Hinduism and Science: Contemporary Considerations

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HINDUISM AND SCIENCE: SOME REFLECTIONS

by Varadaraja V. Raman

Abstract. In recent decades scholars in every major religious tradition have been commenting on the relationship between their own tradition and science. The subject in the context of Hinduism is complex because there is no central institutionalized authority to dictate what is acceptable Hindu belief and what is not. This has resulted in a variety of perspectives that are touched upon here. Historical factors in the introduction of modern science in the Hindu world have also influenced the subject. The reflections in this paper are based on these.

Keywords: affirmative agnosticism; aparā; avatāra; Cārvāka; parā; polyodosism; postcolonial; postmodern; Ādi Shankara; Rāmānuja; Upanishads; Vaishṇava; Vedānta; Vedas

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Preamble

In the past few decades the topic of Religion and Science, two major expressions of the human spirit, has become a growing theme for discussion and debate. The subject is not altogether new. In ancient Greece and Rome, in ancient China and India, in medieval Islam and modern Europe, thinkers grappled with the question of how traditional worldviews that carry the weight of centuries and the sanctity of scriptures can be accommodated in the changing worldviews that have come from expanding knowledge, newer insights, and naturalistic frameworks for interpreting the experienced world.

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That challenge is handled by thinkers in different cultures in a variety of ways. Even within any specific culture there are dissimilar modes of confronting the issues. Nevertheless, it has become a general pattern to speak of Christianity and Science, Judaism and Science, Buddhism and Science, Islam and Science, and so on. So, one speaks about Hinduism and Science.

Over the ages science and religion have been engaging each other, sometimes harmoniously and sometimes confrontationally. The dual mode of cooperation and opposition is one common thread among the many ways in which religion and science have been interacting in different cultures. In virtually all instances there have been enthusiasts as well as opponents to efforts at reconciling the two pursuits. In our own times there are countless articles, books, Internet exchanges, and conferences that explore science and particular religious frameworks.

What all this means is that any serious discussion of science and religion is not only informed but also constrained by the religion in question and the interest or affiliation of the author. Thus, when one sees writings entitled X and Science, X being a particular religion, it should be clearly understood that in most cases one is not speaking of universal religious truths but rather of specific religious, denominational, or sectarian perspectives. All too often, both author and readers tend to forget this. I wish therefore to make it clear at the outset that my comments will be those of one who is emotionally and culturally affiliated with the Hindu world, epistemologically biased toward modern science, and intellectually anchored to the view that though formed by different cultures and rooted in different traditions, we are all striving to find meaning and fulfillment from our quests as human beings most of all. I will comment as much on how I see the field as on my own views of the issues. I have always felt that this perspective is not incompatible with my Hindu upbringing, where variety is thought to add spice to the religious quest, and humanity is regarded as the family to which we all belong.

Hindu Perspectives

Ancient Roots: Naturalism in the Vedas. Hinduism traces its beginnings to the sacred Vedas, a powerful religious literature in the long saga of human history. Most of the gods and goddesses, doctrines and worldviews, chants and incantations, cosmology and spiritual insights in the Hindu world flow from the pristine poetry of Vedic hymns that are, in the view of many scholars, unsurpassed in grandeur, majesty, and ancientness. Here we find the earliest expressions of awe and reverence for the forces and principles that govern the natural world and sustain humanity. The Vedas offer homage to sun and moon, to water and wind, and to the order in Nature that is universal. Here, in short, may be seen the seeds of naturalism

that were to sprout in later centuries as scientific interpretations of the world. For science also includes the search for overarching principles that give rise to the phenomenal world.

But that abstract view of the natural world in terms of wind and water, air and sky was/is too intangible for the average human mind to grasp and celebrate. Even while revealing truths about nature and the human condition, poetry often turns to visualizable imageries and personifies the abstract. Thus, when the poet John Keats sang odes to the nightingale or to autumn, he certainly did not believe the bird hears or the season appreciates his evocation; but his language brings beauty and meaning to the reader. So the sage poets of the Hindu world who articulated their responses to Nature's wonders and magnificence addressed them as if these were attributes of cosmic personages. Just as the abstractions of mathematical physics enable us to better grasp the complexities of perceived reality, our responses to the awesome splendors of Nature, when cast in sublime meters, become experientially more relevant. Thus arose the Vedic deities.

In due course these were transformed into super-anthropic representations that eventually became the colorful galaxy of gods and goddesses that adorn Hindu places of worship. Behind each of these iconic visions of the Divine in multitudinous aspects are fascinating narratives that are rich in their sweep and stir up deep reverence in the heart of every Hindu. Some of them also enshrine explanations, albeit mythic, for cosmogenesis and biogenesis.

Multiplicity of Ways in the Hindu World: Polyodosism. As in other religious traditions, the personalized worship mode touches the hearts of Hindus in their devotional postures, and enriches their religious life. The variety of icons that are evoked in Hindu prayers is a recognition that that the Divine, like glorious music, can be experienced in countless ways. This is reflected in the oft-quoted nugget of religious wisdom in the Rig Veda (1.164.46): *ekam sat: viprā bahudā vadanti*: Truth (God) is one, but is described in many ways by the learned. Thus, it is not that the insight of monotheism is absent in the Hindu framework, but its formulation is different from the Abrahamic. Rather than insist that the One God is *my* God, it has a different subtext—namely, that the god of every religion is worthy of veneration.

This is the doctrine of *polyodosism* or *bahumārga*: the possibility of finding spiritual fulfillment through many paths.[1] This view is perhaps the greatest contribution of the Hindu world to the religious quest, especially in the confrontational context in which humanity finds itself today. Interestingly a similar multiplicity of approach sometimes occurs in physics. Thus, problems in classical mechanics may be solved by adopting Newton's laws or through by adopting variational principles. Some problems in optics can be solved using the wave theory or the corpuscular theory of

light. In quantum mechanics likewise, we have wave mechanics and matrix mechanics.

Indic civilization dates back to more than three millennia. Therefore, it is not surprising that a great many ideas, concepts, and theories have emerged there, not all of them in perfect concordance with one another. These include many philosophical and metaphysical insights. Volumes have been written on them.

What one may conclude from inquiries into the subject is that the interaction between science (quest for worldly knowledge) and religion (quest for transcendental truths) has always been part of Indic culture. As in the Christian world with its multiple denominations (Catholic, Lutheran, Quaker, etc.), in the Hindu world too there is a wide doctrinal spectrum, so that specific elucidations and claims as to the Ultimate are often a function of sectarian schools of thought. But this is not always explicitly stated. Thus, for example, an excellent book on *Maya* (Thompson 2003) is a fascinating exposition of that quintessentially Hindu doctrine, but the work is very much from the Vaishnava standpoint, so much so that it scrupulously avoids even mentioning the competing preeminent Shaiva exponent of Maya—namely, Shankara. Likewise, another erudite and thought-provoking study, entitled *Hinduism and Biology* (Edelmann 2012), is actually a fine Vaishnava exposition based on an important Vaishnava scriptural text. This is hinted only in its subtitle. This is as philosophically sweeping as when a work on Thomistic philosophy and Biology is presented as *Christianity and Biology.* Of course this does not diminish the value of such books, but only that there is more to any religion than the perspective of one of its denominations.

Ancient Science in the Hindu World. Classical Indic thinkers reflected on the origin and meaning of human existence, explored the nature of ultimate reality, hypothesized on cosmogony, developed the concept of zero, and more. In astronomy, ancient rules prescribing how Vedic sacrificial altars are to be constructed display sound knowledge of arithmetic and geometry. It has been pointed out that in verse numbers in Vedic hymns the authors were correlating patterns in the numbers of syllables, lines, and verses with celestial periodicities through an *astronomical code* (Kak 2000a, 2000b).

In Indic culture mathematics was described as "the crest on the head of the peacock," which was a metaphorical way of saying that it is the crowning beauty of all knowledge (Joseph 2000). In his *Liber Abaci* (1202) Fibonacci explicitly stated that he had been introduced "to the art of the Indians' nine symbols through remarkable teaching. . . ." Historians of science know of the work of Al Khwarizmi's Latin translation on Hindu mathematics that introduced Hindu mathematics into Europe. Some still refer to the decimal system as Arab-Hindu numerals (Ifrah 1985). Pierre Simon de Laplace paid

homage to this invention, adding that it had escaped two of the greatest mathematical thinkers of antiquity: Archimedes and Apollonius. E. T. Bell recalled that "the first clear recognition of imaginaries was Mahavira's extremely intelligent remark in the ninth century that, in the nature of things, a negative number has no square root" (Bell 1945, 175).

Classical Hindus also explored the nature of the physical world, the properties of matter, the origin of consciousness, and more. The Hindu world also elaborated a complex system of medicine with a theoretical framework that continues to flourish and expand to this day. Many of these works have been published in many volumes (Bose 1971; Rahman 1999).

What may be less widely known is that there was sophisticated technology in India prior to the encroachment of the British. That technology dealt with metallurgy and chemicals, agricultural techniques and the manufacture of alloys, inoculation, and so on. Dharampal, who carefully looked into mounds of documents on aspects of Indian technology in the eighteenth century, recounts details of the subject (Dharampal 1983). To give but one example from his book, consider what J. Z. Holwell wrote in 1767: "Inoculation is performed in Indostan by a particular tribe of Brahmins, who are delegated annually for this service from the different Colleges of Bindoobund, Eleabas, Banaras, etc., over all the distant provinces; dividing themselves into small parties, of three or four each, they plan their traveling circuits in such wise as to arrive at the places of their respective destination some weeks before the return of the disease. . . ."

Hindu Philosophy and Science. Classical Hindu thinkers probed deep into the nature of human knowledge. Their reflections form an impressive body of philosophical literature that is a rich treasure-chest in India's cultural heritage (Radhakrishnan and Moore 1967). Because the fundamental concern in much of this relates to the religious and spiritual dimensions of the experienced world, these writings sound more like theology and metaphysics than philosophy or science. This is not unlike what we find in the scholastics of the Western tradition. In today's world, just as there are keen Jewish, Christian and Islamic scholars who write on how modern science may be seen from the perspective of their own tradition, we have a number of learned thinkers in the Hindu world too who write on science and Hinduism.

Much of the vast corpus of literature on this subject is related to what is known broadly as the Vedāntic worldview. Vedānta is one of the six major canonical schools of classical Hindu philosophy. It has several subgroups with which are associated the names of several eminent thinkers of the tradition. Perhaps the most widely known of these to the Western world is the system expounded by the eminent Ādi Shankara, who was one of the most prolific visionaries of classical India. A great many Hindu scholars

who used to write on science and Hinduism were anchored to Shankara's version of Vedanta.[2]

Another classical philosopher-sage of spiritual stature was Rāmānuja, who differed from the Advaita school on fundamental issues as to the nature of the relationship between individual consciousness and the Supreme One.[3] Such disagreements on metaphysical questions led to different religious schools (sects) that persist to this day. In recent decades, thanks largely to the prolific erudite commentaries and inspiration of the charismatic A. C. Bhaktivedanta Prabhupada and some of his ardent followers, many books, articles, and conferences on Hindu science-religion discussions have come from Vaishnava scholars. There is also a vibrant Internet group on science and religion (www.mahaprabhu.net/harmonizer) initiated by members of this group.

Upanishadic Epistemology. The philosophers of the tradition went beyond piety to explore the roots of the religious thirst that seems to be intrinsic to humans. They recognized this to be something that required not external observations and instruments to probe but introspection and meditation to become aware of. They reflected on these in a number of works that sometimes read like Plato's *Dialogues*, except that they are not all attributed to a single author. Their works, collectively known as the *Upanishads* (Radhakrishnan 1994), form the foundations of Hindu philosophical-spiritual and traditional-scientific worldviews. Among the many insights of Upanishadic seers, we may mention four:

(a) *The undergirding of the Universe*: The Upanishadic authors affirm with experiential certitude that beneath and beyond the tangible world of perceived reality there is an unsubstantial realm that is more omnipresent in its cosmic stretch than electromagnetic radiations in the physical world. This substratum was there even before the emergence of the physical universe, and will persist even after its physical dissolution. It is subtler than the throbbing vacuum of current physics with its virtual particles. This pre–big bang principle undergirding the world is endowed with a consciousness that palpitates throughout the length and breadth of the cosmos. It is referred to *Brahman*. This indestructible aspect is the spiritual dimension of the world.

(b) *Human knowledge is of two kinds*: In the Muṇḍaka Upanishad it is stated that knowledge is of two categorically different kinds that may be called this-world-knowledge (*aparā-vidyā*) and transcendent knowledge (*parā-vidyā*). The first is what is obtained through the normal modes of perception, logic, observation, and analysis. This kind of knowledge is no doubt important and useful. However, it does not relate to the knowledge of the imperishable dimension of

reality (*akshara*). The second relates to the spiritual dimension.[4] This categorization has a resemblance to Stephen Gould's NOMA idea, which regards science and religion as nonoverlapping magisteria. But the Upanishadic NOMA says something more. The *parā-aparā* distinction is not about religion and science, but about human awareness at the core. It gives full credit to the many human endeavors (including science) to unravel the nature of physical reality. But it also affirms, on the basis of investigations into the deepest recesses of consciousness, that there is a dimension of reality that is to be realized rather than understood, apprehended rather than comprehended. In a modest way every religious practitioner in a state of prayer or meditation gets, or attempts to get, a glimpse of that ineffable *parā* dimension of reality.

We may also describe this as *affirmative agnosticism*, by which I mean this: Normally we simply cannot know anything about transcendent reality, postmortem phase, nature of God, and so on. However, through spiritual disciplines it is possible to erase this nescience and become aware of such matters.

(c) *We are fragments of the Cosmos*: The third and perhaps the most remarkable thesis of the Upanishads is that every living entity is a splinter from the Cosmic Fire. Per current scientific understanding, every proton and electron, no matter where in the world it is, came from the first grand bang that led to the physical universe such as we know it. Moreover, according to current understandings in astrophysics, the heavier atoms in our bodies came from the core of supernovas where they were concocted. Likewise, from the Upanishadic perspective, every individual consciousness is an emanation from the universal consciousness. This is expressed through the aphorism *tat tvam asi*: Thou art That (Puligandla 2002). Modern astrophysics tells us that we are stardust. The Upanishads tell us that we are cosmic-consciousness-dust.

(d) *Hints at the empirical method*: The Upanishads contain metaphysical speculations and spiritual visions. Yet, there is at least one section there that reveals an experimental outlook. In the *Chāndogya Upanishad* we read about a certain Uddālaka Āruṇi. He has a discussion with his son about the essence of things in the course of which he mentions water as essential for life and food as indispensable for the mind. This he establishes by instructing the son to live only on water for two weeks. The son survives, but does not remember many things. Then he is asked to eat for some days and come back. The son does this and gets back his memory. This is an empirical methodology for establishing the truth value of a proposition. As one historian of science who explored the matter in detail stated, Uddālaka Āruṇi,

> who predates Thales of Miletus, "did in fact boldly knock at the gates of natural science to be opened," for which effort he deserves to be called "the first rational natural scientist in the history of the Indian subcontinent, if not in global history." (Chattopadhyaya 1991, 105 *et seq*.).

Nontheistic Understandings of the World. Worldviews are usually of two kinds: theistic, which regard the universe as resulting from an intentional personal God; and naturalistic, which view the world as a phenomenon that can be understood without imagining a Creator-God. One classical nontheistic Hindu interpretation is known as the *Sāmkhya* (*Sāmkhya*) system, one of six canonical schools of classical Hindu explanatory structures (Larson 1979). Its origin is traced to a thinker by the name of Kapila, but it has been elaborated and commented upon by numerous other authors.

Leaving aside the metaphysical paraphernalia associated with the system, the essential thesis of this school is quite simple. It states that, corresponding to the big bang of current cosmology, the Cosmic Consciousness (*paramātman*) splits into two entities: a subject (called *purusha*) and an object (called *prakriti*). Purusha experiences prakriti. Then prakriti variegated into countless simple and complex entities, and purusha into countless individual consciousnesses (*jīvātmans*) that are independent and separate experiencing entities.

From this perspective one might say that the *jīvātmans* are engaged in two kinds of activities. One is to interact with and interpret *prakriti*. This constitutes what we call science. The other is their effort to discover the source from which it emerged. This constitutes what may be called the religious or spiritual quest (Raman 2011, 88). This is an interesting model for interpreting the enterprises we call science and religion.

We may also see the *Samkhya* system as containing one version of the notion of emergence. One of its central thesis, known as *satkāryavāda* (doctrine of cause-effect-potentiality), is that the observed effect is already implicit in the apparent cause, not unlike oil being already present in the sesame seed. The causal principle is essentially an operation that transforms the potential into the actual (Shaw 2011).

Associated with this is the idea of an agent (*kartā*) in the context of causality. Though it is an extrapolation from anthropic creativity, it is an idea that can be extended to the natural world as well. From the laws of physics alone, the orbit of a projectile can be shown to be parabolic. The laws of physics constitute the cause and the orbit is the effect in any given projectile motion. However, the particular trajectory and place of fall of the projectile, let alone the fact that it was projected at all, will be determined by the initial conditions of projection. These are specified by an agent: the person who throws the projectile. In many natural phenomena the agent is

an unobserved entity. Thus, when a radioactive nucleus decays in a sample of the element there is no visible physical agent that causes one particular nucleus rather than another to disintegrate. Or again, when an electron in an atom jumps from one stationary orbit or another, the agency responsible for this particular transition is not physically discernible. Likewise, when planets were formed, what caused each of them to be at a certain distance from the sun or in a certain orbital plane is totally unknown. In current physics all such instances are ascribed to randomness. The notion of *kartā* can be very helpful here.

Indeed, scholars have traced in the Samkhya system the roots of "the fundamental ideas of positive science" and "a theory of matter, a theory of causality, a theory of knowledge and a theory of evolutionary process" (Chattopadhyaya 1978, 363).

Explicit Atheist. It is true that the Hindu world, like many other religious frameworks, has a strong and pervasive God-component. Aside from nontheistic schools like the Sāmkhya, there have also been explicitly atheistic schools in the Hindu tradition. One virulently antisupernatural system is/was the so-called Cārvāka school, whose members were rank materialists. For them all that mattered was matter itself. True, there is consciousness, they conceded, but this was to them no more than another manifestation of matter. *Jivātman* and *paramātman* were all gibberish, they maintained. A person dies, and that is the end of it: No spirit and no reentry into another body. In their view, rituals to the departed served no purpose but to feed the priests. Their worldview was very similar to that of the New Atheists.

The Cārvāka philosophy led to hedonistic ethics: As long as we live, we must make the best of it. Pleasure should be the goal of life. Those who preach that we should renounce the world because of pain and suffering want to throw out the baby with the bathwater. There is a thorn in every rose. Does it mean we should ignore the rose? Should grain be discarded because husk comes with it? Such ideas may seem alien to the normal Hindu thinking such as it has been portrayed by mainstream Hindu thinkers. To a degree they are. But they were/are as Hindu as any other. All through Hindu history, thinkers with such views have come up now and again. Such radicals either broke away, or were subdued and silenced. Some of them established new religions or became brief chapters, if not footnotes, in books on Indian philosophy. There have been many scholarly studies on Hindu materialism (Chattopadhyaya 1978), but for various reasons the Cārvākas have not acquired the widespread dissemination that the more orthodox schools have received. It has also been argued that those who were disparaging the pure pleasure-seekers were themselves "subscribing to the same philosophy, though surreptitiously" (Chattapodhyaya 1978, 35), but in lofty metaphysical terms.

We may picture the philosopher Cārvāka—if such a one existed—as a highly original thinker who could not possibly accept what must have seemed to him to be a lot of mumble-jumble in rituals, and who dared to speak out against the system. Intellectual and spiritual rebels have but two fates: they are eventually deified or destroyed. It is entirely possible that Cārvāka was but a symbol, a name for a whole group of people who did not take the routine rites and rituals seriously; for whom feast and frolic were more meaningful than prayer and pilgrimage. There is at least one historical fiction on Cārvāka's life (Randreas 2005).

Hinduism and Psychology. More than in any other field, it was in the field of psychology that the Hindu world distinguished itself with some important discoveries. It was not so much in the doctrine of a transmigrating soul which carries with it traces of a previous birth, but in the exploration into the nature of the mind, its multiple layers, its various facets of experience and the like that Hindu thinkers developed the spiritual discipline of *yoga*. The yoga system has enormous practical benefits, and it rests on a complex conceptual foundation. It is a major recognition relating to the human condition. It speaks to us about the perennially restless mind and prescribes ways to bring the mind under full control. It prescribes techniques for actualizing the full potential of the body and the mind.

The theory and practice of yoga have undergone many changes over the centuries. They have been revised and reformulated by many enlightened practitioners over the ages. In today's world they have spread far and wide beyond the shores of India, enriched and distorted in a variety of ways. As a science it has several technical terms that have philological dimensions (Desmarais 2008). Leaving aside the incredible feats that individual yogis have performed—some defying normal physiological capacities—yogic discipline has enabled millions over many generations to achieve physical fitness and mental balance, and a select few to experience cosmic ecstasy. The associated meditation techniques have not only brought peace of mind to many in the modern world, they have also saved many from the ruin of drug addiction in their search for elevated experiences.

Modern applied psychology is concerned mostly with sick and deranged minds and is not anchored to anything spiritual. Traditional Hindu psychology focused on how to bring normal minds to their full potential. A number of Hindu psychologists have been working on the connections between the two approaches. Classical Hindu psychology is not one monolithic system but includes several systems that sometimes contradict and sometimes complement one another. For example, it has been pointed out that "the metaphysical underpinnings of the Yoga system and Advaita Vedanta are glaringly different. Yoga . . . embraces dualism of matter and consciousness and pluralism of purushas, whereas Advaita is uncompromisingly non-dualist and absolutist. Yet there is a great deal

of similarity in their conception of mind and theories of cognition and perception" (Rao and Marwaha 2005, 24).

Associated with this are efforts to uncover the nature of inscrutable consciousness. Already in the distant past Hindu thinkers proposed some very profound theories on the subject. It was only in the twentieth century that science began to take upon itself the challenge of explaining what consciousness is all about, how it came to be, what its ultimate status will be, whether and to what extent it is bound to the physiology of the brain, and so on. It is interesting to study how these questions are explored in the West and in the Hindu world (Rao 2002).

Biological Evolution: A Mythopoeic Metaphor. In the mythopoesy of the Purāṇas, the Divine incarnates periodically here on earth to save humanity from unhappy situations that might arise. Such a descent of the Divine to the earth below is referred to as an *avatāra*. The *avatāra* concept is an important doctrine in the Hindu framework. Aside from its expression of a historical optimism that says even the most difficult phases in human history will end eventually through the emergence of savior-personages in societies, what is interesting is that according to some reckonings there have been nine mythic *avatāras* already. These appeared in the forms of Fish, Tortoise, Boar, Leonanthrop (Lion-Man), Dwarf, Personage with Axe, Ideal Hero, Super-strong Man, and Divine Wisdom.

The list of the forms of the various avatāras cannot but remind us that it refers to beings from the aquatic and the amphibians to mammal, theranthropic animal-man and humans culturally and spiritually evolved. The biologist J. B. S. Haldane once referred to this as a metaphor for Darwinian evolution. Since then, quite a few Hindu writers have taken this up as proof that ancient Hindus knew about biological evolution, if not as proof for the occurrence of the avatāras. In the rich tradition there are other enumerations of avatāras as well.[5] A scholarly analysis of the Hindu view of evolution with considerable academic integrity, as reflected in particular in the Bhāgavata Purāṇa, is given in Edelman's book (Edelman 2012).

The Tamil Shaiva poet Māṇikkavāsakar, probably of the ninth century, wrote that in previous births he had been a blade of grass, a shrub, a worm, a tree, a dog, a bird, a snake, a stone, a mean spirit, a demon, and a sage, and that he had grown pretty tired of rebirths (Raman 2012a, 2012b). This is another poetic vision of evolving life forms, but it has little to do with the Darwinian biological worldview.

While the world was laughing at American creationists trying to introduce intelligent design in schools, ardent Hindu creationists have been working hard to refute Darwinian evolution (which, like their fundamentalist brothers in other religious traditions, they reject overtly or indirectly). Again like their Muslim and Christian counterparts, some

of them propound their antievolution views in Internet messages and websites or publish learned volumes to expound their scripture-inspired perspectives. No matter how intensely they differ in their local doctrinal beliefs, all traditional religionists reject evolution for two important reasons: The idea displaces *Homo sapiens* from the privileged pinnacle assigned to the species by religions, and it usurps the role of God in the context of biology. These are valid endopotent positions to adopt, but to argue that they are equally scientific may be blurring the demarcation between religion and science (Raman 2001).

What is noteworthy in the Hindu notion of the *avatāra* is that it embodies the idea that the variety of life-forms emerged sequentially in more and more complex forms, from the simple to the complex, from the lifeless to the mindful, from the aquatic to the superhuman. This may not explain anything, but at the very least it is an intelligent observation. Ancient reflections are significant for their insights rather than for their precise formulations or explanations. It is entirely possible, as per the Kuhnian view of science, that current versions of cosmogenesis, biogenesis, and anthropogenesis will undergo changes, mild or momentous, in ages to come, but it is unlikely that there will be a return to ancient mythologies within the scientific framework.

The essence in the Hindu perspective that I find reasonable and least contradictory to our scientific understanding is that every instance of life and life-process is an emanation from a larger cosmic cause or principle.[6]

Hinduism and Cosmology. Every culture has its cosmology. This is true of Hinduism also. What is exceptional here is, again, its multiplicity. There are, in the Vedic tradition, several different cosmologies. Perhaps the best known of these is the *Nāsadiya súkta* (Mandala X: 129) of the Rig Veda. What is remarkable here is that the sage-poet reflecting in mystical language on how the universe began concludes by saying that perhaps even the One above might not know how it all started. This extraordinary agnosticism stands in glaring contrast to the more self-assured (not to say dogmatic) affirmations that scriptures generally make on this matter. This creation hymn reveals a commendable and uncommon humility in the face of what is perhaps the most difficult question confronting any thinking mind.[7] Traditional Hindu accounts of the creation of the world range from the fascinating to the mythical.

But two things of relevance to modern cosmology stand out in all this. First, here for the first time in all of ancient speculations on cosmic origins, and never even imagined elsewhere until the dawn of the twentieth century, are statements to the effect that the age of the universe is not a few thousand or a few million years, but several billion. It was stated that our current eon began some 5,000 years ago (this should make Bishop Ussher feel good), and that it will last for a total of 432,000 years (this should disappoint

some Mayan-sooth sayers). In Hindu reckoning, this eon (*yuga*) is the last phase of a four-eon cycle of successively much longer yuga-periods, lasting for a total of 4.32 million years. After going through a thousand such cycles (4.32 billion years) the universe will be dissolved, only to be reborn again. It has been conjectured that perhaps this number was arrived at from the fact that there are 43,200 seconds in 12 hours. Whatever the source, the point to remember is that until the discovery of radioactive elements and their half-lives, physics could never even imagine anything of this time-span.

This brings us to the second interesting thesis of Hindu cosmology. At the close of each four-yuga cycle, the universe will dissolve and be reformed. The process will continue indefinitely. This notion of a cyclic cosmology was a hypothesis of modern science some decades ago. It has been revived in recent years (Steinhardtand Turok 2007). It had never before been imagined in any culture before.

Hinduism and Quantum Mechanics. Another topic of interest in the context of Hinduism and Science is the degree to which quantum mechanics brings to the fore some of the worldviews articulated by ancient Hindu thinkers. It must be noted here that it was not Hindu theologians who claimed such interconnections, but some quantum physicists. In particular, the notion of the centrality of consciousness in the world was minimized, if not eliminated, in classical physics. In a widely read book Erwin Schrödinger, one of the founders of quantum mechanics, stated explicitly: "The plurality that we perceive is only an appearance; it is not real. Vedāntic philosophy, in which this is a fundamental dogma, has sought to clarify it by a number of analogies, one of the most attractive being the many-faceted crystal which, while showing hundreds of little pictures of what is in reality a single existent object, does not really multiply that object" (Schrödinger 1964, 18–19). Many quantum physicists concede that it is not possible "to formulate the laws of quantum mechanics in a fully consistent way without reference to consciousness" (Wigner 1970). On the other hand, consciousness is a cornerstone in Hindu interpretations of the world.

Among the authors who have linked the role of consciousness in quantum physics to classical Hindu metaphysics is the Hindu physicist Amit Goswami (1995), a knowledgeable and highly regarded spokesman for Vedāntic perspectives on quantum mechanics. He has discussed in depth such complex questions as the quantum mind, quantum physics and the demise of materialism, and the nine lives of Schrödinger's cat. Though considerably different in tone from Tipler (1994) but in a very similar spirit, Goswami has also authored a book that explores the quantum physics of the soul, spirit, reincarnation, and such matters with Deepak Chopra (Chopra and Goswami 2001). Deepak Chopra is a prolific and sometimes controversial but highly successful celebrity with a background

in medicine. He has written, among other things, on such topics as quantum healing, perfect digestion, and how to know God. Some of the assertions in the Chopra-Goswami book run counter to the current paradigm of quantum physics, shifting though it is; but in postmodern science, boundaries between science and imaginative extrapolations are getting to be blurred considerably, especially in the popular-book market. Nevertheless professional quantum physicists are somewhat taken aback by New-Age claims about science and are reluctant to accommodate them into mainstream science.

No matter whether or where modern quantum mechanics and ancient Hindu worldviews concur or diverge, the fact remains that some of the thought-provoking reflections of ancient Hindu visionaries can be fruitfully recalled while discussing Bell's theorem, quantum entanglement, or the subject-object interface (Raman 2011).

Historical and Intercultural Aspects

Ancient Impressions from Beyond. India has had perhaps more visitors, welcome and unwelcome, more unpleasant intruders and helpless refugees than most other countries. Since time immemorial many of them have been recording their impressions on the country and its people. These writings reveal that over the centuries people from many regions of the world looked upon India with awe, respect, admiration, and even adulation, not only for her natural resources, but also for her intellectual life.

The seventh-century traveler Xuanzang (Hiuen Tsang) from China was so impressed by the vigor and curiosity of the people that he observed that students at the university where he studied did not have enough time in a day to ask questions. They spent many hours from dawn to dark discussing various issues (Watters 1996).

The eleventh-century scholar Abu'l-Qasim from Andalusia wrote: "Among the nations, during the course of centuries and throughout the passage of time, India was known as the mine of wisdom and the fountainhead of justice and good government and the Indians were credited with excellent intellects, exalted ideas, universal maxims, rare inventions and wonderful talents. . . . They have studied arithmetic and geometry. They have also acquired copious and abundant knowledge of the movements of the stars, the secrets of the celestial sphere and all other kinds of mathematical sciences. Moreover, of all the peoples they are the most learned in the science of medicine and thoroughly informed about the properties of drugs, the nature of composite elements and peculiarities of the existing things" (Salem and Kumar 1996).

Marco Polo, the thirteenth-century world traveler had only the most complementary things to say about the Brahmins of South India. He wrote, for example, that they "are the best merchants in the world, and

the most truthful, for they would not tell a lie for anything on earth. . . . They eat no flesh, and drink no wine, and live a life of great chastity . . . ; nor would they on any account take what belongs to another; so their law commands. . . . These Brahmans are very long-lived owing to their extreme abstinence in eating. . . . They have capital teeth, which is owing to a certain herb they chew, which greatly improves their appearance, and is also very good for the health" (Atherton 1912, 140).

In more recent times, several thinkers even from the colonizing West have paid homage to the intellectual and spiritual dimensions of ancient India.

Impact of the British. It is a well-known and unpleasant fact of history that India was among the victims of the age of expansion of the West. A number of European nations (Portugal, France, Denmark, and Great Britain) arrived on Indian shores as merchants and gradually settled themselves there on a different basis. As elsewhere, the colonizing European powers fought among themselves to acquire regions that they would call their own. In due course, the Danes were completely routed out, the Portuguese and the French managed to hold on to some territories, while the British succeeded in usurping a vast chunk of Hindu and Muslim kingdoms that were in power in vast portions of the Indian subcontinent. By the middle of the nineteenth century much of India was under British political domination. Associated with this was considerable economic exploitation, which was the primary goal of European expansionism.

The period of British colonialism in India has had several lasting effects. The four most important of these are (a) the political unification of India as a modern secular democratic nation; (b) the bifurcation of the Indian subcontinent into a secular democracy (Republic of India) and a theocratic state (Pakistan); (c) the penetration of English as a primary medium of communication among the linguistically different groups of the Indian people; and (d) the introduction of modern science in the Indian educational system.

It should be noted in this context that India has also benefited in countless ways from her contacts with the outside world, though this fact is not always acknowledged explicitly these days. In particular, it was the intrusion of Great Britain into India that ushered some sections of the Indian people into the modern world. But it is also important to remember that colonial domination, besides the considerable harm it did in other ways, was not a necessary condition for this transformation. In the minds of many modern Hindus India's, entry into the world of modern science via the British has created the misperception of modern science as a colonialist tool for economic exploitation.

English as the medium of expression and mutual communication for modern Indian scientists and engineers made their expertise available

to the world at large. But it also had the ill-effect of creating a schism in the British-Indian Hindu world: an English knowing upper class with all the advantages that come from knowledge and power and English, and a more traditional, less sophisticated, less powerful, and often marginalized class to whom only ancient views and values were available. The first group was brainwashed into believing that its members were intrinsically superior and that ancient traditions needed to be disparaged, decried, or discarded. New movements have now arisen to correct such erroneous and culturally suicidal attitudes.[8]

Impact of the Enlightenment. The rise of European Enlightenment in the seventeenth century had major impacts on Western civilization. Notwithstanding its devaluation and denigration by some postmodernists, many of these impacts have been positive. It has also changed the worldviews of leaders and movers in non-Western civilizations. The results and ideas of modern science were transmitted to India via the universities initiated by the colonizers. Before long Hindus entered into the mainstream of international science. They have now become an integral part of the seamless scientific community that in principle knows no ethnic, religious, or national boundaries. Hundreds of them publish in professional journals. Five of them have received the Nobel Prize for their technical work, and quite a few have been elected Fellows of the Royal Society.

Another significant consequence of the emergence of modern science was that scholars began to undertake systematic inquiries into the past, delving into ancient texts, translating them, digging for archeological finds, deciphering ancient scripts, and so on. Those investigations into the past, not only within Europe but in other areas of the world as well, brought within human reach much of ancient history that had been practically erased from our collective memory.[9]

Research of this kind brought to the attention of the larger world the scientific achievements of ancient Mesopotamia and Egypt, India, China, and more. Prior to the eighteenth century there was hardly a book within reach of Westerners, or even of indigenous scholars, on the scientific traditions of other peoples. There were inevitable ethnocentric biases in the interpretations of the findings by Western scholars. These are being brought to light in postcolonial literature. But what is seldom acknowledged in such assessments is that many peoples in non-Western cultures became aware of the scientific dimensions in the legacy of their own distant ancestors as a result of the scholarly investigations initiated by post-Enlightenment probes by Western investigators.

Thus, for example, the astronomical works of Aryabhata and Bhaskara, the medical treatises of Charaka and Shusruta, the mathematical works of the Kerala school, and the empirical approach of Uddālaka Āruni of Upanishadic fame—all these became mainstream knowledge even within

India, only because of researches that began in the eighteenth century and has continued since.[10]

These facts need to be mentioned because in the understandable negative reactions to Western economic exploitation, political domination, and cultural marginalization of the non-West, perpetrated during the eighteenth and nineteenth centuries, quite a few recent writings either underplay or ignore the positive byproducts of Western Enlightenment. Recalling this is by no means intended to condone and justify the unconscionable aggressions perpetrated by the West for well over two centuries, but only to remind ourselves of dimensions of European awakening that have been beneficial also to the rest of the world. One may hope that scholars of a new era will assess the good as well as the bad aspects of all peoples when they write histories.

Reactions to New Worldviews. Another impact of the West via modern science is the jolt it gave to traditional modes of interpreting the world. This sometimes led to direct confrontation between the emerging scientific interpretations of natural phenomena and long held religion-centered worldviews. One confused reaction to this among some Hindu writers is to regard the modern scientific framework as Western and to contrast it with Hindu science. This has led to some antagonism toward science and to the belief that the British were trying to uproot traditional Hindu worldviews by imposing their science on the people. It is surprising that this perspective was not there before Indian independence and has emerged only in the past two or three decades. What was/is not realized in such contentions is that very similar confrontations have occurred (and continue to be there) between traditional Christianity and modern science in the West also.[11] On the other hand, a great many Hindus who have been drawn to science by dint of their own studies realize that science is not as culturally biased at the core as some people in the non-West imagine. They not only embrace modern science wholeheartedly but also productively participate in the endeavor.

When the full merit and culture-independent validity of modern science came to be realized, there emerged another reaction. One began to recast ancient philosophical and scriptural writings in the language of modern science. This nostalgic error has its parallels in other religious traditions as well (Raman 1999, 18). This perspective sometimes leads to claims to the effect that some of the recent results of modern science are implicit in ancient writings that need to be properly interpreted to see the science in them. This thesis is different from the views of men like Johannes Kepler and others who merely argued that biblical passages had to be seen in symbolic terms, rather than be taken literally in order to avoid conflicts with modern findings. It is also quite different from the admonition of thinkers like Sri Aurobindo to the effect that mindless embrace of materialism

that is often a corollary of the physical sciences could be hurtful to the human condition in the long run. The goal of some of the new thinkers is not to satisfy religious authorities, but to argue that what is claimed as scientific knowledge in the West is not all that new. In this spirit, a number of science-informed writers have detected significant similarities between some results of twentieth-century fundamental physics and their deeper epistemological implications on the one hand, and some of the penetrating visions of Hindu seers on the other. Their writings have had considerable impact on science-religion discussions in the Hindu world.

Swami Vivekananda, a pioneering spokesman for Hindu worldviews in the late nineteenth and early twentieth centuries, declared optimistically, or perhaps presciently, that "science and religion will meet and shake hands. Poetry and philosophy will become friends. This will be the religion of the future, and if we can work it out, we may be sure that it will be for all times and peoples" (Vivekananda 1947, 149). This is yet to come to pass.

In the early twentieth century Pierre Duhem's scholarly work resuscitated medieval thinkers who had been marginalized or rendered irrelevant by the thinkers of the Enlightenment. Long before that, Swami Dayanand Saraswati, a man of great learning and impeccable spiritual integrity, who was a social reformer no less, delved deep into the Vedas and argued eloquently that science was well and vibrant in ancient India. Furthermore, he affirmed that Vedic civilization was also technologically advanced.

In the Christian world, scholars like Étienne Gilson saw the relevance of Thomistic philosophy to the modern world and went so far as to suggest that only Thomism can save us from the precarious world created by modern science—a thesis reiterated by a number of thinkers of good standing. Such ideas have their counterparts in the Hindu world where again eminent scholars have gone beyond the philosophical contents of Vedānta and explained how Vedāntic worldviews alone can solve the social, cultural, and ethical problems humanity is facing. Thus, one author concluded his scholarly presentation by stating that "when all has been said, the outstanding fact remains that it (Vedānta) is the science of wisdom and happiness, of truth irrefutable and vital to the perennial interests of man" (Iyer 1965, 530).

Postmodernist Impact. Scientific methodology led to the science of anthropology and sociology. Just as a child born of loving parents can grow to be loving of its own parents, sociology turned its focus on science itself. Thus arose the academic study of science, not as a body of knowledge but as a human enterprise, spurred by factors that its own practitioners were not consciously aware of. Now investigators unraveled that there is more to science than disinterested quest for knowledge. Extreme versions of these commentaries on science claim that science has no greater claims to objective truth than other enterprises, that science is essentially a

human-made construct, that science's goal is to acquire power, to exploit the masses, and to serve the cause of capitalism and European colonialism.

This last thesis appeals to thinkers in nations that had been victims of Western imperialism. So there began to appear articles and books exploring and emphasizing this view of science. While Indian/Hindu scientists, working in various laboratories and universities in India and beyond, have been making contributions to modern scientific knowledge through their research and publications like their counterparts all over the world, not unlike in the West, there have been a growing number of scholars—sociologists, historians, psychologists, and general commentators extramural to the scientific citadel—who write on science. Their insights and scholarship have enriched the discourse on science and Hinduism. Aside from journals like the *Indian Journal for the History of Science* and *Science and Culture*, there are symposia, conferences, and books on the theme of Hinduism and Science. Anthologies of essays on this subject are published on a regular basis, with titles like *Thoughts on Synthesis of Science and Religion* (Singh and Bandyopadhyay 2001), *Modern Science, Religion and the Quest for Unity* (Kozhamthadan 2005), and *Science and Spirtuality in Modern India* (Paranjape 2006).

Unlike the scientists of the first half of the twentieth century such as Jagdish Chandra Bose, Meghnad Saha, C. V. Raman, Subramanyan Chandrasekhar, and scores of other productive scientists, postmodern Hindu writers on science insist, as mentioned earlier, on differentiating Hindu culture and traditions from modern science. They are right in that culture and tradition, community and nationalism, religion and hegemonic undercurrents play a role in the growth of science. However, when this multicomponent liquid is distilled an essence comes out: and that is science *qua* knowledge. This knowledge-component-science, which all initiates into science understand and which many of them enrich, transcends caste and creed, race and religion, culture and nationality. Claims and comments on science may be inspired by parochial pride and culture-complexes, but when it comes to writing the equations of motion, analyzing the structure of molecules, or tracing the genome of a species, passport and patronym play no role whatsoever. It is in the non-recognition of this core feature of science that interpretations of culture-centered science—whether Hindu or Islamic, Catholic, Buddhis, and Judaic—grievously err.

One perceptive commentator described the situation succinctly as follows: "Indian modernity is thus Janus-faced if not schizophrenic. On the one hand it seeks to preserve, almost cling to, traditions that would have become obsolete in most parts of the world. On the other hand it champions modern science even though scientific premises and methodology contradict its own traditions" (Paranjape 2008, xxii). This paradox may be resolved when it is realized that modern science did not grow out of Indian soil: more seriously, it was ushered in by a

colonizing power. But it also is very useful, indeed indispensable, for practical purposes. As a result, science (or at least the scientific spirit) is as yet not whole-heartedly embraced, as has happened among thinkers in Japan, China, and Russia, for example. This is one reason why modern science is still regarded by many, including and especially by those who are unable to rid themselves of postcolonial victimhood, as an imposition by miscreant aliens, or as old wine (visions of their ancestors) in the new bottle of Western languages. Not many practicing Hindu scientists share this view while they are doing or teaching science. As to being marginalized, one author has pointed out that "the easy demarcation of the society into the elite and the subalterns in postcolonialism fails to capture the complexity and heterogeneity of the history of modern science in India" (Sur 2011, 25). This statement is equally true when some Hindus talk about the effects of the writings of Western authors on Indian culture, science, and history, where they consider themselves to be the subalterns in the global context dominated by the hegemonic West.

Postcolonial scholars do not seem to recognize that there was, and still is, a continuous tug of war between traditionalists (Christians) and modernists within the Western matrix also, except that in the West modern science is not an exotic import, much less brought in as an imposition by aliens who wished to destroy the local culture. Those who see science as an instrument used by Western and science-awakened Indians thinkers to destroy India's traditional culture (Chatterjee 1986) have their vocal counterparts in the Islamic world also, where some resort to other means than writing articles and books to counteract the alien cultural force. They seem to be unwilling or unable to recognize that new ideas always transform cultures and civilizations, whether from internal or external impetuses, for the good in some ways and for the bad in other ways, that such transformations cannot be averted in the global-knowledge context, and that the alternative to change is stagnation in ages whose glories are more in the recalling than in the reliving.

This is not to deny that radical changes in the cultural framework of a people have the potential for destroying a tradition altogether. It is therefore extremely important that thinkers in the non-West be deeply concerned about the integrity and survival of their culture, and it is appropriate that they alert us to the hegemonic and all-devouring nature of the changes ushered in by science, technology, and the globalization of English and Western lifestyles. The challenges facing traditionalists in this regard, whether in the West or in the non-West, are significant and nontrivial. Indeed, they are among the difficult challenges facing all peoples.

Science in Scriptures. In the first part of the twentieth century an important theme in many books was to the effect that classical Hindu philosophical perspectives had significant elements that were very relevant

in current issues in the philosophy of science. But in the last quarter of that century germinated another thesis: that some of the results of modern science were already implicit in ancient Hindu science. Spurred as much by provocative books like *The Tao of Physics* (Capra 1975) and *The Dancing Wu Li Masters* (Zukav 1979), as by serious rethinking about ancient works, a new paradigm has been gaining ground in the rich imagination of some Hindus, to the effect that even the notion of quarks lie occult in ancient aphorisms. Instances of this may be found in books like *Vedic Science and Technology* (Biswal and Ray 2009) and *Vedic Physics* (Roy 1999). In a work entitled *Vedic String Theory* (Bhakta 2006, 3), the author says: "In the depth of their meditation, the Vedic sages intuitively gained the concept of strings of consciousness as the originators of the fabric of space-time, and following their tradition of using mundane experience (the familiar) to describe the Divine (the unfamiliar) used the analogy of a handloom, which makes fabric from thread."

In this context it should be pointed out that in recent decades some Europeans and Americans have adopted Hinduism and India to the point that they have not only settled down in the country but have been writing with affection, respect, and knowledge about India and her culture, and about the gross injustices her people have suffered at the hands of ruthless invaders. Some of them have written on Vedic science and astrology and their connections with modern science. They are certainly serving Hindus, if not Hinduism, in making them feel positively about ancient Hindu science. Unwittingly, they are also reinforcing the natural inclination not to let go of ancient ideas even when new knowledge is available.

Meera Nanda has given a robust critique of efforts to reinstate old ideas in the garb of new science. Her thesis is that the resurgence of Hindu cultural patriotism, inspired by postmodernist relativism about scientific truths, is propagating the fantasy that much of modern science lies implicit in old sayings. She sees in all this the resurgence of Hindu fundamentalism that has its counterparts in other traditions as well. She writes with some exaggeration that "those who are agitating for the scientificity of ontology and epistemology are also at the forefront of defending the righteousness of the traditional Hindu social order which gives priority to the social group over the individual" (Nanda 2003, 88).

Western postmodernist writers, some of whom are practitioners of science, have been contributing to this situation. They have successfully propagated the thesis that all truths are relative. This means that scientific truths do not occupy a privileged position in the arena of human knowledge. This is not the place to discuss the merits or demerits of this contention. Suffice it to say that it has played an important role in devaluing modern science in the estimation of many people everywhere. The science and Enlightenment that originated in the West have turned topsy-turvy its own culture and transformed its own millennia-long traditions in

unrecognizable ways. They have been doing this in other cultural settings as well. What is not recognized in this tradition-destroying global onslaught is that it is *not colonialist governments* that have been changing the minds of the people, but the *reasoned knowledge, information, and emancipating values* that are part science and Enlightenment. The feel-good call to reject modern science because it had its origins in the West has been persuasively expounded by some thoughtful scholars in India. But they have not succeeded in diminishing the practice of science within India where research and inventions continue. Nor have such musings slowed down the pace of modern science education and progressive social values in colleges and universities in India. Thanks to these, the country is emerging as a leader to be reckoned with in the comity of nations.

In my view, modern Hindu scientists working in research centers, observatories, and laboratories are, literally or metaphorically, reincarnations of the founders of the Sāmkhya, Nyāya, Vedāntic, and other classical Hindu schools who did not simply parrot what their ancestors had said, but thought boldly and independently, and formulated new and original perspectives.

Concluding Thoughts

Science and religion are in harmony and in conflict in the Hindu world, as in all dynamic civilizations. Hindu worldviews are rich in insights and flexible in their capacity to incorporate new ideas and grow. Evolution and other scientific paradigms can be accepted even by religiously inclined thinkers, and even though astrology and numerology continue to impress and guide the masses, by and large they do not influence decision makers regarding the place of modern science in colleges and universities. In spite of attempts by some groups, educational institutions have thus far been shielded from such ancient sciences creeping into the curriculum. Perhaps the greatest strength of the Hindu framework lies in the fact that those who are brought up in the tradition generally have the capacity to accommodate contrarian worldviews that have contextual appeal and significance. The cheerful practice of traditional modes in the religious context gives meaning and purpose to most Hindus; and the willing embrace of rational science gives them a fuller appreciation of the natural world.

Given the rich intellectual heritage, it is not surprising that when the Hindu world encountered what was then largely Western science, it received and absorbed it with eagerness. There are at least two reasons why very soon Indians of Hindu heritage began to accept the scientific framework and to participate productively in the international endeavor we call modern science. First, the Hindu psyche has always been accustomed to new and divergent perspectives, and it accepts multiplicity as intrinsic to the human condition. The second and no less important reason is that

there has never been an institutionalized supreme authority, elected or anointed in the Hindu world, to dictate to its adherents what should and should not be accepted, what can and cannot be regarded as the Truth. This implies an extraordinary freedom in the religious context. Therefore, while rigid orthodoxy and what one would call fundamentalist doctrinal believers are still common in the Hindu world, there are also open-minded religionists, free thinkers and atheists in the tradition, as also enlightened bridge-builders between time-honored culturally meaningful (endopotent) worldviews and impersonal scientifically derived (exopotent) results.

General Comments on Science and Religion

What makes the subject of Science and Religion interesting is that notwithstanding all the advances that modern science has made during the past four and odd centuries, religions continue to play an important role in human culture, civilization, and history. One reason for this is that religions answer to some of the basic needs of humanity. Religions give joy in the celebrations of ancestral visions, hope in times of despair, and solace in times grief. Religions bind people through practices and add sanctity to life and relationships through sacraments. Religions have instigated commendable ethical principles like charity and love, compassion and service to others. They have inspired great art and glorious music and sublime poetry. Religions furnish meaning and purpose to countless billions. Severing links to these could be traumatic, with unhappy collective consequences. Whenever and wherever a religion has been removed, it has been replaced by another, by persuasion or by force.

Unfortunately, associated with many historical and current practices of religions are elements that are neither healthy for the individual nor safe for society. Such, for instance, are superstitions, intolerant attitudes toward the beliefs of others, sectarian persecutions, bigotry, sometimes racism and class hierarchy.

Since time immemorial people have been studying religions in systematic ways. There is a difference between studying one's own religion and that of a different group. In the first instance one tends to be spontaneously more sympathetic, while in the latter case, such sympathy does not arise naturally. The sheer strangeness of it all tends to incline the outsider in the opposite direction. Anyone who approaches another religion without a positive feeling toward it is not likely to benefit from the study in any way. Such a person is likely to distort and devalue what the practitioners regard as worthy and sacred. The goal of interfaith movements should be, not simply to learn about other religions but to learn to respect and appreciate other faith systems for their intrinsic non-hurtful qualities.

One topic that is seldom made explicit in discussions on science and religion is the methodological differences between science and religion

and the criteria for the truth content of propositions in the two contexts (Raman 2010, 60 et seq.). When these differences are ignored controversies are inevitable, for the participants in the two systems are like players playing with same ball, each following the rules of a different game.

It is important to emphasize that modern science—as distinct from ancient science and religious systems—relies largely on precise quantified data obtained through ingenious and carefully constructed instruments of varying degrees of sophistication for its conclusions. It utilizes well-defined constructs and, in many instances, mathematical techniques in the analysis of mounds of carefully collected data. There are meticulous methods of examination, verification, critiques, and reformulations when necessary, of scientifically proclaimed results.

The roots of religious truths are revelations that are accepted on the basis of the weight and sanctity one attaches to the source. From the religious perspective these are as trustworthy as a meter reading is to the scientist. In the religious context revealed truths are no less relevant, reliable, and important than logically derived theorems are in mathematics. More importantly, they are significant for culture and civilization. Therefore, in viewing scientific and religious views on any issue, even while appreciating and respecting the enrichment that both bring to human responses to perceived reality, it is important to bear in mind the fundamental ways in which science and religion differ as valid and worthwhile pursuits in the human experience to achieve intellectual and spiritual fulfillment.

Notes

1. Though stated with a different purpose, this idea is expressed in the first stanza of Hermann Hesse's poem *Allein*:

> *Es führen über die Erde Straßen und Wege viel,*
> *Aber alle haben dasselbe Ziel.*
> Many streets and ways on earth do lead.
> But their goals are all the same indeed.

2. The central thesis of Shankara is known as *Advaita Vedānta* or Vedāntic Monism.
3. Rāmānuja's system is known technically as *Visishtadvaita* or qualified nondualism.
4. *dve vidye veditavya iti, ha sma yad brahma-vido vadanti—parā caivāparāca*: There are two kinds of knowledge. One deals with transcendental knowledge and the other with material knowledge.
5. It should be pointed out that the ten avatāras are of Vishnu. Thus, this is an essentially Vaishnava view. The Bhāgavata Purāṇa lists twenty-two explicitly. The Tamil Chaiva tradition has the epic *Kanda Puranam*, which narrates the avatāra of Murugan.
6. If saying this or referring to the fact that there are aspects of life and mind, culture and cognition that have yet to be explained to the full satisfaction of all scientists qualifies me to be classed as "a sadhu-inspired and sadhu-citing scientist," I am flattered for a compliment I do not quite deserve (Brown 2012, 227).
7. The latest version of scientific cosmology, as popularized by Stephen Hawking and Lawrence Kreuss, is that the universe came out of nothing—which has all along been an assumption of any nontheistic cosmology since time immemorial.

8. Ironically, the vast percentage of eloquent spokespersons calling for the overthrow of the West-inculcated mindset are products of modern education in British-inspired schools, and well read in European Enlightenment literature.

9. Thus, in 1759 the first modern history of mathematics was published by Jean Étienne Montucla (Sarton 1936). Such investigations revealed, contrary to the Baconian view, that many ancient cultures had developed serious science in a variety of fields.

10. The same may be said of science in ancient Egypt, Mesopotamia, and China also.

11. Just as Marxism called for the workers of the world to unite against the capitalists of the world, and in today's global economy the capitalists of the world are united in the exploitation of the laborers of the world, the religious traditionalists of the world (though not united in their doctrinal convictions) are speaking out against the Darwinists of the world.

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