Faith in Science

Arthur T. Johnson

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Skeptics deny the validity of religious beliefs, as if science is completely reasonable and only religion depends on faith. They ignore or deny that scientific beliefs also require faith in the sincerity and trustworthiness of the declarer of scientific truth.

Faith is the desire to believe in something as true, or, if not absolutely true, then at least dependable. Faith seems to have been promoted through evolutionary trends, and, as such, it is a concoction of deep brain processes. Related to faith is the concept of truth. Truth is an ephemeral mental construct. We each have some idea of the meaning of truth. Most of the time, our ideas of truth reduce to what we are willing to believe through faith. Truth, in other words, can come from the words of our parents, instructors in our schools, or the teachings of our pastors. Truth can come from books on science or religion. These are different truths, to be sure, but they form the foundations of our essential selves.

We all want to believe in something and that something can vary from individual to individual. I have heard the word "faith" applied almost exclusively to religious beliefs. I don't disagree.

Nevertheless, it has occurred to me that there is a lot of faith required to believe scientific truths as well as religious truths. After all, in both cases I must rely on someone's word that what they purport to be true is, actually, true. I have not seen the face of God, but there are those who maintain that they have, so I can either believe them or not, but belief requires faith. Similarly, I have not personally seen a Higgs boson, not do I have the knowledge or skill to recognize a Higgs boson if it hit me in the face, but there are scientists who claim that they have seen one, so I believe them, or at least have faith in their assertions. Nor have I seen an electron, a DNA molecule, or the edge of the universe. I believe that each of these exists because experts have told me that they exist, and I have faith in their claims.

And then there is quantum theory. Particles behave as waves, butterflies fluttering halfway around the world cause tornadoes on the other side of the Earth, information can travel faster than the speed of light, and Schrödinger has a cat both dead and alive at the same time. C'mon, who're ya tryin' ta kid?

Quantum Bayesianism, or QBism, is one modern tool used to predict quantum events, but QBism is based upon a purely subjective belief in certain wave functions, which, themselves, are admitted as unreal (*Scientific American*, vol. 308(6), pp 46-51). If ever there was a case for belief in imaginary scientific concepts, this is it. Yet, QBism has been found to be somewhat useful to physicists working in quantum mechanics.

When I was in college, I took a course in the philosophy of science. It was a very interesting course because it showed me how much scientific progress depended on the basic beliefs of the

scientists involved. For instance, Einstein's theory of relativity came about because he believed in the symmetry of the universe. It also led to his assumption of the invariability of certain physical constants.

Science is based on observation. So is religion. Scientific observation these days is based upon techniques so sophisticated that I have no hope of ever seeing these things for myself, so I take the words of others who say that they have seen them. As science proceeds from hypothesis through observation and refinement to almost indisputable fact, the requisite faith necessary to acceptance declines and certainty in the belief expands. Nevertheless, it is questionable whether this is a case of certainty or just familiarity.

Religious beliefs are also based upon observations seen by others who claim miraculous experiences. There seems to be very little difference between the faith necessary to form beliefs in science and religion.

There are charlatans in both science and religion, and one must know when to suspend belief. On the scientific side are the questionable papers authored by David Rockefeller, the false stem cell claims by Hwang Woo-suk, and those responsible for Piltdown man. There is junk science unbelievable to most experts, such as the belief that childhood vaccines cause autism, and there is science-for-hire, such as the Eastman Chemical Company financially supporting so-called "independent" laboratories to prove that its Tritan plastic is safe for human exposure. Some people believe everything they read on the internet, whether it is scientifically reasonable or not. There are even questions being raised about Gregor Mendel's genetic experiments with results seemingly too good to be true.

On the other side of the issue, I recently read letters from readers of a newspaper (*Lancaster Farming*) claiming that Darwinian evolution is not true, and that the Earth, it says in the Bible, is only 6000 years old. I cannot believe the assertions in these letters, but, again, I depend upon my belief in scientists that they know what they are talking about in order to make that judgment.

Science is observational, but it is also correlational, finding connections between different events. Sometimes these become causes and effects; at other times it is not so clear which is which. Science, however, cannot explain why those correlations exist in the first place. To science, the way things are is just the way it is. There is no serious scientific questioning about why a certain set of correlations exist except to try to identify which event causes the other. This gives science the power of prediction as long as the basic set of circumstances does not change. But it is theoretically possible that our scientific truths here and now might be completely useless over there or at a different time.

The strength and appeal of science is that it can explain observations and predict likely future outcomes, but, then, again, so does religion. Unlike religion, science cannot explain the "why" or the "how" about the way things got to where they are in the first place. We live in a universe where time progresses from older to newer. Why did it have to be that way? There is no scientific explanation. We live in a three-dimensional space, although string theory says otherwise. Why? We might alternately have lived in a two-dimensional Flatland. This would give a three-dimensional being unfettered control over our lives. In three dimensions, a four-

dimensional creature could have the same power, appearing to be both omnipresent and omnipotent. Could this be the supernatural being who we call God?

With science, replication is key, and if reported results cannot be reproduced, then they are thrown into the trash heap of irreproducible results. The test of religious truth is not quite so easy. Miracles reproduced become commonplace occurrences; only those that are rare can be considered true miracles. In the event that miracles are repeated, we tend to try to find logical, reasonable, and scientific explanations for them. Religious discernments depend a lot on reproducibility and repeatability leading to ageless wisdom, whereas scientific observations lead to universal knowledge.

During the Age of Enlightenment, it became popular that reason, not revelation, should be paramount in human philosophy. As long as science was local, that is, one could see or feel for one's self, science and reason were closely aligned. But, today, much of science is not personal; it is revelatory in that the current objects of much of science are either highly theoretical, or require methods of such sophistication that they are beyond the ability of most to comprehend them. In either case, they far removed from individual observation. To believe in such science requires a belief, not in one's senses, but in the words of others who make claims beyond our own immediate experience.

Reading the earlier scientific literature demonstrates clearly that scientific facts assumed without question today were wrested with great effort from the state of the unknown that existed at the time. Marie Curie's Nobel lecture (1911) on the existence of the electron, Theodor Svedberg's Nobel lecture (1926) on the reality of molecules, and Barry Marshall's (2005) self-inflicted gastric ulcer to prove causation by *Helicobacter pylori* are evidence that some of the scientific facts beyond doubt today were, at one time, very unfamiliar or even discredited. In the not-too-distant past, the existence of microbes, the structure of DNA, and the orbits of the planets around the sun were unknown and their ideas scoffed at. It took hard work, refined methods, risk taking, and open minds to develop those scientific advances that we take as granted today. It took belief and acceptance, first by peers, then by the intelligentsia, then by the general public before these new pieces of knowledge became foundational parts of our core scientific beliefs. If the past is prolog to the future, what we know for sure today will be only a small part of what humans will know centuries from now. Some of what we know most assuredly will be modified or overturned. This process takes time and it doesn't always happen smoothly, but it is essential that the new knowledge is believable.

In his 1934 Nobel Prize lecture on the origin of the Earth, Harold C. Urey postulated: "None of us was there at the time, and any suggestions that I may make can hardly be considered as certainly true. The most that can be done is to outline a possible course of events which doesn't contradict physical laws and observed facts." He went on to explain what he thought was the sequence of events leading up to the Earth as we now know as a pretty good place to live. His ideas were speculative, and, with time, modified greatly by other scientists. Yet here was a renowned scientist, a Nobel Prize winner, who had put forth some ideas that eventually were found to be unacceptable. That is the way science progresses, but at what point does everyone start to believe that the stated ideas are, indeed, true?

All this is not to say that science and scientific facts are not to be believed. But I do say that there is an element of remoteness in parts of science that requires believing what others tell us rather than experiencing it ourselves. This, it seems to me, is faith.