Goethals News

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Spirituality Beyond Education

Friends,

I looked up at the rising Sun and asked, "What have you to teach me today?" I heard a voice which said, "Always generate more light than heat". At St. Xavier's College, the search for the light of knowledge that will illuminate the soul has been perennial. We do not restrict ourselves to the written word and seek the truth, for Nothing is Beyond us. And, it is a part of this quest that had urged us to start Spirituality Beyond Education three summers ago. Since then, successive batches of Xaverians have mulled on a subject that is as much in the realm of the mind as it is of the heart and spirit. The esoteric and the purely sublime has been sought to be comprehended by the laws of science, voyages into the dark recesses of Meta Physics have been contemplated, even charted.

It is my honour and pleasure to welcome all you blessed minds to the Fourth Edition of Spirituality Beyond Education in the form of "Science and Religion". The quest to comprehend an Infinity that is Divine contained within the close confines of the mortal mind, is by no means unique and certainly not something that is new; nor is our resolve to spread the Light, to touch hearts, to transform.

I express my gratitude to **Prof. Aleksandar Zecevic** from Santa Clara University, California, USA for his painstaking effort to come to Kolkata for four consecutive years to have the live lectures at St. Xavier's College.

I convey my best wishes and heartiest congratulations to **Fr. Xavier Savarimuthu**, the new assistant director of GILRS, for shouldering the responsibility to design this newsletter with the fruits of labour from the student community attending this noble course.

May God Bless us all.

Dr. J. Felix Raj, SJ.
Director, GILRS, Kolkata

Science and Religion : Keeping the water steady

A man asked an artist, "How do you make such beautiful things from stone...?"He replied, "Beauty is already hidden there, I just remove extra stone." St. Xavier's believes in revealing the hidden beauty within the student community by its innovation and freedom of courses and its syllabus it has developed for four consecutive years, namely, "science and religion." A course that colours the beauty of the soul with this realisation that "Beautiful face will age and a perfect body will change, but a beautiful soul will always be a beautiful soul."

A night before the day of Matsya Vedh (Piercing Fish eye) competition, Krishna and Arjuna are conversing. Krishna says, "Arjuna, take care, put your step forward and concentrate on the eye of the fish". Arjuna says, " If I have to do everything, then what will you do?" Krishna in a very soft tone tells him, "What you can't do, I will do". Arjuna asks, "And what is it that I can't do?"Krishna answers, "I will keep the water steady."At St Xavier's College, we have made it our mission to search for answers to questions, and innumerable rhetorics like these. And it is this indomitable spirit, the quest to train the mind to search and research for answers that will illuminate the being, that has urged us to tread on for more than a hundred and fifty years now to remember that God is our silent invisible partner...!!

It is my honour and pleasure to be a part of an institution that has been so steadfast in its goal to move beyond the curriculum of convention, of conciliation, of compromise. And it is with this Xaverian spirit – of Nihil Ultra – that I welcome you to the Fourth Edition of Spirituality beyond Education. The earlier versions have set high watermarks in terms of thought and content, each surpassing the other in terms of sheer brilliance. A powerful message was written on the flying balloon, it is NOT what's outside, but what's inside that takes you to the TOP. I am sure that together, we will attain what we seek from Inside.

Dr. Xavier Savarimuthu, SJ.
Assistant Director, GILRS, Kolkata

Science Knocks on Heaven's Door

Sanjali Mitra

Department of Biotechnology, 3rd Year

"At this moment it seems as though science will never be able to raise the curtain on the mystery of creation. For the scientist who has lived by his faith in the power of reason, the story ends like a bad dream. He has scaled the mountains of ignorance; he is about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by a band of theologians who have been sitting there for centuries." Robert Jastrow

We pass through various stages of academic and spiritual development in our life. I started out as the credulous child, who followed her parents' religious practices with sheer joy in her heart, without the need to look for reason. As a teenager, however, I prided myself on being an atheist who took great interest in science classes at school, and vehemently opposed any belief that did not agree with my understanding of scientific logic. I did sometimes look up at the sky and was bewildered by the very questions that have bothered so many of us for so long. Where does the universe end? What exists outside of it? What does existence essentially mean? I realized that science did not have answers to my questions, but I was neither too well informed nor sufficiently flexible to willingly accept its constraints. Only recently, through some reading and personal experiences, have I begun to realize that science, like theology, does in fact provide room for mystery and humbly acknowledges the existence of unknowable truths.

This subtle connection between science and spirituality has been a prominent theme in the writings of psychiatrist M. Scott Peck, who proposed a generalized model that distinguishes between four possible levels of spiritual development – the chaotic stage, the formal stage, the skeptical stage and the mystical stage. The chaotic stage is a stage of underdeveloped spirituality, in which people are self-centred and uncaring. Those who are in the formal stage tend to blindly believe in rituals without looking for deeper meaning, and are intolerant to change or the expression of doubt. In the skeptical stage, people question their fundamental beliefs and feel the intense need to reconcile faith with reason, whereas those in the mystical stage recognize the limitations of the scientific method and its inability to answer some fundamental questions.

"While Stage 4 men and women enter religion in order to approach mystery, people in Stage 2, to a considerable extent, enter religion in order to escape from it". M. Scott Peck.

Thus, contrary to popular belief, science and religion do in fact complement each other very nicely, and can be seen as different aspects of a greater whole. Renowned physicist and Nobel laureate, Charles Townes, expressed this view in the following way: "I see religion as an attempt to understand the purpose of our universe and science as an attempt to understand its nature and characteristics."

If this is indeed the case, however, why have science and religion clashed so many times in the past? Celebrated astrophysicist and author, Carl Sagan, was of the opinion

that: "Science is not only compatible with spirituality; it is a profound source of spirituality." He further observed that "In its encounter with Nature, science invariably elicits a sense of reverence and awe." "But", he added, "superstition and pseudoscience keep getting in the way, distracting us, providing easy answers, dodging skeptical scrutiny, casually pressing our awe buttons and cheapening the experience, making us routine and comfortable practitioners as well as victims of credulity."

Thinking along similar lines, Charles Townes pointed out that even though we might be inclined to think that faith is intrinsic to religion but not to science, such an impression is not entirely accurate. He illustrated this point with a simple example in which he asks us to consider what happens when we drop a pencil. The laws of physics predict that it will fall at a particular rate, but the truth is that we cannot know that for sure. We only assume the constancy of scientific laws, based on the fact that we never recorded a violation. Eminent philosopher and mathematician Bertrand Russell pointed out, however, that such arguments do not carry the weight of logical certainty, and are ultimately statistical. He even went on to say (jokingly, of course) that "It is not certain that I will die, it is only highly likely."

Another attribute that is common to both science and religion is beauty. From a theological point of view, beauty has always been seen as an attribute of God and His creation. If one adopts this point of view, it follows that recognition of beauty in nature provides us with a way to grasp the magnificence of its Creator. Theologians also maintain that humans, being creators themselves, gain spiritual insights though acts of creativity. They argue that the very process of creating something, regardless of the outcome, is spiritually enlightening, and that the appreciation of beauty in art or in nature can have the same effect.

What is particularly interesting in this context is the relationship between beauty and truth. Beauty, we say, lies in the eyes of the beholder and yet it has, at various times in the past, guided us towards scientifically verifiable truths. According to French mathematician Henri Poincare, aesthetics acts like a "delicate sieve" that helps scientists sort through confusing data. Scientists, like artists, are good observers, and are frequently able to identify hidden links between seemingly disparate aspects of reality. As M. C. Escher (who was a Dutch graphic artist with a keen interest in mathematics) rightly said, "Science and art can sometimes touch one another, like two pieces of the jigsaw puzzle which is our human life, and that contact may be made across the borderline between the two respective domains."

Two striking examples of how our sense of beauty can inform scientific inquiry are the discovery of the omega minus particle and Mendeleev's Periodic Table. When Nobel Prize winning physicist Murray Gell-Mann plotted properties of a class of subatomic particles in terms of two quantities known as isospin and hypercharge, he obtained a pattern that looked like an inverted triangle with the tip missing. He found this to be aesthetically unappealing, and started looking for a particle that would complete the diagram (which eventually led to the discovery of the omega minus). Similar considerations led Russian chemist Dmitri Mendeleev to predict the existence of yet-to-be discovered elements in the periodic system. When he arranged the elements that were known at the time in a table, he found the result to be "aesthetically incomplete". He therefore assumed that wherever there were gaps in his table, new elements would be discovered (which is precisely what happened).

History has also shown that artists can make significant contributions to science. A typical example is George Antheil, who was a composer and pianist in the 20th century. During World War II, it was recognized that a radio-controlled torpedo could cause irreparable damage to enemy ships. However, if the torpedo was controlled by a single frequency radio signal, then the signal could be easily detected and jammed by the enemy (which would cause the torpedo to stray from course). Antheil and actress Hedy Lamarr developed the idea of "frequency hopping", where a piano roll could be used to change the frequency of the signal sent to the torpedo at short but regular intervals, within a range of 88 frequencies on the spectrum (which correspond to 88 keys on a piano). Such a "code" for the sequence of the frequencies proved to be too complex for the enemy to scan and jam.

In this context, it is also interesting to mention the work of neurosurgeon Leonard Shlain, who put forward a very thought-provoking hypothesis about the interplay between art and science. According to him, when humanity becomes ready for new discoveries about nature, it is usually the artists that sense it first (probably on a subconscious level) and reflect it in their art. Scientists come into the picture much later, and formalize the idea in mathematical terms. All this suggests that science and religion have touched each other more often than not, and when this union has not been broken by unnecessary animosity the outcome has always brought about something wondrous and new. I believe that science and religion can be effectively described as halves of the same whole – they may be different colours in the palette of life, but through the masterful use of both, something truly sublime can be created.

Nexus between Beauty and Credibility of Science

Priyanka Mukherjee

Department of Biotechnology, 3rd Year

Art has been traditionally assumed to be the production of beauty, whereas science is seen as a search for truth. The word 'science' typically stimulates images such as fat textbooks, chemicals, white lab coats, etc. The word 'beauty', on the other hand, floods the mind with pictures of beautiful landscapes, flowers and sunsets. But are the two connected in any meaningful way? A quote by Richard Buckminster Fuller sheds some light on this question:

"When I'm working on a problem, I never think about beauty. I think only how to solve the problem. But when I have finished, if the solution is not beautiful, I know it is wrong."

Contrary to popular belief, scientific research is not a precisely defined process. Every step that leads to a discovery or invention requires creativity, passion and the need to stitch seemingly disparate ideas together. So to say that beauty has nothing to do with science is completely fallacious. The converse is also true, since science can occasionally help us understand why we find certain things to be beautiful. An example that comes to mind in this context is the work of American artist Jackson Pollock, who inspired an art movement called Abstract Expressionism in the 1940s. In his famous Drip Paintings, Pollock splashed paint from a can onto a canvas rolled out across the floor of his barn. Many years after Pollock's death, researchers found that these paintings were not random at all, and actually had a fractal dimension.

Fractals may seem haphazard at first glance, yet each one is composed of a single geometric pattern repeated thousands of times at different magnifications, like Russian dolls nested within one another. Fractal geometry is indispensable in studying natural forms, and can be applied to objects ranging from clouds, ferns and

mountains to peacocks' feathers and broccoli. Broccoli (which is a variant of the cauliflower) is a particularly interesting example, since it is the ultimate "fractal vegetable". Its pattern is a natural representation of the golden spiral, a logarithmic spiral where every quarter turn is farther from the origin by a factor of phi, the golden ratio.

The golden ratio is intimately related to the Fibonacci sequence, whose history dates back to the early 13th century. Leonardo Pisano Bigollo (who discovered this sequence) was a member of an important merchant family in Pisa, Italy, and travelled extensively throughout the Middle East. On his travels, he was riveted by the mathematical ideas that had come from India through Arab-controlled territories. On his return to Pisa, he published his ideas in a book called Liber Abaci. In this book Fibonacci posed the following seemingly innocent question:

"If a pair of rabbits is placed in an enclosed area, how many rabbits will be born there if we assume that every month a pair of rabbits produces another pair, and that rabbits begin to bear young two months after their birth?"

The answer to this question involves a simple equation whose solution is a set of numbers which is known as the Fibonacci sequence. This sequence is often regarded as the "nature's numbering system", since it is frequently observed in both living and inanimate forms.

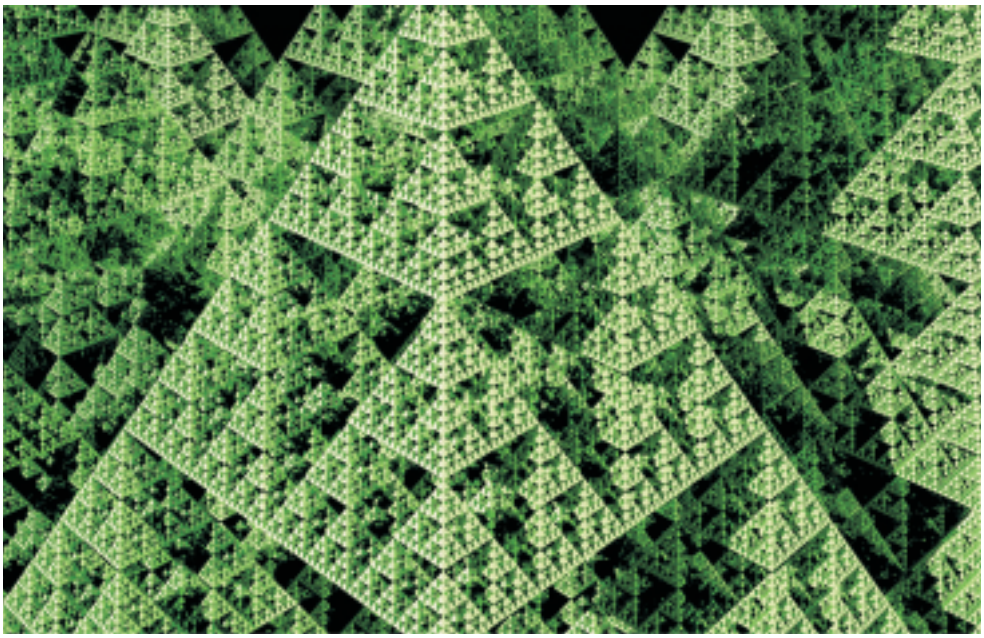
Physicist Paul Dirac was one of many prominent scientists who recognized the importance of beauty in their work:

"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. 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."

The importance of aesthetic considerations in science is apparent in the way physicists use symmetry and symmetry breaking to guide them in their work. These two features are closely related, since the original symmetry is lost whenever a simple structure attains complexity. A typical example of such a process occurs in particle physics. Under laboratory conditions, matter and antimatter particles are always produced in pairs, which annihilate one another when they come in contact. Had this symmetry been maintained in the immediate aftermath of the Big Bang, matter and antimatter would have cancelled out each other completely, leaving behind nothing but pure energy in the universe. Fortunately, that is not what happened. "Something" must have disrupted the symmetry, because today everything we see from the smallest life forms on Earth to the largest stellar objects is made almost entirely of matter.

Symmetry breaking is also a crucial aspect in the development of biological systems. As the Nobel laureate P.W. Anderson speculated, increasing levels of symmetry breaking in many-body systems (systems of many interacting components) correlates with increasing complexity and functional specialization. Symmetry breaking along well-defined axes is intimately linked to functional diversification in biological systems. Stem cells, for example, can maintain tissue homeostasis by dividing asymmetrically to produce a differentiating cell and a stem cell.

All this suggests that both symmetry and symmetry breaking add a touch of beauty to science, making it more alluring. Thus, even though science and beauty are considered by some to be unrelated, in reality they complement each other (and often do so very elegantly). Those scientists who recognize this are likely to take greater pleasure in their work than those who do not. It is interesting to note in this context that a study conducted at University College, London, established a correlation between the way we appreciate mathematical beauty and works of art. In this study, neuroscientists examined fMRI images of the brain activity of 15 mathematicians who were shown a range of different formulas. What they found was that formulas which were perceived as beautiful activated the same region of the brain as the one that is stimulated by music and the visual arts.



Humour 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; therefore I have titled this page as "Humour in Science and Religion." They correspond to various dimensions of our lives and so I am presenting them here for your humorous reading.

"GOD" IS THE GIVER OF EVERYTHING

The qualifications that gave you a job is the same qualifications someone has, but does not have a job.

Be grateful.

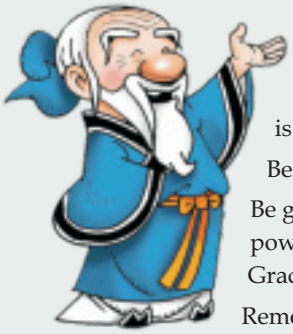
The prayer that God answered for you, is the same prayer others have been praying without success.

Be grateful.

The road you use safely on a daily basis is the same road many others died on.

Be grateful.

The bed you used in the hospital, you got healed and was discharged, is on the same bed many other people died.



Be grateful.

The rain that made your field produce good crops, is the same rain that destroyed someone's field.

Be grateful.

Be grateful because whatever you have is not by your power, your might, or your qualifications, but it's the Grace of God.

Remember He is the giver of everything you have.

He made all things beautiful in His time

Jacob looked at Joseph and saw a good son!
The ten brothers looked at Joseph and saw a useless dreamer!
The travellers looked at Joseph and saw a slave!!
Potiphar looked at Joseph and saw a fine servant!!
Potiphar's wife looked at Joseph and saw a potential boyfriend!
The prison officers saw in Joseph a prisoner!
How wrong were all of them!
God looked at Joseph and saw a Prime Minister of Egypt in waiting!!
Don't be discouraged by what people see in you!!
Be encouraged by what God sees in you!!
Never underestimate the person next to you because you never know what the Lord has deposited in that person.
Remember David got the anointing of becoming a King while he was a simple child herding sheep.
Esther was a simple orphaned girl yet she was a Queen in waiting.
For He is the potter and we are the clay.
Keep waiting for His time. He made all things beautiful in His time.

Yeh dil maange more !!!

This heart desires for MORE!!!

A person on his death bed (in Mumbai at Hospital) with Wife, Kids and a Nurse beside him.

Man to Eldest son : You take the 15 Bungalows at Borivali.

To daughter : You take the 8 bungalows at Juhu.

To youngest son: You are my youngest and most dearest and I want your future to be bright, so you keep the 20 offices at Nariman Point.

To wife: Dear Kavita, you keep all 11 of our Lokhandwala building flats.

Nurse : Quite impressed....

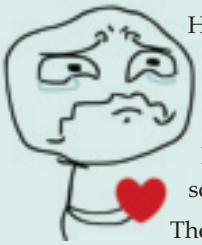
To wife: WoW...You are lucky to have such a husband who is so rich and giving you all the properties etc.

Wife: What properties, what rich ...Doodhwala hai sala.... he's distributing our responsibilities of delivering Milk to his clients in the morning ..

Nurse FAINTED !!!

Life in Pooja

A man visits a mental hospital. He sees a patient with torn clothes & unkempt hair shouting "Pooja... Pooja..."



He asks the assistant about the reason for his behavior. Asst. says the patient used to love a girl called Pooja, but couldn't marry her. She had eloped with somebody else. So he became mad.

The man visits next ward. There also he sees another patient with torn clothes & unkempt hair shouting "Pooja...Pooja..."

The man looks at the assistant.

The assistant says

"This is the one who MARRIED Pooja".

What is legal but not logical

Chintu failed in the final Law Exam & decided to make a deal with the Professor.

Chintu: Sir, Can I ask you one question?

Professor: Yes.

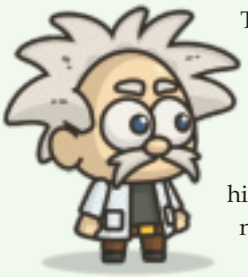
Chintu: If you can answer this question, I will accept my final marks, if you cant, you will have to give me an "A" grading.

Professor agreed.

Chintu asked: **"What is legal but not logical, logical but not legal & neither legal nor logical?"**

Professor thought about it for hours & pondered but couldn't think of an answer. He had to finally give up as he really did not know the answer. He gave this boy an "A" grading as promised.

The following day, Professor asked same question to his students. **He was shocked when all of them raised their hands.** He asked one student.



The student answered:

Sir, you are 65, married to a 28yrs old woman, this is legal but not logical. Your wife, is having an affair with a 23 year old boy, this is logical but not legal. Your wife's boyfriend has failed in his exam & yet you have given him an "A", this is neither logical nor legal. ..

Professor fainted.

That Seventy Percent!

When we die, our money remains in the bank. Yet, when we are alive, we don't have enough money to spend. In reality, when we are gone, there is still a lot of money not spent.

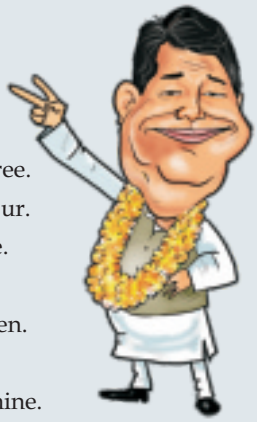
One business tycoon in China passed away. His widow, was left with $1.9 billion in the bank, and she married his chauffeur. His chauffeur said, "All the while, I thought I was working for my boss... It is only now, that I realize that my boss was all the time, working for me"!!

The cruel reality is: "It is more important to live longer than to have more wealth". So, we must strive to have a strong and healthy body. It really doesn't matter who is working for who. In a high end hand phone, 70% of the functions are useless! For an expensive car, 70% of the speed and gadgets are not needed. If you own a luxurious villa or mansion, 70% of the space is usually not used or occupied. How about your wardrobes of clothes? 70% of them are not worn! A whole life of work and earning. 70% of which is for other people to spend. So, we must protect and make full use of our 30%

- Go for medical check-ups even if not sick.
- Drink more water, even if not thirsty.
- Learn to let go, even if faced with grave problems.
- Endeavour to give in, even if you are in the right.
- Remain humble, even if you are very rich and powerful.
- Learn to be contented, even if you are not rich.
- Exercise your mind and body, even if you are very busy.
- Make time for people you care about.

Written in 43 B.C.,

Cicero of the Roman empire wrote this about the social situation during his times:



1. The poor - work & work.
2. The rich - exploit the poor.
3. The soldier - protects both.
4. The taxpayer - pays for all three.
5. The wanderer - rests for all four.
6. The drunk - drinks for all five.
7. The banker - robs all six.
8. The lawyer - misleads all seven.
9. The doctor - bills all eight.
10. The undertaker - buries all nine.
11. The Politician - lives happily on account of all ten.

Written in 43 B.C., but valid even today.

Self-Appraisal

A Little boy went to a telephone booth which was at the cash counter of a store and dialed a number. The store-owner observed and listened to the conversation:

Boy: "Madam, can you give me the job of cutting your lawn?"

Woman: (at the other end of the phone line) "I already have someone to cut my lawn."

Boy: "Madam, I will cut your lawn for half the price than the person who cuts your lawn now."

Woman: "I'm very satisfied with the person who is presently cutting the lawn."

Boy: (with more perseverance) "Madam, I'll even sweep the floor and the stairs of your house for free."

Woman: "No, thank you."

With a smile on his face, the little boy put the receiver down. The store-owner, who was listening to all this, walked over to the boy.

Store-owner: "Son….I like your attitude; I like that positive spirit and would like to offer you a job."

Boy: "No thanks."

Store-owner: "But you were really pleading for one."

Boy: "No Sir, I was just checking my performance at the job I already have. I am the one who is working for that lady I was talking to!"

This is called "Self-Appraisal." Give your best and the world comes to you! Don't relax or show laziness. Whole world is watching you!!

A famous quote said by Lord Krishna in Bhagvat Gita : "If u don't fight for what u want, don't cry for what u lost..."

"Nothing depends on luck, everything depends on work because, even luck has to work."

Religion
– the Science of Consciousness and the Connection with God

Arpita Hazra

Department of Biotechnology, 3rd Year

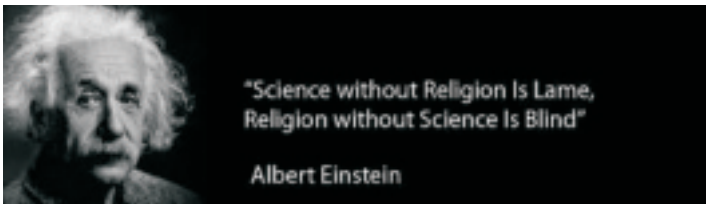
Science and religion have been the two great quests of humanity, but there is a widespread belief that they stand in opposition to each other. It is well known that science is interested in discovering order in the impersonal world of space, time, energy and matter, while religion is concerned with human consciousness and spirituality. But if we agree that reality is built up of both matter and consciousness, why should the quest for understanding the external world be antagonistic to the quest for understanding the inner world of the mind?

If we look at their origins, we will find that both quests are rooted in human inquisitiveness. But if we ask the question "Why are we inquisitive?" there appears to be no clear answer. What we do know, however, is that this tendency is not always utilitarian. Technology, for instance, is a by-product of science, but it is not the primary reason why we engage in scientific research. Indeed, humans were inquiring into why the sky is blue, why the sun rises and sets and why trees grow long before any form of technology came into being. In a similar way, questions such as "Who am I?", "What is the purpose of life?" and "Is there something beyond death?" gave rise to religion. Rituals and religious institutions evolved later, as a by-product in our search for answers.

Just as there have been great scientists, there have also been great religious teachers. People respected these teachers because they had first-hand experience of a universal consciousness, which was connected to (but different from) the physical world. But what did their followers do? They evolved a system of organized practices, and were satisfied with simply propagating the teachings of their gurus. Suppose that scientists had done the same, and had built a temple to Newton and another one to Einstein instead of expanding their ideas. If one group were to say, "We are Newtonians, Newton is our leader, whatever Newton said is true and we are going to follow it" and another group of scientists did the same for Einstein, would we be justified in calling them scientists? Probably not. But in the field of religion, we have been very gullible. We lost sight of the fact that religion is also a quest, an enquiry, a way of seeking understanding. The truly religious mind is in constant search of truth, which it posits as the unknown. Science does something similar, and continually refines its models in trying to approximate physical reality. I would suggest, therefore, that humanity ought to focus on the scientific and religious pursuit of truth without getting too entangled in their by-products.

Having said that, it is important to keep in mind that the two quests have some significant differences. Indeed, while the natural world can be investigated in a systematic way, it is impossible for any mortal mind to truly grasp the reality of God. This should not surprise us, since whatever is created can never comprehend or describe its creator. A table, for example, is incapable of understanding the craftsman who made it, even though his skills and attributes may be reflected in the final product. What this means is that no matter how broad or imaginative our concept of God may be, it will always necessarily be circumscribed by the limitations of the human mind.

The errors that we are likely to make if we neglect this fact are perhaps best illustrated by the Buddha's claim that all phenomena are essentially illusions. There are many different types of illusion, but what they all have in common is a discrepancy between what is perceived and what is real. Like a mirage that seems to be water but is in fact not, appearances can be deceptive. Not understanding their real nature, we can be easily fooled. The result of grasping at phenomena in this way develops self - cherishing, attachment, hatred, jealousy and other delusions, our mind becomes unbalanced, and our peace is destroyed. We become like travelers in a desert, who exhaust themselves running after mirages.



Thank God for Evolving Us

Nilanjan Das

Department of Biotechnology, 3rd Year

The notion that science and religion are irreconcilable centers in large part on the question of evolution. But is evolution really opposed to religious teachings? In order to establish this, we need to address two basic questions: (1) Does evolution have a direction? and (2) Are human beings "special" in any way?

Many secular thinkers have pointed out that evolution cannot follow a "plan" since it depends on too many chance factors. But this does not imply that it cannot have a purpose. As an illustration, consider an analogy from mathematics, in which we are asked to analyze the following pair of equations:

$$x(k+1) = ½ [x(k) + xR]$$

$$y(k+1) = ½ [y(k) + yR]$$

This system involves a regular transfer of information from state k to state k+1, but there is also a randomly chosen pair of elements (xR, yR) that is added in each step. What we have, therefore, is a mix of order and randomness. Interestingly, no matter how we choose the initial conditions x(0) and y(0) we end up with the highly ordered structure shown in Figure 1 (which is known as the Sierpinski triangle). Perhaps evolution follows a similar pattern, and combines randomness and orderly laws to achieve a definite purpose.

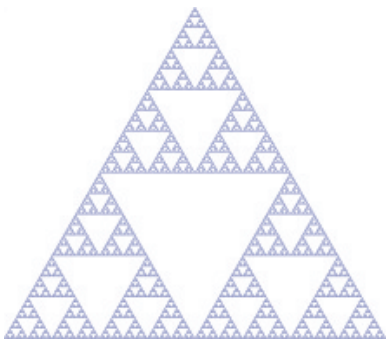


Figure 1. The Sierpinski triangle

In thinking about this subject, one should also bear in mind that evolution is not necessarily at odds with Christian beliefs. Pope Francis says this in no uncertain terms:

"When we read about creation in Genesis, we run the risk of imagining God was a magician, with a magic wand able to do everything… God is not... a magician, but the Creator who brought everything to life… Evolution in nature is not inconsistent with the notion of creation, because evolution requires the creation of beings that evolve."

What this suggests is that science does not contradict the Bible unless we interpret it literally. Both theologians and scientists of faith have argued that we should avoid that, and should instead understand the scriptures allegorically.

The other important question that we need to address is whether humans are somehow "special". Did God really single us out while creating the Universe, or are we no different from other animals? A possible answer to this question can be given with a simple analogy which illustrates how abrupt transformations can result from very small changes. When water temperature reaches 100 degrees, a phase transition occurs in which water suddenly changes from liquid to vapour. In this process there are no "intermediate stages", although these two physical states are dramatically different. What this tells us is that qualitative changes in nature can occur almost discontinuously, and that such changes often take place under perfectly "ordinary" circumstances. Why, then, should we exclude the possibility that humans and monkeys are fundamentally different species, although their genomes differ by only 1%? If evolution is a nonlinear process, this is entirely plausible.

Another indicator that human beings are "special" is our ability to think abstractly and use our imagination in creative ways. We must acknowledge, however, that not everyone subscribes to this point of view. Francis Crick, for example, has argued that human consciousness is no more than an 'epiphenomenon' (an epiphenomenon is the incidental result of a process, but does not influence the process itself). According to him, what we see as the defining characteristic of our species is simply a by-product of physical and chemical processes in the brain, and nothing more.

One could counter such arguments by pointing out that they implicitly assume that consciousness is reducible to biochemistry, which is by no means certain. We must therefore keep an open mind, and allow for the possibility that there is more to the human mind that Crick thinks. I am more inclined to agree with another scientist, Brian Greene, who suggests that science and religion can operate in different realms without contradicting each other:

"Science is very good at answering the 'how' questions. How did the universe evolve to the form that we see? But it is woefully inadequate in addressing the 'why' questions. Why is there a universe at all?"

Science and Religion

Ishani Mukherjee

Department of Biotechnology, 5th Year

"Isaac Luria is a mystic but he's also obsessed with how the universe began, which happens to be a scientific endeavor. The thyroid glands of three-toed sloths clearly sounds like zoology. The demeanor of the sloth, however, adds spiritual interest. Pi can't stay away from religion. He also can't stay away from science." Yann Martel, the Life of Pi.

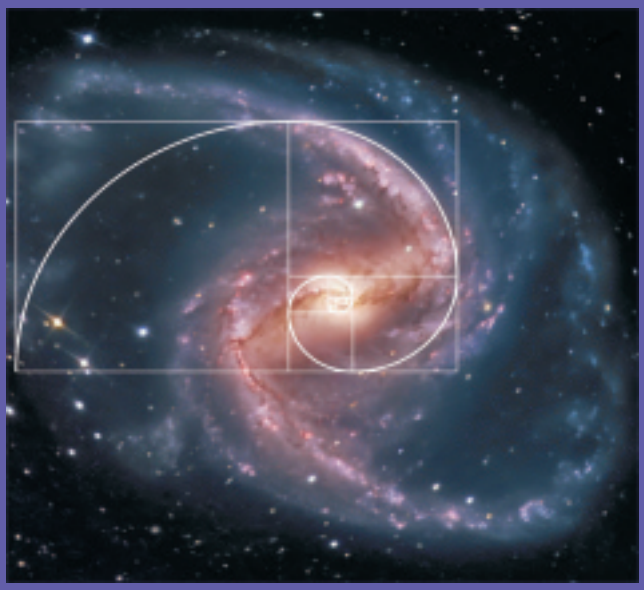
Yann Martel tells his readers that science and religion are intertwined and cannot be completely disassociated from each other. Most of us have the idea that scientists remain confined in their laboratories, immersed in research work. On the other hand, we also tend to believe that religious mystics are a completely different set of people with a totally different mindset. Immersed in faith, they preach their religion and aim for spiritual enlightenment. I believe, however, that religion and science are closely related, and that the two must not be dealt with separately.

One thing that science and religion have in common is that they both aim to satisfy the human thirst for explanations. When we draw such parallels, it is important to keep in mind that science cannot explain everything. We know, for example, that a unicellular organism such as the E.coli metabolizes, respires and functions via a number of signaling cascades or circuits inside the cell each of which is encoded by a cluster of genes. These pathways are intricate and require precise coordination if the E.coli is to survive. But how could such a delicate mechanism evolve through mutation and natural selection, given that both processes involve a considerable amount of randomness?

A possible answer is that clever laws mixed with randomness can bring about something that is highly organized and often beautiful. A physical process can have a thousand possible (and equally likely) outcomes, but which one of them actually occurs may be determined by a completely unrelated (and often random) event. In chaos theory, for example, there is the butterfly effect

Who knows the ways of the universe?
Where and when a raindrop might fall?

in which a small change in one state of a deterministic nonlinear system can result in large differences in a later state. An immediate consequence of this phenomenon is that we cannot predict the long-term behavior of the system.



Another thing that science and religion have in common is the appreciation of beauty.

"God is the most beautiful and beauty is the expression of God. If you can't appreciate beauty in the world how can you understand God?" Amit Ray, Meditation Insights and Inspirations.

Beauty can be found throughout the universe, and we must recognize that. The Golden Ratio, for example, is something I find truly beautiful. This ratio gives rise to harmonious proportions, and is widely present both in nature and in art, music and architecture. We see it in the arrangement of leaves and branches along the stems and in veins of leaves, as well as in Leonardo **Da Vinci's Vitruvian Man, the** Mona Lisa and the Last Supper. Some of Mondrian's geometrical paintings exhibit the golden ratio as well, as do certain musical compositions (such as Debussy's La Mer, for example). I find this quite remarkable, since there is no evidence to suggest that Debussy consciously sought out such proportions.

Science and Religion batch of 2017 with Prof. Aleksandar Zecevic

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, 2018 (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 2018)

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)

Registration: Last Date by 20th December 2017) | Contact Person: Fr. S. Xavier, SJ. (sxavi2005@gmail.com)

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