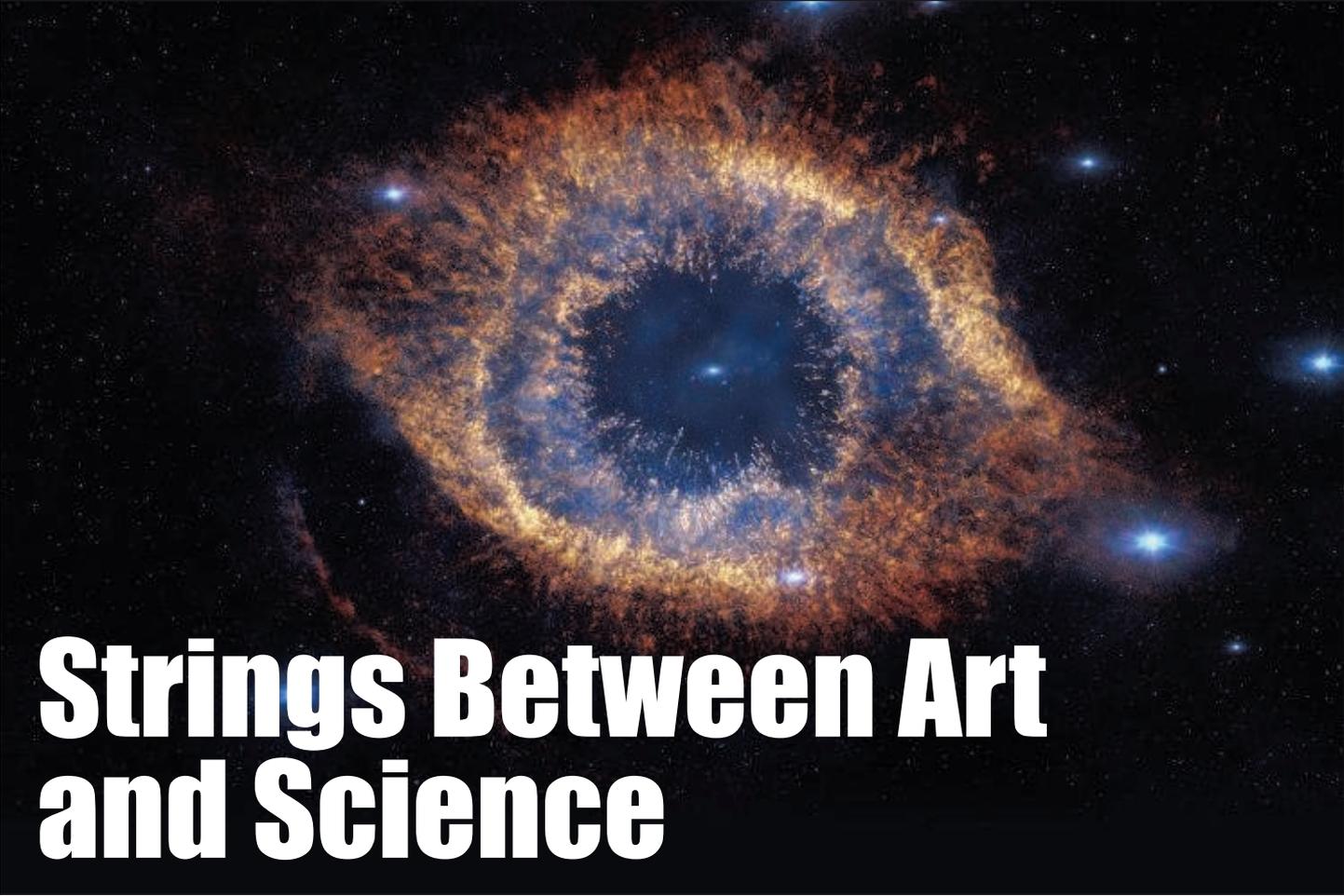
It is this search for excellence, for the truth, that has urged St Xavier's College to give the young minds who come to pursue their studies here a free reign. Freedom from the shackles of being restricted to their course curriculum, they search for what they perceive to be the truth, in their unique ways. St Xavier's has always encouraged the inquisitive mind and the discourse on Science and Religion too is no exception.

Perhaps, it will not be an exaggeration to say that in no time in known history has the need to find the common high ground between science and religion been more pronounced.

These are difficult days. The unhindered run of Science has led to the unleashing of forces that are rife with the seeds of destruction. Anthropocene Man, has punctured the Ozone layers, depleted almost all the resources nature has created over millennia to dangerous levels, adopted lifestyles that are corroding his own existential needs and is bearing a soul that is bereft of the ability to administer any healing balm. The same man, instead of seeking the solace that religion can provide, is using it as a weapon for human destruction.

The need of the hour therefore is to harness the youthful energies of Science and have the wisdom of Religion lead it, so that humankind can be weaned away from the self-destructive mode that it has set itself on. The time is now, for Science and Religion to work together for the greatest common good. Science permitting and God willing, may St. Xavier's show the way.

Three Cheers to all you pilgrims who have contributed about your respective journeys in search of the true realisation. The pilgrims who did the finishing line are **Sukanya Chakraborty**: "Strings Between Art and Science", **Asmita Majmudar**: "Chaos Theory", **Ankita Chattopadhyay**: "Is Math in the Mind of God?", **Ojorshy Basak**: "The Unaudited Spectrum", **Aman Niyaz**: "Science and Religion". We are indeed proud of your progress.



# Strings Between Art and Science

**Sukanya Chakraborty**

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*PG Department of Biotechnology, 3rd Year*

“All religions, arts and sciences are branches of the same tree. All these aspirations are directed toward ennobling man's life, lifting it from the sphere of mere physical existence and leading the individual towards freedom.”

In high school, most of us learned that the scientific method is a rigid, step-by-step process. But in practice, successful science is often conducted loosely, nonlinearly, and with an occasional breaking of the rules. Every stage of the process requires creativity and passion, with the need to connect seemingly disparate ideas. So artists and scientists are more alike than different.

We expect works of art to enlighten us, and we expect science to enlighten us – yet the two fields are frequently regarded as separate, distinct entities which we respond to using different areas of the brain. But what if those distinctions are arbitrary? As Leonard Shlain suggests in his book *Art & Physics: Parallel Visions in Space, Time, and Light*, innovations in artistic style often precede scientific breakthroughs. Picasso was experimenting with space and time in art well before Einstein published his papers on relativity.

Many mathematicians and scientists have commented on the beauty they find in the structure and symmetry of the equations that underpin their work, and that beauty is often the first sign of truth. In *A Mathematician's Apology*, G. H. Hardy wrote: “The mathematician's patterns, like the painter's or the poet's must be beautiful; the ideas, like the colors or the words must fit together in a harmonious way. Beauty is the first test: there is no permanent place in this world for ugly mathematics.”

Physicist Paul Dirac went even further:

“I think that there is a moral to this story, namely that it is more important to have beauty in one's equations than to have them fit experiment. If [Erwin] Schrödinger had been more confident of his work, he could have published it some months earlier, and he could have published a more accurate equation. It seems that if one is working from the point of view of getting beauty in one's equations, and if one has really a sound insight, one is on a sure line of progress. If there is not complete agreement between the results of one's work and experiment, one should not allow oneself to be too

discouraged, because the discrepancy may well be due to minor features that are not properly taken into account and that will get cleared up with further development of the theory."

Researchers had asked 15 mathematicians to view a series of 60 mathematical equations and rate each one on a scale of -5 (the ugliest) to +5 (the most beautiful). Then they scanned the subjects' brains with functional MRI as they looked at the equations again. Follow-up surveys revealed that understanding the math was necessary but not sufficient for a participant to see beauty in an equation - some equations were well understood but did not strike the mathematicians as beautiful. This distinction allowed researchers to isolate the brain activity associated with understanding, and home in on the area responsible for the feeling of beauty: the medial orbitofrontal cortex, an area thought to integrate sensory experience, emotion and decision making. Previous studies have shown that this area is highly active when subjects see or hear something - for instance, art or music - that they perceive as beautiful.

One of the most striking examples of how our sense of beauty can give rise to important scientific discoveries is Mendeleev's Periodic Table. He arranged the elements that were known at the time according to their atomic weight, but noticed that the resulting table lacked aesthetic appeal. It seemed "incomplete", which eventually led him to predict a number of "missing" elements long before they were discovered. We should note, however, that although Mendeleev's contribution to science was remarkable, there is a real sense in which the periodic system is inevitable, and is provided by Nature itself. It was just a matter of uncovering this profound truth.

Science and art are often considered opposites - so what happens when top practitioners in each field collaborate? Yes, Leonardo da Vinci was both artist and inventor. Not only have scientists and artists exchanged ideas throughout history (Picasso read Poincare), but the question of what is science and what is art remains unresolved. Many artists

view the studio as a lab, and scientists speak often about theory and discovery as if it were art.

This brings up the following question: Can science be used to further our understanding of art? For the abstract paintings produced by Jackson Pollock in the late 1940s, the answer is a resounding "yes". Pollock dripped paint from a can onto large canvases rolled out across the floor of his barn. Recent research has shown that these paintings are not just a lot of splattered paint, but also have a certain hidden regularity. This regularity lies not in art but in mathematics - specifically, in the *fractal dimension* of Pollock's paintings (which is unique to his work).

Some believe that science can never fully explain the aesthetic complexities of art. Art is a paradox, in the sense that we are not able to say if it is right or wrong. So an appropriate answer to the question "what does it mean" could very well be "everything".



A real, a deep, a great piece of art contains, through an infinite number of associations, the whole world.

Reality, as we all know, has multiple aspects - some objective, others subjective. It is

important to keep in mind in this context that subjectivity itself is not a forbidden word in the world of physics. Quantum mechanics tells us, for example, that the way we probe a particle is a subjective decision. When we perform the "double slit" experiment, we essentially influence reality and "force" matter to behave as a wave or a particle. It is also true that different observers can see contradictory things, and that both can be 'right'. This suggests that there are areas of physical reality which are quite ambiguous and perhaps more open to the kind of freedom that artists claim. To me, this suggests that there is much more to reality than observation and simulation can disclose. And the part that humans play in shaping this "reality" should not be underestimated, because through us, the universe contemplates itself, be it through science or art. ■



# Chaos Theory

*Asmita Majmudar*

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Chaos theory deals with nonlinear dynamic systems that exhibit exquisite sensitivity to initial conditions, eventual unpredictability, and other intriguing features despite the inevitably deterministic character of the underlying mathematical equations. Chaos theory has been used to model processes in diverse fields, including physics (quantum chaos, non-equilibrium thermodynamics), chemistry, ecology, economics, physiology, meteorology, zoology, and neuroscience. The term *chaos theory* was coined by mathematician and physicist James Yorke in 1972 and was introduced to the scientific literature in 1975 by mathematician and biologist Robert May. Robert Devaney gave the first mathematical-technical definition of chaos in 1989, but his definition does not cover all features of interest to mathematicians who study chaos. Chaos theory is not to be understood as being opposed to order, and should not be confused with the metaphorical and colloquial use of the word *chaos*. Rather, it describes how order breaks down and re-emerges on many levels of complexity within dynamic systems.

There are four essential aspects of chaos theory:

1. Because of its recursive and iterative character, a chaotic system is extraordinarily sensitive to its initial conditions. This means that the slightest variations in the system parameters may result in tremendous differences

in the way it evolves over time. This feature is known as the *Butterfly Effect*.

2. Within the various modes of chaotic dynamics, there are certain levels of stability which are characterized by *attractors*. Attractors are not unique to chaos – in classical thermodynamics, for example, the state of maximum entropy can be regarded as an attractor. This is very different, however, from the “strange” attractors that characterize chaotic dynamics – these attractors are complex geometric forms known as *fractals*.
3. The essential difference between the evolution of a non-chaotic system and a chaotic one has to do with the relationship between determinism and predictability. Chaotic systems possess a certain degree of predictability (which is measured by the so-called Lyapunov exponent), but all such systems are unpredictable in the long run. Because of this unusual mixture of order and unpredictability, chaos theory is sometimes called the “theory of deterministic chaos”.
4. In contrast to a non-chaotic deterministic system, a chaotic deterministic system is *not* reversible, due to progressive information loss as the system evolves. Thus, it is not possible to trace the trajectory of such a system backwards to its initial conditions.

For nearly three hundred years, scientists believed that the deterministic laws of classical physics accurately reflected nature. This view grew out of triumph of Newtonian physics in the 18th century. Since the laws of classical physics were deterministic, many took it for granted that these equations apply to all natural processes. Pierre Simon Marquis de Laplace boldly stated this outlook in the following way:

“All events, even those which on account of their insignificance do not seem to follow the great laws of nature, are the result of it just as necessarily as the revolutions of the sun. In ignorance of the ties which unite such events to the entire system of the universe, they have been made to depend upon final causes or upon hazard... but these imaginary causes have gradually receded with the widening bounds of knowledge and disappear entirely before sound philosophy, which sees in them only the expression of our ignorance of the true causes... We ought to regard the present state of the universe as the effect of its anterior state and as the cause of the one which is to follow.”

Today scientists realize that classical deterministic models apply only to a limited subset of natural phenomena. Some examples of systems that can exhibit chaotic behavior are three-body systems, chemical reactions, turbulence, heat flow, ecology, cardiac rhythms, population changes, the solar system, weather, et cetera. All of these systems are characterized by the sort of irregular and unpredictable dynamics that one encounters in random processes.

Chaos theory raises some interesting questions about whether there is a purpose and direction in history. Is everything that happens “dictated” by God? And is there a final outcome to history, which can be known beforehand? According to the Bible, the evolution of the universe is inseparably linked to the human race. Both the cosmos and human history emerged from chaos, which is still present in some forms. In the natural world, this chaos can be observed and described using standard scientific techniques. In the

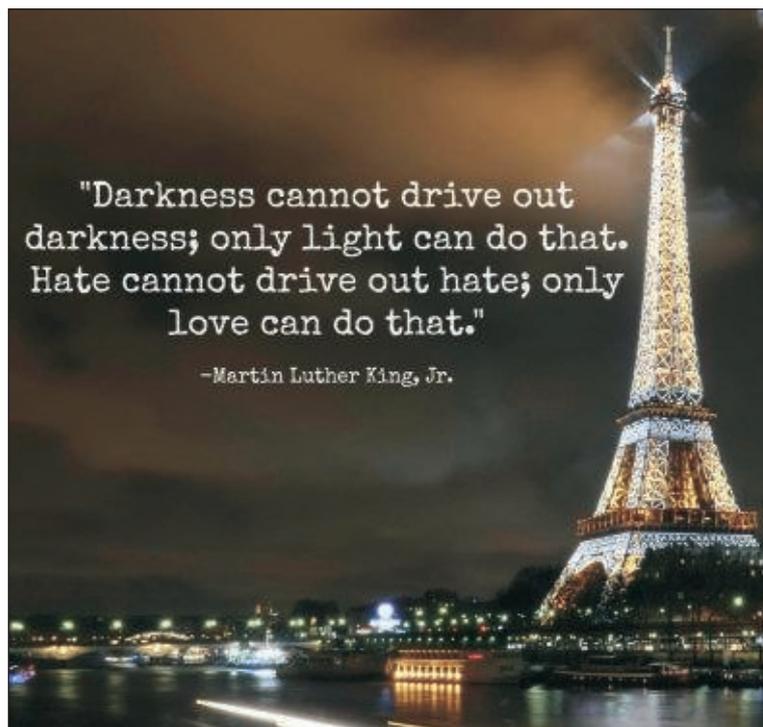
domain of human behavior, this phenomenon is studied by social sciences (sometimes called “soft sciences”), which observe and describe people. Historically, the “hard” sciences have not attached much importance to the results obtained in these disciplines, largely because of the difficulties that are associated with observing and predicting human behavior. They seem to forget, however, that unpredictability also characterizes quantum mechanics and chaos theory, which are among the crowning achievements of modern science.

The “soft” sciences have a great deal to say about religion, so it is unfortunate that social scientists have attempted to do this by adopting the methods of physical scientists (presumably in order to gain legitimacy in their eyes). This

approach carries with it considerable philosophical baggage, since it forces social scientists to deal with religion only as an observable phenomenon. By doing so, they tend to disregard the transcendental aspects of religious belief.

The Bible approaches this question in a very different way. Rather than identifying a single cause that drives human behavior, it portrays a variety of people and groups that are motivated by different impulses.

One might expect the Bible to portray God as “the ultimate determinist”, in the sense that he causes every event and circumstance in human history. This, however, would be an inadequate interpretation. While the Bible makes clear without qualification that God has absolute power and authority over time and eternity, the description of the way in which he exercises his sovereignty appears more artistic than totalitarian. God consistently interacts with people in their own circumstances, in the chaos of human events. The Bible describes God as effortlessly interacting with all manner of human situations to move humanity toward his ultimate goal. Like a master chess player, it does not matter what move his novice opponent makes, he has the final victory in sight from the first move. ■



# Humours in Science and Religion

Dr. Xavier Savarimuthu, SJ.

I am sure after going through the pages on the issues of science and religion, you are feeling quite heavy. I thought of refreshing your mind before you move on to the next set of articles; there fore I have named this article as " Humours in Science and Religion". They correspond to various dimensions of our lives and so I am presenting them here for your humorous reading.

## Four worms and a lesson to be learned!!!!

A minister in a Church decided that a visual demonstration would add emphasis to his Sunday sermon. Four worms were placed into four separate jars. The first worm was put into a container of alcohol. The second worm was put into a container of cigarette smoke. The third worm was put into a container of chocolate syrup. The fourth worm was put into a container of good clean soil.

At the conclusion of the sermon, the Minister reported the following results:

The first worm in alcohol..... Dead.

The second worm in cigarette smoke...Dead.

Third worm in chocolate syrup.... Dead.

Fourth worm in good clean soil...Alive.

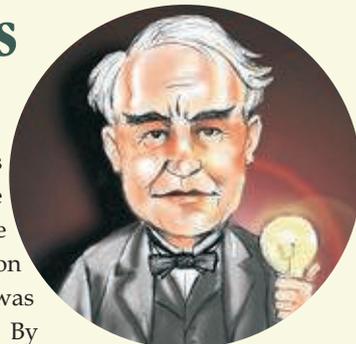
So the Minister asked the congregation, "What did you learn from this demonstration?"

Maxine was sitting in the back, quickly raised her hand and said.. "As long as you drink, smoke and eat chocolate, You won't have worms!"

That pretty much ended the service!



## Edison's Secret



If ever there was anyone whose life can be said to be the personification of persistence, it was Thomas Edison. By the time Edison died, he had invented the phonograph, the electric light and the motion picture projector. He had been awarded 1,094 patents, more than any man or group of men in history. For him, true genius was a lot more about persistence than a high IQ.

During his three-year pursuit of the electric light, Edison was reportedly asked, "Why do you keep trying to create an electric light when you've already failed ten thousand times?" He said, "I have not failed ten thousand times; rather, I have successfully discovered ten thousand alternatives that don't work, and with each one of those discoveries, I am that much closer to finding the one discovery that will work. He is said to have tested five hundred filaments before finding one that worked. Had he given up after testing number four hundred, we might still be reading by candlelight or kerosene lamps.

## The Power of Prayer or Nature

A bar opened opposite a Church!

The Church prayed daily against the bar business...

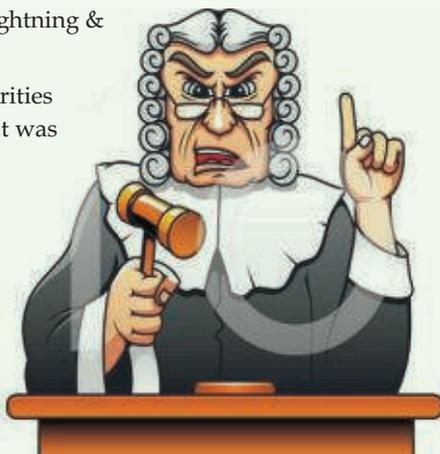
Days later the bar was struck by lightning & caught fire which destroyed it.

Bar Owner sued the Church authorities for the cause of its destruction, as it was an action because of their prayer...

The Church denied all responsibility!

So, the judge commented,

"It's difficult to decide the case because here we have a Bar Owner who believes in the power of prayer and an entire Church that doesn't believe in it!"



## Pesticide Percentage (%) in drinks released from IMA (Indian Medical Association) recently.

1	Thums up	15.2%
2	Coke	13.4%
3	7 up	12.5%
4	Mirinda	10.7%
5	Pepsi	10.9%
6	Fanta	9.1%
7	Sprite	15.3%
8	Vodka	0%
9	Gin	0%
10	Rum	0%
11	Beer	0%
12	Whisky	0%



So choose what you drink. 1 to 7 are very dangerous to the Human Liver. Results in Cancer!

# Jesuits' Contribution To India (in Science, Religion, Environment, Arts and Culture)

1. Anthony Monserrate SJ, Spaniard, (1536-1600) was the first geographer to complete a map of India in 1590.
2. Thomas Stevans SJ, English, (1549-1619) wrote "Krista Purana" a classic in Marathi.
3. The first printing press in India was started by the Jesuits in 1556.
4. Robert De Nobili SJ, Italian, (1577-1656) was the first European Sanskrit Scholar. He wrote 21 books in Tamil, Telugu and Sanskrit.
5. J. Richard SJ, French, was the first to use telescope on Indian soil in 1689 in Pondicherry.
6. Constanzo Giuseppe Beschi SJ, Italian, (1680-1747) is called the "Father of Tamil Prose".
7. Antonio Moscheni SJ, Italian, (1854-1905) was a great painter who painted the St. Aloysius' College Chapel, Mangalore, the Holy Name Cathedral of Mumbai, the Holy Cross Cathedral, Kochi.
8. Jerome D'Souza SJ, Indian, (1896-1977) was a member of the Indian Constituent Assembly and four times India's delegate to the UN General Assembly. Made considerable contributions to the Constitutions of India.
9. Camille Buckle SJ, Belgian, (1909-1982) is India's most famous Christian Hindi Scholar and a well-known lexicographer. He received the Padma Bhushan.
10. Johans SJ, Dandoy SJ, Antonie SJ and Fallon SJ, Belgians of St. Xavier's College, Kolkatta, were great Indologists and enriched the Bengali & Sanskrit languages.
11. Carlos Valles SJ, Spaniard, (1925-) was awarded the Ranjitram Gold Medal for his contribution to Gujarati language.
12. Anthony de Mello SJ, Indian, (1931-1987) endeavoured to integrate deep Christian spirituality with Eastern concepts and methods of prayer.
13. Pallithanam SJ, Indian, one of the first Indian Jesuit botanists.
14. K. M. Mathew SJ, Indian, the most productive Indian taxonomist ever. He is the world's specialist in Jasmine.
15. Lancolot D'Cruz SJ, Indian, has developed people-forest-industry linkages for socio-economic development and protection of the traditional medial knowledge.
16. Savarimuthu Ignacimuthu SJ, Indian, discovered an insect which has been named after him Ignacimuthue.
17. Francis Perianayagam SJ, Indian, is developing semi-conductors as less expensive and easier synthesized alternatives to current germanium and silicon ones.
18. Leo D'Souza SJ, Indian, is a pioneer in plant tissue culture and in vitro propagation of several forest trees.
19. Cecil Saldanha SJ: Taxonomist. He has done extensive research and published volumes on Hassan & Karnataka flora.
20. Rudolph Aquaviva SJ, Fr. Duarte Leitao SJ & Fr. Christobal de vege SJ, were in the court of Akbar at his own request.
21. Bento de Goes SJ went to Tibet by the land route and prepared the way to the unknown and forbidden lands.
22. Fr Constant Lievens SJ (1856-1893) started the co-operative movement in Chotanagpur region.
23. Br Anthony Moscheni SJ embellished St Aloysius College Chapel with his paintings.
24. Br Peter Royappan SJ of Sembaganur served in postal service for 36 years and the Government recognized him nationally as managing "the Best Post Office in India".
25. Fr Henry Heras SJ deciphered the writings of Harappa Civilization.

## Religion Finding Solution

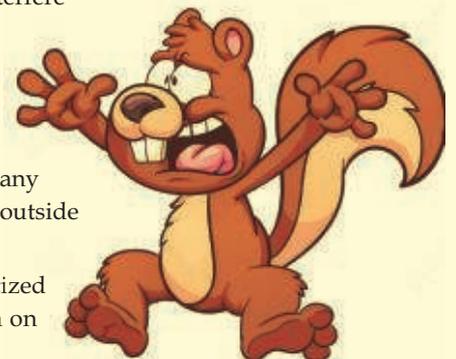
There were five houses of religion in a small town: The Presbyterian Church, the Baptist Church, the Methodist Church, the Catholic Church and the Jewish Synagogue. Each church and Synagogue was overrun with pesky squirrels.

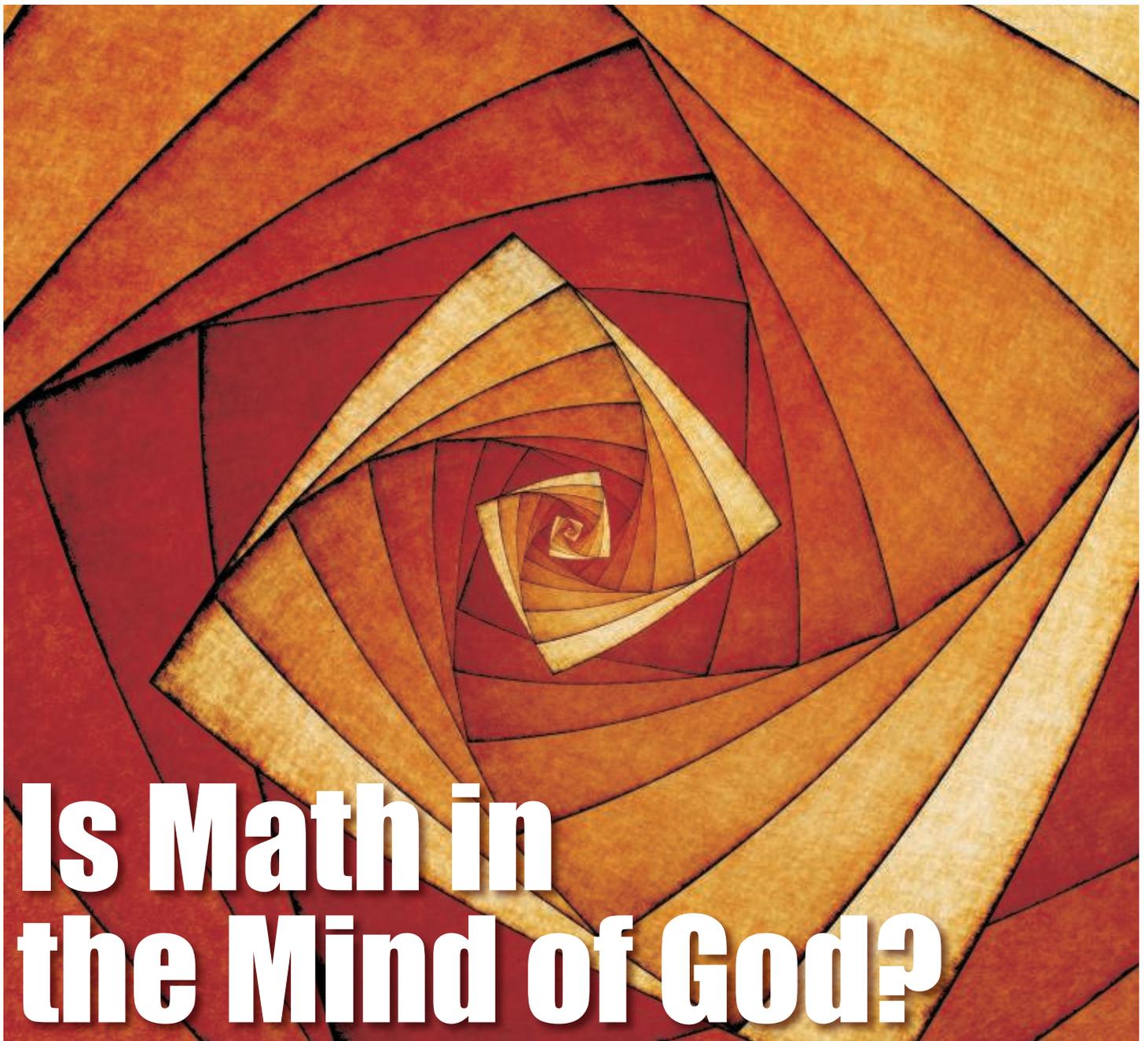
One day, the Presbyterian Church called a meeting to decide what to do about the squirrels. After much prayer and consideration, they determined that the squirrels were predestined to be there and they shouldn't interfere with God's divine will.

In The BAPTIST CHURCH the squirrels had taken up habitation in the baptistery. The deacons met and decided to put a cover on the baptistery and drown the squirrels in it. The squirrels escaped somehow and there were twice as many there the next week.

The Methodist Church got together and decided that they were not in a position to harm any of God's creation. So, they humanely trapped the squirrels and set them free a few miles outside of town. Three days later, the squirrels were back.

But —The Catholic Church came up with the best and most effective solution. They baptized the squirrels and registered them as members of the church. Now they only see them on Christmas and Easter.





# Is Math in the Mind of God?

**Ankita Chattopadhyay**

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*"Without mathematics we cannot penetrate deeply into philosophy. Without philosophy we cannot penetrate deeply into mathematics. Without both we cannot penetrate deeply into anything."* Leibniz

Most of us view math as a neutral subject. By neutral, I mean "indifferent" or "not aligned with a political or ideological grouping." Believing that math is independent from theology, we tend to approach it as a "safe" subject – a subject we can all see the same way, regardless of our religious beliefs. After all, the equation  $1 + 1 = 2$  works equally well for Christians, Muslims, Buddhists, Hindus, or atheists.

But it would be a mistake to conclude that mathematics and theology are completely unrelated – for one thing, both suggest the existence of *intrinsically unknowable truths*. Consider, for example, how we prove propositions in mathematics. We trace them back to existing theorems and eventually to axioms, but the axioms themselves require no proof – they are implicitly assumed to be true. Euclidean geometry provides a perfect illustration of how this works in practice. It is based on the following five axioms:

1. A straight line segment can be drawn joining any two points.

2. Any straight line segment can be extended indefinitely in a straight line.
3. Given any straight line segment, a circle can be drawn having the segment as radius and one endpoint as centre.
4. All right angles are congruent.
5. If two lines are drawn which intersect a third in such a way that the sum of the inner angles on one side is less than two right angles, then the two lines inevitably must intersect each other on that side if extended far enough.

Euclid actually started out with only the Postulates 1–4, which allowed him to prove the first 28 propositions in the *Elements*. However, he was forced to add the fifth one (the so-called Parallel Postulate) in order to prove the 29th proposition. In 1823, Janos Bolyai and Nicolai



Lobachevsky independently showed that this postulate does not follow from the first four. One of the consequences was that we have a choice – we can add the Parallel Postulate as the fifth axiom, or we can add its *opposite* (in which case we get “non-Euclidean geometries”). Both options are perfectly legitimate, and logically consistent.

Another fundamental result in this area came in 1931, when Austrian mathematician Kurt Gödel showed that mathematics is “incomplete” (in the sense that not every proposition can be categorized as true or false). The fact that some propositions are “undecidable” indicates that certain mathematical truths will remain unknowable to us. Some mathematicians suggested that the problem might be resolved by “upgrading” these problematic propositions to the status of axioms. Gödel showed, however, that this wouldn’t help, since it would necessarily create a number of other undecidable propositions. It is interesting to note in this context that Gödel’s Incompleteness Theorem is not limited to mathematics, and applies to everything that is subject to the laws of logic (which includes science, language and philosophy). And if nature is mathematical and logical, incompleteness presumably also applies to the entire universe as well.

Faith and reason are not enemies. In fact, the exact opposite is true! One is absolutely necessary for the other to exist. All reasoning ultimately traces back to faith in something that you can not prove, and faith implies uncertainty. There would be no uncertainty or faith if there was a logical proof of God, so it follows that fundamental religious propositions must be unprovable.

Similar arguments can be applied to miracles as well. Here scientific laws are not violated, they are just beyond our understanding. What is often forgotten when we debate these issues is that natural laws are *not* logically certain – the fact that we haven’t seen a violation does not mean we will not see one in future. Therefore, the distinction between impossibility and unlikelihood must be taken into account. It may sound bizarre, for example, to assume that a statue could wave at us, but quantum mechanics does not rule out this possibility – it just tells us that such an event is extraordinarily unlikely (since it requires the coordinated activity of a huge number of atoms).

It is also important to note that laws of nature are not something that we can logically prove. You can only *observe* that a law is consistently true every time. Similarly, we cannot prove that the universe is rational – you can only observe that mathematical formulas like  $E = mc^2$  seem to perfectly describe how the universe operates. The bottom line is that nearly all scientific laws are based on inductive reasoning. These laws rest on an assumption that the universe is logical and based on fixed discoverable laws. But we cannot *prove* this – we literally have to take it on faith. ■



# The Unaudited Spectrum

Ojorshy Basak

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*“Everything that we Hear is just an Opinion, Not the Fact;  
Everything that we See is just a Perspective, Not the Truth”.*

Keeping these two lines as our motto, let us examine how the notions of *uncertainty* and *contradiction* might bridge the gap between science and religion. From times immemorial, we humans had the urge to grasp the truth behind every natural occurrence. Ways differed, methodologies changed, but the search continued and a point came when we started questioning our origins and existence. The question was simple yet unfathomable. Attempts to find an answer gave rise to a number of different ideologies, and the two whose rivalry remains a matter of concern to this day are science and religion.

Very loosely speaking, science studies physical reality through observations and experiments, while religion tries to establish the existence of a super natural force that drives this reality. While science depends on facts and experimental data, religion relies on faith and analogical thinking. Science tells us to believe only what we can fathom, while religion tells us to take a leap of faith. Although science is much more inclined towards empirical observations, it is worth mentioning that not everything can be experimentally proved. In the words of physicist John Barrow: “One of the greatest achievements of modern science is the fact that we now know what we cannot know”.

This insight highlights a fundamental distinction that secular thinkers often tend to disregard – the distinction between the *unknown* and the *unknowable*. These two words are not synonymous. The former strongly suggests a temporary situation, while the latter firmly declares our ultimate inability to understand something. Let us look at a couple of examples that clarify what this really means.

The first one has to do with chaos theory. This accidental discovery by scientist Edward Lorenz showed that certain physical systems allow for orderly mathematical representations, but their behavior cannot be accurately predicted. Lorenz described the dynamics of such systems with the famous metaphor known as the *Butterfly Effect*: “The movements of a butterfly’s wings in the Amazon rainforest could conceivably affect the long term weather patterns in China.” This metaphor suggests that no event in the natural

world is isolated – everything depends on something else. As a result, we will never be able to grasp all the relevant factors that influence such phenomena.

Our second example comes from the world of quantum mechanics. In the words of the famous scientist Daniel M. Greenberger: “Einstein said that if quantum mechanics were correct then the world would be crazy. Einstein was right – the world is crazy.” String theory (which was developed for the purpose of reconciling quantum mechanics and general relativity) also makes some very strange predictions, one of which is that we live in a nine-dimensional universe. It has been shown mathematically that in order to circumvent problems related to infinite and negative probabilities, vibrating strings need to be provided with six additional spatial dimensions (which would allow them to have six more degrees of freedom).

Examples of this sort bring us to a point where we realize that there are many unknowable truths in science. We accept them because they are mathematically correct, but we cannot validate them using standard scientific techniques such as repeated experimentation or computer simulation. This naturally brings up comparisons with religion, which resorts to analogical thinking and the use of metaphors to explain its teachings. Such explanations clearly don’t conform to the scientific method, but this does not mean that religion can be equated with ignorance. Enlightened individuals try to gather all possible knowledge, and realizing that there is a missing piece to the whole story, try to transcend it. In the process, they might come across certain insights and experiences that may appear very strange to our normal intuitive thinking. However, we cannot simply disregard such experiences on the grounds that they cannot be replicated.

I would like to conclude my essay with Einstein’s famous words: “All religions, arts and sciences are branches of the same tree. All these aspirations are directed toward ennobling man’s life, lifting it from the sphere of mere physical existence and leading the individual towards freedom.” At the end of the day, all that matters is that we should not deviate from the Path of Knowledge and the Quest for Truth. ■





# Science and Religion

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Everything that the human race has done and thought is concerned with the satisfaction of deeply felt needs and the assuagement of pain. One has to keep this constantly in mind if one wishes to acquire spiritual understanding. With primitive man it was above all fear that evoked religious notions—fear of hunger, wild beasts, sickness, death. Since at this stage of human existence understanding of causal connections was poorly developed, our distant ancestors created imaginary beings more or less analogous to themselves on whose wills and actions these fearful happenings depended. Social impulses are another reason for the emergence of religion. The desire for guidance, love, and support prompted men to form the social or moral conception of God. This was the God of Providence, who protects, disposes, rewards, and punishes.

The individual feels the futility of human desires and aims and the sublime and marvellous order which reveals itself both in nature and in the world of thought. Individual existence impresses him as a sort of prison and he wants to experience the universe as a single significant whole. How can this cosmic religious feeling be communicated from one person to another, if it can give rise to no definite notion of a

God? It is the most important function of art and science to awaken this feeling, and keep it alive in those who are receptive to it.

Only those who realize the immense efforts and, above all, the devotion without which pioneering work in theoretical science cannot be achieved are able to grasp the strength of the emotion out of which such work, remote as it is from the immediate realities of life, can issue. What a deep conviction of the rationality of the universe and what a yearning to understand Kepler and Newton must have had to enable them to spend years of solitary labor in disentangling the principles of celestial mechanics! It is this cosmic religious feeling that gives a man such strength. As a contemporary thinker said (not unjustly), in this materialistic age of ours serious scientists are the only profoundly religious people.

Objective knowledge provides us with powerful instruments for the achievements of certain ends, but the ultimate goal itself and the longing to reach it must come from another source. Intelligence makes clear to us the interrelation of means and ends, but mere thinking cannot give us a sense of the ultimate and fundamental ends. To

identify these fundamental ends, and to set them fast in the emotional life of the individual, seems to me precisely the most important function which religion has to perform in the social life of man.

Instead of asking what religion *is*, I would prefer to ask what characterizes the aspirations of a person who gives the impression of being religious. A person who is religiously enlightened appears to me to be one who has, to the best of his ability, liberated himself from the fetters of his selfish desires and is preoccupied with thoughts, feelings, and aspirations to which he subscribes because of their super personal value. A religious person is devout in the sense that he has no doubt of the significance and loftiness of those super personal goals which neither require nor are capable of a rational foundation. If one conceives of religion and science according to these definitions then a conflict between them appears impossible. For science can only ascertain what is, but not what should be.

Even though the realms of religion and science in themselves are clearly marked off from each other, there are some strong reciprocal relationships and dependencies between them. Religion may be the one that determines the goal, but it has, nevertheless, learned from science what means will contribute to the attainment of the goals it has set. Science, on the other hand, can only be created by those who are thoroughly imbued with the aspiration toward truth and understanding. The source of this feeling, however, cannot be found within science itself – it springs from the sphere of religion. It has to do with the faith in the possibility that the world we live in is rationally organized, and is therefore comprehensible to us. I cannot conceive of a genuine scientist without that profound faith.



If it is one of the goals of religion to liberate mankind as far as possible from the bondage of egocentric cravings, desires, and fears, scientific reasoning can aid religion in yet another sense. Although it is true that it is the goal of science to discover rules, this is not its only aim. It also seeks to reduce the connections discovered to the smallest possible number of mutually independent conceptual elements. It is in this striving after the rational unification of the manifold that it encounters its greatest successes. Whoever has undergone the intense experience of scientific discovery is moved by a profound reverence for the underlying rational structure of the physical universe. Through this understanding, he achieves a far-reaching emancipation from the shackles of personal hopes and desires, which is a goal that religion embraces as well. ■

## COURSE ON SCIENCE AND RELIGION (ENGR 343)

(SXC's International Exchange Program Initiative with Santa Clara University, California, USA)

Course Duration: January 2 –March 15, 2017 (30 hours)

**Resource Person: Dr. Aleksandar Zecevic (azecevic@scu.edu)**

Professor of Electrical Engineering & Associate Dean, School of Engineering, Santa Clara University, California, USA.

- One 2 hour lecture per week for a total of 10 weeks) = 20 hrs • Project Work Hours = 10 hrs
- Online Lectures will be Posted in You tube • Lectures at St. Xavier's College (Mid February of 2017)

**Course Syllabus available at: <http://www.engr.scu.edu/~azecevic/>**

**Participants:** • Faculty Members involved in teaching Foundational Courses • 4th Semester Students of Science (UG)  
• 2nd Semester Students of Science (PG) • 6th and 8th Sem Students of Biotechnology (BMBT)

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