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Preamble : The Questions in the Inquiry
There are today a growing number of individuals and organisations, from both within and outside India, keenly (albeit, sometimes nervously) interested in fostering and being part of a dialogue between Science and Religion (or Metaphysics, Theology, and Spirituality). In some places this is gaining recognition as a burgeoning field or quasi-discipline, much like Cosmology in the natural sciences (to which it is of course connected). Admittedly, the motivations are not always the same: sometimes they are noble; sometimes they are rather wobbly; and sometimes simply partisan and therefore suspicious.

I have been humbly involved in bringing this discussion and current and future forums in this area to India through my connections with JTF (the John Templeton Foundation), SSQ-II (Science and Spiritual Quest-II), CTNS (Center for Theology and Natural Sciences, in Berkeley), NIAS (National Institute of Advanced Studies, Bangalore), and the just established Science and Spirituality in India (SSI) programme (with major funding approved, as I write this, for commencement in Bangalore by the end of 2003). I have also helped arrange major conferences in the area, as well as worked towards curriculum development in India. Hence, I wish to reflect critically on the prescient, pre-structures and template or blueprint (which Kant elsewhere would well have called the Prolegomenon) for such an encounter and endeavour.

I shall begin this inquiry with some questions and embellish it with narratives and anecdotes drawn from the Indian tradition of science, philosophy and theology. I will conclude the essay with some expectations or "the bottom line trajectory" if such an enterprise were to move ahead and benefit Indic intellectual discourse and cultural inquiry in any significant sense. This is by way of a programmatic only and not a fully developed analytical paper or prescriptive imperative! However, it has considerable ramifications for the development of pedagogical and curricular strategies.

The Questions in the Inquiry
The central questions that I think should concern us in such a quest are:
1. Is there such a thing as 'science' in India comparable to that in the West?
2. What are the *vidyas* (sciences) of cosmology, self and life?
3. Are the sciences and their practises in the East comparable to the scientific practises of the West?
4. Has the use of axioms (or axiomatisation) been a grounding feature of eastern sciences, like their Western counterparts?
5. Has the ambience of religion and theology in the indigenous tradition made a significant difference to the development of the sciences and technologies in the East?
6. What are the constitutive factors of the scientific temperament that occurred at different stages of the civilisation's growth or self-discovery?
7. How have the sciences impacted on tradition at large, particularly on moral and religious practices?
8. How have social practices, such as rituals and sacrifices, moral (normative) values and regimes of health-care impacted on this knowledge-tradition, e.g., Vedic ritual on cosmology, astrology on astronomy, yoga and herbal dietetics on Ayurveda (the science of life), ritual geometry on mathematics and astronomy, etc.?

How is Eastern Science Disseminated?

In the modern (post-colonial) Indian context, it is intriguing to note that the Constitution of India (unlike the US Constitution) makes provision for the pursuit and cultivation of the "scientific temper." Although, by the same token, to check the sweeping tide of mono-cultural secularism, based on nineteenth century (European) prescriptivism, it also underwrites the untethered freedom to practice and propagate anyone or a number of India's poly-spiritualities and religious aspirations. No doubt, the founding fathers of the nation, Sir Syed Ahmed Khan, Mahatma Gandhi, Abul Kalam Azad, Dr. Ambedkar, among others, had a great deal to do with forging a vision with such a social "equilibrium."

However, while as an ideal the quest has been for the unifying concept that brings together the particularity of the scientific mind with religious motivations in tradition towards the transcendental or transcendence of the mundane order of existence, the pragmatic outcome has been far short of the mark. Nevertheless, like karma, the seeds had been sown long back. The vision is ingrained, as it were, in the psyche or conscience of the nation, and much progress continues to be made in this direction, if not at governmental levels, then certainly in the private sector in interaction with public space (not least, among the ordinary people representative of a wide range of religious and caste groupings, NGOs, independent research organisations, etc.). However, more could, and indeed, *needs* to be done to achieve the optimum levels of the cherished goals.

The Programmatic

The vision for the programmatic that I have in mind, and what I have termed the "dialectic dialogue," would take the following concerns into consideration, in respect of the rich tradition of reflections that have begun to emerge in the encounter of science and religion in the Eastern traditions, particularly in
India: the significance of early Indian approaches to science (with some of its acclaimed or alleged discoveries); the motivation for the growth of modern science in India that, in part, has made it a recognised leader in world scientific and technological endeavours; the kinds of responses that tradition (religion, philosophy, theology) has made to these two rather disparate strands in Indian science, and its own stories about these; the potential for two major developments – science (with its new metaphysics and I-technologies) and religion (with its theological and philosophical faces) – to come together to address some of the glaring social and economic problems facing this massive and fascinating country, poised to be a world power, after the United States and China, in many areas of the modern world economy.

The following are some of the more concrete strategic concerns that need to be tackled for effecting the earlier mooted "dialectic dialogue."

As explanation for current shortcomings in not being able to take on board the full breadth of cross-cultural inputs, the following observations on cosmology, as an instance, should suffice:

The discussion of cosmology in recent times has largely been dominated by scientists and scientific journalists, and cosmology has been subsumed as a branch of science, in particular as a component of physics and astronomy. It is evident that disciplines such as philosophy of religion, history of religion and philosophy of science that cross the Western frontiers are more needed than ever to help understand the implications of modern scientific activity and theorising and to bring forward a clearer understanding of the issues involved in discussion of cosmology. (Conference on Science, Philosophy and Theology, University of Melbourne, July 1999.)

Add to this the fact that India has a very ancient tradition of thinking in the areas that concern scientific and theological researches – here we might mention a few other areas besides cosmology, namely, metaphysics, ontology, the philosophy of the mind, the nature of human existence and ecology – and the sheer impossibility of being all inclusive is unequivocally driven home.

India is one of the larger producers of modern-day scientists of all descriptions. Certain pertinent questions are now being increasingly asked by Indian scientists as well: for example, whether empirical sciences can really address unfalsifiables, such as concrete events, creativity and universal principles, that are part of the cosmological enterprise? Might philosophical or metaphysical theology have a role in providing alternative perspectives? Anecdotal accounts from Western science are increasingly cited in popular scientific meta-reflections, such as Schrödinger’s Cat, Heisenberg’s Uncertainty Principle, Einstein’s Relativity, Limits of Quantum Experiments, Black Holes, and Singularity Theories, etc.

However, appropriate forums for sustained high-level interactions that produce measurable and effective results have been less than satisfactory; and where these exist, a network connecting their activities with a unified, broader vision is lacking.

A number of Indian scientists remain rooted in their earlier traditional learning while they continue to pursue "pure" research. In the latter part of their career, a good number of Indian scientists turn to thinking deeply about
the philosophical and theological issues in relation to their own scientific understanding of the particular phenomena or problems they have spent their lives researching.

While one does not have to be a scientist or a spiritualist to think deeply on such issues, it is noteworthy that Indian scientists also enter this area of self-reflection, thereby contributing to one dimension of the inter-personal dialogue. More work is needed in the areas of informed contextualisation and systematic analysis of the interactive dialogue (or at least the tensions and unresolved, often vaguely articulated, conflicts and quiddities) and the sense of an emergent intersection between traditional Eastern theology and modern scientific pursuits as represented in another part of the world.

This area is being explored by a number of research organisations in India, a few of which are worth mentioning here. These are the: Project of the History of Indian Science, Philosophy, and Culture (New Delhi-Kolkata); Centre for Philosophy and Foundations of Science (New Delhi); Institute for World Culture (Bangalore); Indological Research Foundation (Bangalore); National Institute of Advanced Studies (Bangalore). All of these have been active in promoting sustained interactive research between science and spirituality, albeit within the critical academic discourse.

But again, the activities are scattered, often unconnected with each other. They do not as yet form part of a nation-wide vision that could pull together these various strands of thinking and reflections. This is essential to form a coherent whole so that a clear and concise story can be told about this process to those who are interested but who have little or no access to the particularity or plurality of the Indian context (from outside, or even from the inside).

**Intellectual and Cultural Concerns**

In any such pursuit and active promotion of dialogue there has to be a built-in sensitivity to the cultural or social location of the local participants, to the kinds of education, background, and religious or scientific commitments they bring to the encounter. India has a growing educated middle-class of people, with relatively liberal scientific and secular outlooks at least among the urban population. And yet, the presence of religious symbolisms and ritual practices remain very strong; in fact it can even be said that they are becoming more marked in the homes of a modernising post-independent India. To be a viable proposition, the envisioned dialogue must take into account not just these apparently incommensurate beliefs, but also the bewildering diversity of religious beliefs and practices.

Thus, for starters, at least two rather disparate intellectual traditions need to be brought together in a confrontational encounter in one site. The rationale for this is in keeping with the objective of confronting distinctive traditions, but coming to them, as it were, from different angles (those more familiar with Western or "modern" traditions will not know sufficiently about Eastern traditions and vice versa). In other words, the encounter being explored is also as much between the East and the West in the broadest possible terms. We want to observe closely what happens when the borders of the East and the West are crossed. For example, Darwin will be familiar to Western (and other modern) scientists, as will be various discoveries in the life sciences; however,
Western scientists may not be aware of the extent to which Hindu orthodoxy might have reacted to the importation of Darwinism and other aspects of evolutionary biological thinking into India (not necessarily because of Creationism, but because of its apparent conflict, let us suppose, with the continuum of an animistic-spiritualism that has a more emergentist explanation of the life- and intelligent-world). Likewise, Eastern scientists familiar with Darwinism may not appreciate the extent to which there has been diffidence in the West on account of its apparent conflict with Creationist theories. Neither Creationism nor Evolutionism, in a broader sense, might be an issue for the East, unlike in the West. Thus each of these warrant separate intensive workshops in their own right.

The Scientific Scope
The thing to explain is not why China didn’t develop science but why the West did. Science requires two amazing discoveries – the axiomatic method by the Greeks and systematic experimentation in the Renaissance. Both are very hard to imagine anyone discovering – Einstein.

The basic question underpinning this aspect of the inquiry is: what does an explanation consist of? How are epistemological justifications established and grounded for any theory and knowledge-tradition that is advanced? Indian sciences, like science in the West, formulated and articulated specific anvisiki (methodologies) that structure the material under investigation in a certain order and lend themselves to inferential moves (deductive, demonstrative and comparative). In addition to empirical and rational processes, the sciences also relied heavily on intuition (yogic insights), the authority of the scriptures and the testimony of learned elders. The manuals of the science of medicine (Charaka) go into considerable details on the theory of knowledge formation, as do texts on astronomy and mathematics.

The traditional method of the presentation of scientific deduction did not follow a symbolic method. Rather it drew on examples, instantiations, and terse or cryptic mantras (formulaic propositions). However, in recent years Indian scholar-scientists (just as Needham and his colleagues in the context of China) have transcribed this traditional knowledge into contemporary scientific technical language, utilising computational calculi and symbolic logic to unpack even the mantric formulations.

One of the major tasks then is to find the best approach and common medium for an understanding, appreciation and dissemination of the same, with respect to the development of, and responses to, the sciences in the Indian context, from the traditional to the colonial periods, and after. This background is important for those less informed about the diversity and richness of the history of Indian science.

It is often thought that (modern) science as we have it developed through rational and empirical investigations unique to the Western civilisation and came into full bloom with the Enlightenment or at least with Roger Bacon. The assumptions of the Greek origins of science have, however, been challenged with the growing knowledge about the role of Arab explorers (who put into practice some of the philosophical observations of Greek antiquity), the native Chinese scientific tradition (Joseph Needham’s work is instructive
here), and the achievements of Indian mathematics. India made the particularly spectacular contribution of the pivotal numeral “zero.” It also made other important discoveries in the fields of astronomy, astrology, cartography, navigation, architecture, metal technology, and medicine. On the philosophical side, theories of knowing, and criteria of truth attuned to the limits of objective knowledge were developed, including the epistemology of falsification and corroboration that aided scientific thinking in India. A sustained ecological science and an environment management tradition have also been recorded in the canons of the Hindu, Buddhist and Jain rulers.

For instance, when the British arrived in the 1770s they marvelled at the astonishingly efficient system of tanks and locally constructed ground-water catchment-structures. Indian scientists trained under the British system – such as J.C. Bose, Sir Syed Ahmed Khan, Srinivasamurthi, Ramanujan – were aware of the hostility of Western science towards India; of the ruse of science, under colonialism, to undermine the confidence and traditional wisdom of the natives, anywhere. Indian scientists throughout the colonial period lived an almost schizoid existence: scientists by day and theologians by night! J.C. Bose went on to find evolutionary scientific basis for the Indian-wisdom belief in the vital sentience of plant life. He succeeded in proving his thesis of vitalism or pranic energy, which even gained popular scientific attention. But what is not that well-known about Bose is that he preceded Marconi in successfully transmitting electromagnetic waves from one place to another without the use of wires, or solid conducting agents. The only difference was that while Bose used the confines of his small home laboratory, Marconi succeeded in transmitting the electromagnetic waves across the Atlantic, thus making possible the invention of long-distance Morse Code, telephonic communications, facsimile transmission, and eventually the internet. But Marconi acknowledged Bose’s unprecedented discovery.

The brilliant mathematician, Srinivasan Ramanujan (1887-1920), practised a neat and non-dualistic science that had been the forte of Indian thought since the AD eighth century. One school of thought believes that his science relied as much on mysticism, metaphysics and astrology as it did on the abstract ideas of mathematics and geometry. The intertwining of mathematics and metaphysics was a unique phenomenon that indeed troubled his academic hosts in Cambridge, for he claimed to have arrived at some of his unprecedented solutions in his dreams through the help of the goddess of learning. But, in effect, these were re-workings of solutions, already known to traditional mathematics, that were used for charting the paths of stars and planets in the sciences of astronomy-cum-astrology. Others, however, believe that Ramanujan’s achievements were of a rare solitary genius with no influence from the tradition. This issue is a subject of much debate among Indian critics and historians of science.

Likewise, C.V. Raman in the 1940s worked with Max Born on crystal dynamics or spectroscopy in the Indian Institute of Science; but Born could not fathom the aesthetic excesses and non-Euclidean geometrical structures that Raman charted in his spectroscopic experiments. The two scientists, of vastly different temperaments, fell out in the end, and Born charged Raman of speculative dabbling and unnecessary mystification. He also tried to refute Raman’s findings. Only now, with advanced C-CAD and digital scanning processes, have
scientists begun to appreciate some of Raman's discoveries, and his likely use of the traditional intuitive or aesthetic critique of Western science. But there are also strong views among Indian scientists and critics that Raman was something of an "authoritarian Brahmin" when it came to pure science, and that his temperament hindered rather than helped the progress of science in the India of the 1940s and 1950s.

Nevertheless, a major research institute is named after him, where two generations of eminent Indian scientists who have made notable strides in many branches of science have been trained. One such advance has been made in astrophysics, notably through the work and teaching of the Nobel Laureate in Astrophysics, S. Chandrasekhar. He worked in Chicago since 1935 and influenced Oppenheimer (to whom the famous quote from the classical Bhagavadgita about the splendour of the thousand suns is attributed, when, in fact, it was Chandrasekhar who first drew attention to it). Chandrasekhar promoted Asian research scientists, two of whom jointly won the Nobel Prize in the field before him (a sign of the humility and modesty of a guru even in the tradition of science!).

Srinivasamurthi, a Sanskrit scholar who in 1923 was dreaming of releasing atomic energy, turned his gaze towards indigenous medical systems, especially Ayurveda, and made a Galen-like stride in incorporating the Hindu Charaka and the Muslim medicinal practices into the modern paradigm of health management, informed by Buddhist non-dualist philosophical principles. He formulated a new paradigm of chemistry that was scathingly critical of the germ theory so central to Western medicine. He, in fact, changed Indian medical science forever.

Another Bose made strides in psychoanalysis, combining Freud’s insights into the unconscious with Indian theories on yoga, the subtle-conscious body, and traditional psycho-spiritual practices of meditation and inner expansion. Bose communicated with Freud about his discoveries and is likely to have mentioned terms such as ‘Nirvana.’ (Nandy, The Savage Freud.)

Yet another Bose nearer to our times, has used traditional Indian musical sensibilities and sound-vibration theories pertaining to mantra incantations and ragas, to develop a system of multi-directional minute boom-speakers maximising surround-sound effect techniques (modelled on echoing cavities within traditional sitar-type instruments). This has revolutionised the home entertainment centre and impacted the multi-media music industry as well: hence the trade mark, BOSE (alias Vasu in the Sanskrit original).

Gandhi’s own personal experimentations with alternative treatment regimes for disease, dietetics and hygiene, his opposition to vivisection, in relation to the modern science of health, and the work of Indian neuroscience on the psychology and philosophy of the mind are also instructive in this context.

Indian scientists, inspired by Max Planck, have been attempting to unify wave and particle theories under a more or less discontinuous quantum spectrum. In January 2001, a major conference on String Theory hosted by India’s Tata Institute for Fundamental Research concluded in Mumbai. At this conference leading Western theoretical physicists known for their work on String Theory (Stephen Hawking, David Gross, Edward Whitten) interacted with Indian scientists who are also noted for their contributions to the unitive theory. The cultural context of this interaction was equally significant, as there
are traditional Indian theories of the microstructure of the cosmos that echo similar principles (although with divergences on the spiritual significance), and Einsteinian sentiment too: the Hindu gods, Shiva and Krishna in particular, did indeed play dice (but their dynamic Shakti-consorts would not tolerate any chances!).

The influence of Indian-trained scientists, technologists, and software developers on the growth of digital, internet, computer science, communication and virtual delivery systems is tremendous. Moreover it has been recognised by no less a personage than Bill Clinton with his visit, as the US President of the United States of America, to India’s epicentre of digital hi-tech research, Hyderabad, and also the twin-city of Bangalore, as well as by Bill Gates (with the setting up of the second largest Microsoft research-base outside of the US, again in Hyderabad). The majority of the recruits and researchers are otherwise practising Hindus and Muslims, deeply rooted in an ancient culture, and in some ways, almost as if unaffected by the whirlwind of developments around them – as was true of the Bose.

In short, the scope of scientific reflections is immense, evidenced in the many stories that can be told about the interaction of science and religion in various guises, from antiquity to the present times.

These kinds of narratives should not, however, replace the actual practice of science, or the agony and battles that gird the many dialogues and self-reflections. Much less should it present a “grand narrative” of the steady-state solutions that many “New Age” scientific writers, such as Fritjof Capra, believe can only come from a merger of science with the traditions of the East. It must be remembered that one cannot always speak for another, in their authentic voice. Moreover, a culture also creates numerous myths about their perceived heroes: thus, Stephen Hawking was recently welcomed to India and garlanded as ‘the greatest physicist-mathematician since Einstein, C.V. Raman, and S. Ramanujan’ in news reports!

But as Helaine Selin’s voluminous Encyclopaedia of the History of Science, Technology and Medicine in Non-Western Cultures demonstrates, the wonderful achievements of the bygone eras and still living cultures cannot be neglected if we are to understand today’s world which is much more global (though not yet unified under a single alliance) than compartmentalised. The disparate knowledge-traditions meet more in commercial space (pharmaceutical and multinational laboratories) than in classrooms or in public discourse (e.g., the spread and transformation of herbal remedies and plant varieties into consumer commodities marketed in/from the West, from Aloe Vera to Neem, Eucheacia to Ginseng, Taxmati and Tuxol, Basmati to Svobeda).

The objective here then ought to be to keep alive, in the spirit of philosophy and critical studies, the ambiguities, ambivalences, uncertainties, tensions, unresolved disquisitions and (in common parlance) the elements of ‘wobbliness’ in the encounter of science and religion in the Indian context. The story as it emerges is by no means one of happy achievements from A to Z!

In sum, keeping the above purposes and caveats in mind, some of the problem-areas and topics to be included under the category ‘Scientific Scope’ would comprise:

1. Cosmology and Ritual Resemblances
2. Geocentric vs. Heliocentric theories
3. Axiomatic Systems (Geometry, Sanskrit)
4. Profundity vs. Explicit Clarity
5. Systematic Variation and Experimentation (Did it develop anywhere else?)
6. Astronomy and Astrology
7. Astronomy and Religion
8. Anatomy (e.g., comparison of non-European anatomy theories with pre-Vesalian European anatomy)
9. Ayurveda – its history, its relation to religion, its reception in the West, present evidence for its efficacy (this last is a particularly fascinating topic)
10. Yogic medical and psychological traditions and their implications
11. Impact of Indian, Islamic and Chinese science/technology on Western society, science and technology
12. The secularisation of India, China, and the West and its effects on religion and science
13. Influence of Indian traditions on such scientists as:
   - J.C. Bose
   - Ramanujan
   - C.V. Raman (in his work with Born?)
   - S. Chandrasekhar
   - Bose (acoustical)
14. Influence of East on development of Western society, technology, science, through:
   - ‘Arabic’ numerals
   - Arabic transmission of Greek science
   - Various technologies
   - Exaggerated claims for impact and value of non-Western science
   - Contrasting scientific/religious traditions of dialogue in India, China, and the West, e.g., explicit debates on different approaches, such as Swami Ranganathananda’s debate with Julian Huxley
   - Differing metaphysics
   - Differing views of nature, of mind and consciousness
   - Indian reactions to Darwin (Hindu; animist-spiritualist)
   - Western medicine’s impact on Eastern medicine (and vice versa)
   - Indian input into DSM III to V
   - Rise of the nineteenth-century European view of India (and to a lesser degree, of China) as an embodiment of great spiritual wisdom in contrast to the secular materialist West – its impact on India’s self-understanding and the downplaying of Indian
achievements in logic, rigorous
metaphysics, etc.

The Religious and Theological Scope

The relative religious scope is also immense. Just about all the major “world religions” are represented in India. The focus here, however, will be primarily upon Hinduism (from its earlier Brahmanical or Vedic origins to its current reshaping under avatars-saintly spiritual leaders), but it will also draw on insights from Buddhism, and Jainism (with Islam, Zoroastrianism, and Christianity figuring in the background). From the early insights of Rigvedic sages on the cosmogonic beginnings of the universe (In the beginning there was neither Being nor non-Being . . .; “the Primordial Purusha sacrificed by the gods to sacrifice . . .;” “thus dismembered His eyes became the sun and moon . . .”), to sophisticated enactments and workings out of a detailed cosmology, an ontology of being and time, a sophisticated metaphysics, psychology or mind-theories, and evolutionary traces of the processes of prakriti (matter), maya (manifestation), lila (divine play) and Yama (death, eschatology), they all provide fertile thought-experiments for conceptualising the universe and its contents in various Leibnizian modalities (or possible worlds).

Checked by the rigours of Dharma (the diffuser of the Problem of Evil), one wonders why this particular world and not some other template was adopted to come to be. Again, religious canons and common wisdom have proffered a number of differing and often conflicting responses, which would be instructive to explore in an inquiry such as this. The Prolegomenon intends in this way to both broaden and exemplify the dialogues between science and religion in a tradition very different from mainstream (Western) triune paradigms of natural sciences, natural theology, and Judeo-Christianity.

An additional element that emerged in the discussions in the Bangalore conference on Science and Metaphysics (July 2000) was the extent to which Indian (and Asian) cosmologies, particularly the cosmogonic myths, cohere with a Creationism vis-à-vis strict Darwinian Evolutionism. And how these speculations address issues of:
  • Whether the universe had a beginning in time
  • Initial conditions
  • Organising principles
  • Laws and constants of nature
  • Symmetries
  • Explanatory power of deification

Science and Religion (Metaphysics and Theology) in Dialectic Dialogue

The tensions within the great religions represented in India, and their own encounters in terms of coming up with newer forms of understanding, need to be explored as an integral part of the dialogue at the interface of science and religion, as well as for the further ramifications it has in the specific areas of theological thinking about God, Freedom, and Immortality (of the Self). For example, the Buddhist denial of a substantial self and impermanence of nature while still retaining (and bolstering) belief in rebirth, the psychic effects of karma, the indispensability of dharma (moral laws), the compassion-zones of the Buddhas, sentient-respecting life on earth, and so on, against the Hindu
insistence on the need to postulate both an inner self (soul) and a transcendental superintendent or dispenser of rewards, punishments, etc., (via a demiurge, gods, Ishvara, godhead), are debates that have ramifications for the philosophy of religion. The concrete thrust will need to be examined in the different ways in which conflicts between science and religion are resolved, and whether the alleged solutions are philosophically persuasive. The framework sketched here provides one of the threads for the dialogue between Indian science and religion, and Western science and the combined Indian response (Indian science in cohort with its religions).

Meanwhile, new developments that have emerged through these encounters and dialogic confrontations need also to be examined and studied through other kinds of on-site field projects and case studies. One such project should include achievements in the areas of sustained ecological revivalism that have come about through the interaction of science and spiritual insights gleaned from traditional sources, or through the projects undertaken by NGOs headed by contemporary spiritual leaders who draw liberally on developments in modern scientific technology, biotechnology and biodiversity. And likewise, there is a need for exploring in greater depth concerns in the areas of the psycho-cosmic evolution of world-appearance (for example, in the Samkhya system of thought), and its impact in latter-day science, i.e., science after Bacon, Newton and Darwin, in India.

**Spirituality and Healing**

On the more concrete side, there is another exploratory area that is worth examining. This would concern how early European and British thinking and diagnostic practices on mental health were received in India, during the colonial period (that brought lobotomy, drug intensive prognosis, use of marijuana and other opiates, ECG and convulsive treatments), and the kinds of responses this provoked from within the persisting traditional systems that were rooted in religious wisdom and practices.

This schema will eventually be ripe for extension to explore the wider interaction of science and traditional wisdom of healing (or the “inner sciences”), from yoga to meditation and ancient scriptural prescriptions of Ayurveda, to field work based among and covering the growing number of specialist and popular institutions where there is evidence of interaction of science and religion (whether understood in the traditional or modern senses), such as large-scale hospitals and “Super Speciality Institutes of Higher Medical Sciences,” Mental Health research institutes, Yoga institutions, Ayurveda centres in and around the Bangalore metropolis, and indeed in Kerala (or satellites of the best known Ayurclinic in Alwaye, Kerala). For instance, certain institutions boast of their being at the cutting-edge of scientific developments (cardiology, neurosciences, DNA-research) while the material support base (the sprawling edifice, hi-tech facilities, day-to-day inexpensive or free operations costs, etc.) is provided by religious organisations and NGO-style spiritual leaders, avatars, and engaged communities such as the Kerala Ayurveda Kendra, the Ayurclinic, the Chinmaya Mission, Sri Sathya Sai Baba, the Mahavir Jain Society and its institutions, the Unitarian and Christian missions, the Syriac-Malayali educational establishments, Tibetan exiles, the J. Krishnamurthy Foundation, the National College, etc.
Another area that needs exploring specifically concerns the religious scope of science, extending to issues such as: evolutionary thesis and emergentism, and the potential accommodation of either or both within traditional Indian cosmological and medical-psychological systems alike; the implications these will have for debates on creationism versus evolution, consciousness. Indian scientists have made immense contributions to research in the areas of Astrophysics and Astronomy. Quantum Mechanics, General and Special Relativity, Super-String Theory; supplemented with Indian moral responses to biotechnological developments (archival proceedings from recent conferences and reports).

The Infotech Revolution
Last but not least is the challenge and need to target a wider understanding, and effective involvement in the socio-educational or public sphere from the side of the recent revolution in Information Technology (the technology of Super Highways software developments, cyber parks, integration of Infotech with biotechnology, advanced generation computer and networking, digital technologies linking different parts of India, and India with the rest of the world, etc.). Indian science and technological as well as biotechnological developments have made unprecedented strides in this area, but little has been said on the kinds of changes these developments are bringing about in the public, social, and cultural life of Indians. Bangalore has been host to a number of major conferences on the interface of IT (Information Technology) and biotechnology, where the delegates and the audience debated issues arising from the data collected on DNA-mapping, the Genome Project, genetic modification research (including GM-bio-undiversification and plant variety rights).

Elsewhere, Bangalore intellectuals and mega-industrial tycoons have embraced sanguine positions on “engaged universal spirituality” as a form of globalisation, noticeable in the speeches of Info-tech giants, Narayana Murthy and Azim Premji. (Since the two entrepreneurs and IT-leaders, also among the wealthiest stock-holders in the world, are Bangalore-based, at least one of them will be asked to speak at the lecture series, through interactive PC-hook-up if necessary.)

In conclusion, two of the key specific goals that would be rational to expect of any such dialogic encounter can be summarised as follows:

- East-West or cross-cultural developments on the frontiers of science, from early Indian scientific stirrings and discoveries to current developments bordering on nuclear physics and advanced neurosciences marks the “indigenist” scientific scope;
- The responses of traditional religions to the above in the Indian subcontinent provides the dialogic goal (inasmuch as there has been any such dialogues and self-reflections) and this marks the theological scope.

What follows is an annotated bibliographical discussion of sources that are likely to be useful for such an inquiry and for curriculum development in this emerging field.

Cosmology and the Theoretical Foundations of Indian Science
This could be broadly structured under the following divisions:
• Cosmological Foundations
• The Idea of Science in India: veda and vidya
• The Framework of the Indian Sciences: the 18 vidyas
• Technical Literature in Sanskrit: the Shastras

Comparative reflections from the History of Religion and Theology such as the 'Beginnings' of the universe, questions of ontology, agency, causality, creation, and efficient and material causes should be raised. Indian Classical texts describe creation at both the microscopic and the macroscopic levels, and they bear comparisons with modern cosmological thinking. Gems of early Indian navigation, astronomical chartings, and seafaring can be traced to the immense knowledge in the vidyas.

The Ritual Sciences
To study the emergence of physical sciences in a ritual context, under the following themes:
• Brahmical Science: The ‘Six Limbs of the Veda.’
• Ritual and Sacrifice: Purusha Sukta, Shrauta Sutras.

The Sciences of Language
It is said that the best way to get a grasp of Indian Cosmology is to observe closely the intricate technology of ritual enactment: the geometric layout, the homology with the planets, the resemblance of the unifying forces of nature, and the language in the form of mantras as the binding ingredient, the messenger Hermes between the gods and the (hu)man. Even the construction of the sacrificial altar has mathematical dimensions, which are homological with the cosmic architecture.

Sanskrit (said to be the “speech of the gods”) played a critical role in the development of grammar, music, linguistics, philology, and etymology. Here is a situation where a language gives rise to the sciences that (later) attempt to study languages! Sanskrit is also used as a link or “model” language in some computer software programmes.

Sanskrit Texts
Aitareya Brāhmaṇa, 3.33.
Brahma Purāṇa
Bṛhadāranyaka Upaniṣad, 1.4.1-6
Mahābhārata
Ṛgveda, 1.71.8; 10-61.5-7

Other Sources

Astronomy and Astrology
Links between astronomy and astrology in ancient knowledge-traditions would be an important area of study.

*Technology*

For discoveries in the sciences such as astronomy and astrology (as recorded also in borrowings by the Arabs); numbers and mathematics; metallurgy and mineral sciences; geophysics; *Charaka Samhita*, *Sushruta Samhita*, and *Ayurveda* (medicine and healing); psychology, theories of the mind and body; and other more recent claims about ancient Indian metaphysics, the following sources will be useful:
These contain useful discussions of the healing sciences by an eminent scientist who made his reputation very early on in the field of metallurgy and geological sciences. For other important sources refer to the next category.

*The Sciences of Life*
This would entail the study of:
• Medicine, Disease and Healing
• Anatomy in Ayurveda, Yoga and Tantra
• Food, Nutrition and Ecology
• Alchemy and Chemistry
The ancient Indians seemed to have believed in the 'good life.' Cherishing the values of happiness, health, and prosperity they developed a holistic way of life. The interesting areas concern the relation of mind and body, the very idea of embodiment, the energies and humours that maintain homeostasis, the subtle unconscious parts that influence dreams and periods of rest, and
the differential roles of breath (oxygen) and *prana* (*Qi* in Chinese terms, or the inhaled and exhaled spirit-energy). The readings will explore a range of such ideas.

**Sanskrit Texts**

Charaka Samhita
Sushruta Samhita
Yoga Sutras

These provide selections on health and the body-mind ontology.

**Other Sources**


**On Psychology**


More sources are available in the list of supplementary references provided below.

**China: Crossing Borders and Expanding Intellectual Boundaries**

Similar themes and questions on a limited scale, for comparative rather than deeper analytic purposes, could be explored in the context of ancient China, and contrasted with the Indian experience. Some development 'bullets' and innovations have been flagged under the summary of major topics provided earlier on.


*Colonial-inspired Sciences: Encounters of Tradition and Modernity*

Here the focus can be on narrative and biographical profiles of scientists such as B.N. Seal, J.C. Bose, Syed Ahmed Khan, Srinivasa Murthi, Ramanujan, C.V. Raman, the psychoanalyst Girindrasekhar Bose, Homi Bhabha, and Raja Ramana. The profiles on Indian scientists should be drawn from various textual and visual sources.


Nandy, a well-known critic of modernity and a defender of Indian religious traditions from a post-colonial perspective, argues in this small but elegant text, that Indian science develops in its own peculiarly spiritual or religious cultural ambience. He further maintains that there is neither such a thing as 'pure science' nor a stand-apart dialogic confrontation, but rather a dialectic pre-given interactive modality. He illustrates this thesis in a lively discussion of the creative works of two of the major Indian scientists. For another excellent work of his, see


This is slightly more sophisticated and theoretical discussion of the development
of science and its imaginary in more recent times, i.e., in the nineteenth and twentieth centuries, under the impact of colonialism. The imperatives of creating a secular society, stripped of sacredness and a traditional sacralising value-system, is the main thrust of this, as of other works by the author who belongs to the fashionable school of "Subaltern Studies" (basically, the rebellious art of re-writing "history from below"). The work is useful for the critical supplement to the disciplines of philosophy and theology from a reformed anti-revisionist history.

For useful small case-study essays refer to the following:

Moral Issues and Ethics in Action
This category would include contemporary work on ecological problems, the growth of biotechnology, challenges from other quarters of science (e.g., cloning, easy euthanasia) and traditional responses; visits to virtual sites on religion and ecology; explorations of comparative issues and responses. Furthermore, segments on the ‘ashram’ life of Gandhi from the film Gandhi, the life and works of Vinoba Bhave, Anil Agarwal, Baba Amte, the Chipko heroes, Vandana Shiva, the agitations of Medha Patkar, Arundhati Roy, may all be instructive.

Selections from Sanskrit Texts
Charaka Samhita
Dharma Shastras
Puranas

Other Sources

Selections that merit particular note are:


The Spirit of the Environment
Web-based resources with slides and illustrations:

The details of the book reviewed are as follows:

This has approximately fifty pages, including two combined essays, abstracts, field notes and still photo slides, diagrams, illustrations, bibliography, references.


Palmer, Joy and David Cooper, eds., 50 Environmental Thinkers. London: Routledge, 2001. Two essays by P. Bilimoria, approximately ten pages each, are of special relevance are "Buddha;" “Gandhi” in Palmer and Cooper.

Other sources include:

Vandana Shiva claims that modern technology is eroding the "spiritual" based traditional methods of the bio- and life-sustaining habitats, soft techniques, and ecology of India.


M.S. Swaminathan’s regular features on agriculture, ecological sciences and the environment in *The Hindu* and *The Times of India* would also be of most use.

For other ethical issues – such as the ramifications of the evil of violence in the global world today; the response of non-violence and restraint on the use of lethal technology, while coming to terms with nuclearisation of Asia: questions of whether it is necessary and ethical, etc. – the following works will be productive:


**Europeanisation of the Earth and Orientalism**

The issues dealt with here would be the secularisation of India, or Indian modernity, and its impact on Indian science; the secularism of science and its relation to religion, the responses of scientists, and also of Christian thinkers in India (from de Nobili to de Smet should be considered). The excessive representation of India as the world cradle of spiritualism in Orientalist scholarship and its consequences for the science-religion dialogue must also be explored.


This book has discussions on the ramifications for modernising Asia.

The return of Indian sciences to more spiritual and theological sensitivities, in the works of the late Prof Visvamitra, the noted Astrophysicist Ramnath Cowsik, and Prof B.V. Srikanthan should also be studied. In this regard refer to the occasional papers and proceedings put out by the National Institute for Advanced Studies, Bangalore; the Raman Research Institute and the Indian Institute of Science, Bangalore, and, Sreekantan, B.V., "Transcendences in Physics and their Implications to Consciousness." A Discussion on Consciousness and Genetics, ed. S. Menon, A. Sinha and B.V. Sreekantan. Bangalore: National Institute of Advanced Studies, 2002.

Supplementary Readings and References

Medicine
—, "Reflections on the Basic Concepts of Indian Pharmacology," in Meulenbeld and Wujastyk, Studies in Indian Medical History 1-17.
— and Dominik Wujastyk, Medical Literature from India, Sri Lanka and Tibet. Leiden: Brill, 1991,


**Cross-cultural Explorations: Greece, Mesopotamia and the Middle East**


Cosmology, Ritual, Sciences and Ethics (General)

See profiles of C.V. Raman, Ramanujan, "Chandrasekhar, available in monographs and film-documentaries." Also see the discussion in:
Seminar Papers from PHISPC, conferences held since 1994.
Singhal, D.P., *India and World Civilization*, vol. 2. London: Sidgwick & Jackson, 1972, 165-93. (This provides a useful discussion of Muslim influence on Hinduism and vice versa.)
Swami Ranganathananda’s Debate with Julian Huxley on Science and Religion. Archived print copy. For further details on this refer to:
Also refer to Sir Julian Huxley’s letter, and the Swami’s reply to the same over Swami Ranganathananda’s book.

REFERENCES

1. One of the notable cases that can be profiled here would comprise the extracurricular activities, inter-disciplinary dialogues, and self-reflections of Indian researchers, from the atomic-nuclear development and advanced applied science-technology projects. These people have had to confront cultural and moral issues that arise from such high-level research, in respect to, both, the cosmological significance, as well as, the applied environmental ramifications of their work.

2. I refer here to Girindrasekhar Bose, who had studied science and psychology at the Presidency College in Calcutta, had taught in Calcutta University, and from 1922 had begun to attend meetings of the Indian Psychoanalytic Society. He came to be regarded as the “doyn of psychoanalysis in India.” Bose also held some fascination for the mystical experiences of saints and yogis of India and he encouraged research into this particular and unique phenomenology India had to offer. Indeed, his call has been heeded in different corners of the globe, and within India the works of Ashis Nandy and Sudhir Kakar attest to the psychological (read, early psychoanalytic) insights of Bose. For greater details, refer to Christiane Hartnack, _Psychoanalysis in Colonial India_, 94-105.

3. I refer here to Dr. Amar G. Bose who was professor of electrical engineering at the Massachusetts Institute of Technology in Boston, US. He founded the Bose Corporation in 1964 and now Bose Jr. continues the legacy of his father, although with a greater economic focus. For further details visit <http://www.bose.com>.

4. Einstein had said, “God does not play dice.”

5. As an instance, the author is involved in a massive research project that is revisiting this fertile area through team archival work and re-construction of the all but lost interactive fecundation of Western psychiatric development and Indian mental health wisdom (a few categories and gems from which however entered the DSM-III to V diagnostic schema).

6. In the year 2000 the first two volumes of this series were published: Vol. 1 is edited by Helaine Selin and is called _Astronomy Across Cultures_. Vol. 2 is edited by Helaine Selin and Ubiratan D’Ambrosio and is called _Mathematics Across Cultures_. Vols. 3 and 4 have also been published in 2003. For further details visit the Springer website.