

The idea of Science - Part 1

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What are the limits of science ? Science can tell us what is true and what is not but can science tell anything about what is good and what is bad ? Where should be the right place for religion, if there should be any ? Can religion and science coexist ? Does our sense of morality necessarily stems from the religion ? How the universe and life came into being ? What is the fate of the universe ? Will we ever be able to overcome the tragedy of the death and not being able to reduce all of our knowledge into a single purpose or meaning of the existence ? There are many such questions which still have been begging for answers.

There are people who claim that science and religion both have the same ultimate goal i.e., to know the truth, and even can supplement each another. I do not agree with this idea. I find them competitors. Both of them try to explain the same things: how life came into being ? how the universe (world) originated and how it works. In order to do better science one needs to come out of religious mind set, or keep all the options open. Religion does not allow people to discover new ideas on the basis of their own experiences and so there is no scope for experiments in religion. What one has to do and what one does in religion is to support the preexisting ideas, proposed thousand years back when human beings had almost no understanding of the nature and its working. I wonder if confirmation of the existing ideas is the sole purpose of human beings then is there any hope for a change. Religion is based on fixed ideas and science on evolving ones. Scientific ideas keep changing with time subject to new experiments and observations. Science gives people opportunity to contribute in its advancement. There are no holy places, people, books and authorities in science, everybody gets a fair chance to contribute in its progress.

As I understand every religion is erected on the following four pillars:

1. Origin:- A story which describes how everything in the universe came into existence.
2. Existence of a super (human) being:- Every single thing in the world is controlled by the wish of a super being which is beyond any limit in every sense.
3. Life before birth and after death:- Most world religions rule out the end of the existence with death and provide very elaborate descriptions about the life before birth and after death.
4. Rituals:- These rituals claim to serve three purposes: make super-being or the god happy, make individual happy, and provide a social order.

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There is sufficient overlap between the items I have listed above and the importance of each item vary from one religion to another. However, one thing is common to all the religions: they all put human beings on the center of the creation and in most cases the super-being is in a human form. The foundation of religion is based on prophecy of holy books and/or men.

There are unanswered questions both in science and religion. For example, religion says god created everything but does not say anything who created the god or why god created things at all. What was the purpose of god ? In science we do not know what was before the Big Bang ? How life was originated at the first place ? Why physical parameters are tuned in such a way that our existence becomes possible. We still do not know the true nature of the physical world we live in at the most fundamental level. We do not know how gravity works in the extreme conditions like in black holes and the big bang.

For me religion makes two promises to the people: happiness in their life (and before and after life also !) and a world view of the universe. I do not think science promises anything at all, it just tries to explain how things work. Religious ideas were developed keeping the man at the center stage. However, scientific ideas have been and are being developed by removing the man from the central stage. Note that in science the man does not get any central importance not due to any bias, but it is forced by observations. How we can say our planet earth is special when we know that it is just one of the nine planets of an average star which belongs to a family of thousand billions stars (galaxy). Science tries to make things as impartial as they can be made. Before the idea of Copernicus it was considered that earth was the center of the solar system and of the universe also. Which was found incompatible with observations and then heliocentric model was proposed and was found correct. I think the idea of the homogeneous and isotropic universe (there is no preferred place or direction in the universe) and the general covariance of the physical laws (physical laws are the same for all observers in their rest frame) represent the spirit of science i.e., nature is indifferent to all observers no matter who they are or where they are.

Any discussion of science and religion is incomplete without discussing morality. Science tells us what is true and what is not but not what is good or what is bad. Science does not say how things should be or out of many choices which one we should pick. This is the area where religion has strong hold. One of the main and most important purposes of the religion is to tell the people what they should do and what they should not do. In other words the religion tries to control the people but not for any obvious purpose. I do not understand why god should bother about our mundane activities. There is a serious flaw in the god hypothesis: if god controls all of our actions then why he should expect so called moral behavior from us. Why he cannot direct ourselves towards the moral behavior. Many people believe that in the absence of the religion we will loss our sense of morality and may start behaving like animals. I do not agree with this idea at all. This was not the discovery of religion which separated us from animals, this was the evolution of the human brain and its use in the development of language and tool making.

The world picture which we see is always convolved with our nature and in order to understand the objective truth we must understand our nature first and this is the place where science does not have much hold. The inner world and outer world are related in the sense how we perceive things depend on who we are. For example the same set of observations can be used by atheists to disprove the existence of the god which can be used by religious people to prove the existence of the god.

In a very broad sense we face two type of questions. The first type of questions are of 'how'

type. Like how to do this or that ? How to make car or drug etc. Other type of questions are of 'why' type. Why physical laws and we exist ? Why this or that ? Science successfully answers most of the 'how' type questions but does not say anything about the 'why' type questions. In fact most 'why' type questions are directly related to the purpose and meaning of things which is beyond the domain of science.

There is an ongoing fight between people who believe in evolution by natural selection as proposed by Charles Darwin two hundred years back and people who believe in creation. Creationists believe that the world (life) is so complex that it cannot come into existence without the intervention of a supernatural power or god. In the extreme form they claim that the life was originated on earth in the way given in religious books. Which seems to be quite incompatible with the scientific observations we have. For example, in any case it is impossible to think that the Earth is just a few thousands years old. The age of life of earth cannot be much smaller than astrophysical scales which are in billion years. Since scientists still do not know exactly how some of the nonliving matter got converted into the living matter (or developed consciousness and intelligence as found in living beings) so the idea that life cannot originate itself can be considered for debate.

People point towards drawbacks and loopholes of Darwin's idea of evolution by natural selection. They say that individual differences between various species are so great that they cannot originate from a common ancestor. They doubt the scientific conclusions drawn from the fossil records. I find it just useless to convince them by listing all the underlying similarities. For me the similarities are at the root not at the top. Every life form on earth propagate its genetic information using DNA molecule only. All of them lead a carbon based life. What else proof is needed ? For me similarities are much more profound at the level of chemistry and physics than at the level of biology.

There are two different approaches to look at things: the top down and the bottom up approach. In the top down approach we first consider the big picture and then go into detail. In the bottom up approach we put bits and pieces together and try to draw the big picture. Once there is an agreement on the big picture, conflicting ideas about the detail can be easily sorted out. However, that is not the case when there is a disagreement about the big picture. The big picture which emerges from the religious ideas is that the world was created by a super being or god for the human beings. Religion proposes that the material world in which we live is controlled by god. One thing which I find confusing is that most religions invoke god in terms of a material being and claim that it is free from the limitation of matter. I think the idea of a non-material god or immaterial god can better help them to explain the world. On one side god is considered a material being and another side is considered creator of matter. How is this possible. Who created the material which formed the god. Or if the material has been always there then why we need a god at all.

The universe is the effect of a cause which scientists trace back to the Big Bang. But what was the cause of that first cause. This is a difficult question to answer. One answer may be that the first cause was of a different kind which was not an effect of any other cause. Or one can also say that the cause of the first cause (Big Bang) was outside the physical universe but then how something which is not a part of the universe can cause something in the universe. In the framework of Einstein general theory of relativity causal relations may be established and broken so it is possible that the universe in which we live was branched out from some another universe and then lost the causal connection with our universe. In this situation it is possible that the cause of the first cause which created our universe is out of our universe. This idea is more or less the same as many theories of inflation in cosmology claim.

One interesting thing is that scientist also change their big picture of the universe. In sixteenth and seventeenth century due to great advancement in mechanics people used to think that the universe is gigantic machine. Later on in coming centuries thermodynamics was developed and the universe was considered as a huge thermodynamic system which is trying to reach towards some equilibrium state. Note that neither in the mechanical idea was it clear who first started the machine nor in the second case who put the system far away from the equilibrium. In the present century computer science is at the center stage and many people (including me !) think that the universe is huge computer which was given a set of initial data (input) and instructions (physical laws) at the beginning of the universe since then the universe is faithfully following the instructions and crunching the data.

Science works in terms of laws. From observations and experiments scientists derive a set of laws which govern the underlying phenomenons. These laws can be used to make predictions about future events or explain past events. Scientific laws are not immutable but are subject to changes. However, these changes are not arbitrary. Most of the time the modified laws are just the super-set of the old laws. For example, Newton's laws of motions are subset of Einstein's general theory of relativity. Unpredictability in science is attributed to the lack of our understanding or limitations not to any supernatural power. Religion discards the idea of a set of laws. In place of laws, religion postulates an omnipotent god which is not bound by any laws and can force nature to work according to his or her will.

It surprises me why laws of physics are always mathematical in nature. You may ask me what are other options for them to be. I do not have any answer. However, I think the way our thinking process works definitely play a key role in the mathematical nature of physical laws. It seems very unlikely that before the universe was originated a set of laws which govern the universe was already in place.

Physical laws can be easily put in the form of a tree structure. Physical laws which govern different phenomena in the world branch out from a single tree of laws at different points. In physics there are laws of gravity, electromagnetism, radioactivity and nuclear interactions. They all can be derived from the laws of quantum mechanics and laws of general relativity. So far it has not become possible to derive the laws of quantum mechanics and general relativity from a single set of laws. We can simply say that that in physics there are two trees of laws.

It is interesting to note that in the framework of the standard model of cosmology (big bang theory) lesser and lesser number of physical laws are needed when we approach towards the big bang. There is a hope that in future we may find that at the big bang there was just a single law. This will be really remarkable. This will not only take away burdens of scientists to explain the plethora of laws and fine tunings without any help from god ! This will make their job easy for further investigations.

Physicists are working hard to reduce the two different trees of laws in a single tree which they call the "Theory of Everything" or TOE. This is not only the challenge. There is a crisis at much deeper level: scientists do not have a common set of laws for living and nonliving beings. It has been a long time for scientists reducing living and nonliving stuff in the form of atoms, molecules and subatomic particles. In most cases it has been possible to explain the behavior of nonliving stuff at macroscopic level in terms of behavior of its components which may be at the most fundamental particles. That is not the case for living beings. Living beings do not seem to be totally controlled by the properties of the ingredients which form them. They seems to be following a set of laws which cannot be reduced to the set of laws which govern the world of nonliving stuff. In place of going into detail, I would like to mention just one property of the

living beings: they try hard to survive at any cost or they want to live. Neither it is clear to me that if this has any resemblance to the law of inertia which all material objects in the world follow nor it is clear to me that by being in "living state" living beings try to be in the lowest energy state. Contrary to that I think if we could map the "living state" and "non-living state" in the energy domain then "non-living" state may have lower energy than the "living state". It may seem ridiculous but I think nature wants to wipe out life (second law of thermodynamics) but this is the integrity and strength of the life itself that it can survive. Life in the simplest form can be defined in the form of "packets of information" which can evolve in such a way that some part of it is always preserved. In order to make sure that some information remains preserved life tries to make as many copies of it as possible using the immediate resources available.

One of the challenging issue in science is to know the limit of local observations when the global picture has to be drawn. Time is one of the classic example of this dilemma. Local observations support the idea of the periodicity of time i.e., repetition of days, years and so on. From this periodicity one can immediately conclude that on an average the universe does not change. This contradicts the second law of thermodynamics. Therefore it is safe to say that at global scale the behavior of time is linear and is responsible for the evolution of the universe. Second law of thermodynamics is a law which dictates how systems should evolve given they have some "cause" to evolve. However, it itself cannot provide a cause for systems to evolve. This is the gravity which causes the universe and its various components stars, galaxies etc., to evolve. Gravity sets a direction for systems to evolve. Neither it is possible to isolate systems from gravity (so that they do not evolve) nor the direction of evolution can be reversed (given that gravity is always attractive). This means that evolution is inevitable. In the big bang theory it is considered that space, time and matter all three were created at the big bang and before that there was nothing and since then time is progressing linearly. I think this idea is still uncomfortable to a large section of people including me. If time is periodic at the scale of universe then there is no start and end of the universe i.e., it is eternal.

I have been interested to know about three systems: computer, life and the universe. These three systems seem to be disconnected and very different from one another. However, for me none of these is less complex than the other two. Moreover, at present it seems very difficult to understand the function of any one these systems without knowing how the other two work. I have identified three great questions about these systems: (1) is it possible to simulate a sufficiently complex system computationally with all the details (2) what makes living things living i.e., why living things which are made of non-living matter are so different from the non-living matter (3) was the universe actually originated and if yes then how? Before going in detail about these issues let me put my list of the most interesting questions about the nature, universe and everything.

1. Most people will agree with me that the living beings are very different from non living beings although both of them are made of the same substances. My question is what makes this difference. This question is close to the question how the first life in the universe originated.
2. Everything in the universe seems to be following well defined physical laws which can be expressed in terms of mathematical equations. Is the true nature of the physical world really mathematical, or are these patterns in our mind which give us this impression.
3. It seems that everything in the universe is well planned. The values of physical constants which determine the nature of physical world seem to be tuned for our existence. Is the

universe really designed for us or do we exist in one of the universes/part of the universe compatible to our existence ?

4. We (life) lies in between a hierarchy of scales at the top of which is the universe itself and at the bottom fundamental particles, strings, or we do not know what. Does this hierarchy actually breaks at the top and bottom or is it like a fractal ? In simple words what are the fundamental constituents of the most fundamental objects in the universe and what lies beyond the boundary of the universe ?
5. A lot of progress has been made in the field of computational science but still we are far from the computational power of the human brain in many respects. Will we able to make a computer which has consciousness as the brain has. This question is close to the question how information is stored in the brain ? Can we manipulate this information as we do that stored in a computer ?
6. It seems that most of our activities and behavior can be predicted on the basis of our socio-cultural and biological history and environment and still we are able to make unpredictable decisions. Do we have free will ? If not then what controls our unpredictable decisions ? Is there any third power who is responsible for this ?
7. Evolutionary theories predict that the complex life in the universe was evolved from the simple form of life. This means there is well defined direction towards which evolution progresses. Human beings are considered the most complex form of life on the earth. My question is in what form human beings will evolve in future.

In the most widely accepted interpretation of quantum mechanics physical quantities come into existence only when we measure them. This means that an electron has mass only when we measure it. In the case when physical quantities are outcome of measurements it seems impossible to consider that physical parameters which are suppose to be fine tuned were assigned to the universe a priori. It seems to me that physical quantities are merely useful tools to represent the behavior of physical systems under certain situations i.e., in which physical quantities are measured. Universality of the physical constants depends on our ability to identify common behavior of physical systems under different physical conditions. It seems absurd to assume that the values of physical constants determine the nature (physical properties) of the universe because in this situations we definitely need an explanation for fine tuning. My point is that the universe is the primary object and physical constants are just the results of our investigations. Many people can argue that this is a chicken-egg problem but I think this is not the case. Here the problem is of chicken and its height.

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