Science and Metaphysics

A discussion on

Consciousness and Genetics

Editors

Sangeetha Menon
Anindya Sinha
B. V. Sreekantan

NATIONAL INSTITUTE OF ADVANCED STUDIES
Bangalore, India

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Editors' Note

The notion that science and metaphysics are two different themes which cannot have issues of common concern has changed with the new and different ways of looking at science, technology, philosophy and spiritual traditions. A dialogue between scientific and metaphysical traditions has become not only relevant but also imperative in the modern context, where we are often confronted with dilemmas in defining values whether they be scientific and technological developments and innovations, societal and communal health, or moral and spiritual explorations. Research on genetic signatures and genome mapping, neural and biochemical aspects of brain activities, psychological, philosophical and spiritual understanding of the human mind and consciousness has enlarged the picture and many interfaces for dialogue and multidisciplinary understanding have developed.

At the National Institute of Advanced Studies (NIAS) in Bangalore, we have a small group working in the area of cognitive science and consciousness. We organised the first national conference on consciousness in February 1999 on the theme "Scientific and philosophical studies on consciousness" and the proceedings of this meeting were published as a special publication by NIAS the same year (NIAS Special Publication 5-99, 1999). This event made us aware of the considerable interest in this field in India. We felt that it would be appropriate to organise an international seminar that would provide an opportunity to review the new developments that are taking place in this field and also to present our own work in this area. We were considerably encouraged when the Sir John Templeton Foundation, USA, supported this idea and agreed to collaborate on such a meeting. We also received ready support from the Indian Council of Philosophical Research (ICPR) and Centre for Studies in Civilisations (CSC).

On the one hand, a rich literature exists on the philosophical understanding of the complexity of consciousness, especially in the Indian wisdom traditions. On the other, scientists are excited about the emergence of new insights into many outstanding issues in the life sciences. In particular, molecular genetics has caused waves through the Human Genome Project and raised, rightly or wrongly, great hopes as well as great fears. Thanks to the new generation of non-invasive instrumental techniques including CAT-scan, fNMR, PET, LASER, electric and magnetic encephalography and microelectrodes, there have been far reaching developments in the neurosciences, and the spatiotemporal events in the brain and its accessories are being mapped out in detail. And scientists feel that we should not be far from answering the crucial question – are the electro-physico-chemical activities of the neurons and the synapses responsible for consciousness? Or is it the other way round – does consciousness drive these circuits?

These proceedings of the international seminar on "Science and metaphysics: a discussion on consciousness and genetics" held at NIAS from 24-27 June 2001, consist of the individual presentations at various sessions and the panel discussions. The papers in this volume have been generally arranged according to their themes. Some papers remain unrepresented in this volume since we did not receive them at all. The editors of this volume have taken the liberty of making essential editorial changes in order to follow a uniform format in the listing of references and notes at the end of each paper. The diacritical marks for sanskrit words are denoted as per the styles followed by the authors. We thank the authors for sending in their papers on time and also extend our due apologies for any inadvertent errors or omissions in the final versions of these papers.

Regarding the panel discussions, some of the panelists have sent us manuscripts of their contributions which we have fully reproduced in the volume. Not to lose out on the flavour of the contributions from others, extracts and summaries prepared by the panel coordinators, making use of the tape recordings, have been included. The editors are grateful to the coordinators, Prof B V Subbarayappa and Dr M G Narasimhan for undertaking this arduous task.

The seminar was jointly organised by the National Institute of Advanced Studies and the Sir John Templeton Foundation, USA. We extend our thanks to the Foundation for their support and interest. We also thank the Indian Council of Philosophical Research and Centre for Studies in Civilisations, New Delhi, for co-sponsoring this seminar. We thank Her Excellency Smt V S Ramadevi, the Governor of Karnataka, for her presidential address, Prof D P Chattopadhyaya for the inaugural address and Dr P N Tandon for delivering the valedictory address for the seminar. Our thanks are also due to Prof R Narasimha, Director, NIAS, for his encouragement, and Dr Raja Ramanna, NIAS, for many discussions. Our thanks are also for Ms V B Mariyammal and Ms K R Suchitra for helping us to organise the papers, and Ms K Shashikala, Indian Academy of Sciences, for copy-editing the text of this volume. Finally, we thank all our colleagues in NIAS for helping us to organise this conference and in the preparation of this volume.

September 6, 2002

Sangeetha Menon
Anindya Sinha
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Section 1

Myth, metaphysics and science*

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1. Remarks on philological routes to protoscience and science

The meaning of our thought and of the ideas contained in it depends much upon the language in and through which we are expressing ourselves. The English word "myth" is traceable to the Greek word *mūthos* which stands for speech, word, tale, legend and their cognates. Its exact etymology is doubtful. But the word *Purāṇa* has its definite meaning in Sanskrit and Sanskrit-rooted languages. *Purāṇa* has been said to be an element of *Itihāsa,* which literally means what really happened, referring to both events and ideas of the past. In this sense, myth as *Purāṇa,* contrary to popular belief, does not stand for what is fictitious or necessarily supernatural. For example, when one speaks of "the myth of deluge", it has an underpinning of the palaeo-anthropology of North West Asia, from the legend

*Inaugural Address

of Noah to India's *Visnupurāṇa* and beyond, extended to the corroborative and similar myths in the Mid-Pacific and South Pacific islands. Further, when one speaks of the myth of Cupid and Psyche, one can easily discover its allegorical implicatons.

When we enter the realm of myths following the Sanskritic routes, we are on firmer ground. Here *Purāṇa* means what belongs to ancient or olden times. *Purāṇa* is referred to in different *Vedas.* It is the name of a class of sacred works attributed to *Vyāsa.* The three main groups of *Purāṇas* are classified under (i) *Rājasa* exalting *Brahmā* (e.g., the *Brahmāṇḍa Purāṇa, Brahmāvaivarta Purāṇa, Bhaviṣya Purāṇa* ...), *(ii) Sāttvika* exhalting *Viṣṇu* (e.g., the *Viṣṇu Purāṇa,* the *Bhāgavata Purāṇa, Garuḍa Purāna*...) and (iii) *Tāmas* exalting *Śiva* (the *Śiva, Liṅga, Agni* ....). There are other types of grouping of the *Purāṇas.* But the interesting point to be noted in this connection is that the seemingly fanciful concepts have their proto-cosmological, if not clearly cosmological, implications. Like the *Vedas,* the *Purāṇas* have in them their hidden cosmological concepts, for example, of fire, water, air, etc. To *Aghamarṣaṇa* and *Prajāpati Parameṣṭhin* is attributed the view that the visible world is due to the action of Warmth, Creative Fervour (*tāpas*) in the primitive substance called Water. Warmth (*tāpas*) and Night (*tāmas*) are the successive forces of the time principle called Year (*Saṁvatsara*). Like the Hellenic philosopher, Thales (624-546 BC), who asserted that Water is the first principle of creation, we have in India Prajāpati Parameṣṭhin proffering the principle of *Salila* as the fundamental cosmological principle of creation. Another cosmological principle of creation, *Air or Vāyu,* is also found both in the Hellenic and the Indic traditions. In the *Ṛgveda* (X. 168.3) as well as in the *Atharva Veda,* we find reference to *Anila* or *Vāyu,* as Ṛtāvā, the principle of things and beings. This reminds us of another Hellenic thinker, Anaximenes (570-500 BC), who asserted that *Air* (Greek *aer*), possessing inherent capacity for motion, is the first principle of creation.

Two arguments should be kept in view about why myths should *not* be taken as purely fictitious and that, positively speaking, why the same should be recognized as having some factual, if not proscientific, implications in them. First, in many such major civilizations as Indic, Sinic, Semitic and Hellenic, the basic elements of Nature as recognized by modern science had also been recognized in a pre-experimental or intuitive manner. Second, in the recognition of Earth (Kṣiti), Water (*Ap*), Fire or Energy (*Tejas* or *Tāpa*), Air (*Marūt*) and Sky (*Vyom*) as fundamental natural elements, the ancients might have been influenced both environmentally and intuitively. Myths retain their understanding in symbolic and metaphorical languages. It is instructive to note that most of the natural forces have been deified by them and given the names of Gods and Goddesses. It is not surprising that many insightful proscientific modern philosophers, particularly the metaphysicians, regard myths as chaff or husks having grains or seeds hidden in them. Distinctions between the mythical and the metaphysical and between the mythical and the scientific can best be understood through patient and perceptive linguistic analysis based on the principles of philology and etymology.

2. Anthropologists and sociologists on the passage from myth to reality

While many cultural anthropologists and sociologists highlight the differences in the pro-scientific characters of myths, many others highlight the differences from fairy tales, folk lore and narratives about sacred beings and semi-divine heroes. Since the *un*substantial aspect of myths has received much, at times even unduly negative, attention, I would concentrate on those views, which have tried to *dis*cover the reality-addressed character of myths.

Several philosophically oriented anthropologists and sociologists like Durkheim, Marcel, Lèvy-Bruhl and Lèvi-Strauss are of the view that myths are "collective representations", a vague reference to race-memory, - mystical, anti-causal, pre-logical and non-testable. Given these characteristics, it is clear that myths as such cannot be accorded the dignity of scientific views. It must be added here that social positivists' disappointment with the alleged mystical, anti-causal and pre-logical nature of myths is due to their exclusive commitment to the paradigm of physical science. In fairness to structuralists like Lèvi-Strauss, it may be stated that they have their own *universal* and rational account of myth-logic.

Among the famous social anthropologists who have specially emphasized the non-fantastic or non-fictitious aspect of myths, one must recall the names of Borislav Malinowski and Mircea Eliade. Myth to Malinowski, "is *not merely* a story .... but a reality lived" (my emphasis). By "reality" he means that "myths are characters of extant social institution". Even the seemingly fictitious details, he claims, reveal, on scrutiny, their realistic moorings. Eliade ascribed "sacred reality" as distinguished from "profane reality", to the mythical world. Myths embody a supernatural, but not unreal, level of existence. Myths present a sacred history.

While Eliade's account of myth is *mystical*, that of Malinowski is *cultural*, C G Jung offers a *psychological* theory of myths. According to him, myths are not mere allegories of physical processes. These have *vital* meaning. The primitive mind, says he, "does not invent myths, it experiences them". Myths are expressions of "psychological universals", "archetypal" or "primordial", not culture-specific and language-bound. Interestingly enough, Jung, from the psychological standpoint, and Lèvi-Strauss, from the structuralist standpoint, come to the same conclusion that the meaningful hidden substratum of myths is universal. It may be recalled here that both Lèvi-Strauss and Chomsky have derived their structural universalism from their common mentor, Roman Jakobson, who first developed this kind of theory of language.

3. Language and myth : Argument extended

In the Indian tradition one also notices a very ancient linguistic turn to so-called mythical gods and goddesses. In this connection, reference must be made to the god *Agni* (Fire), whose name is derived etymologically from *agre* (forward), *agre also* means the first-created and forward-moving. Visibly the flame of fire is ahead of both fire itself and its causal locus. Another god, *Indra*, said to be the king of godheads, etymologically means "kindler". Because he kindles *vital* airs, bodily sense-organs (*indriyas*) and uses thunder (*vajra*) as his main weapon against the forces of darkness (symbolized by black clouds). It is instructive to note that both *Agni* and *Indra* are fire-, light-, and energy-symbolising powers.

In the Indo-European family of languages, this particular word *Agni* has its widespread synonyms (which are both phonologically and contentwise related), viz., Latin *ignis,* Lithuanian *ugnis* and Russian *ogoṅ.* From India to Bulgaria, Macedonia and Serbia, with few interruptions, *agni* is available in the same form, only when it crosses the Adriatic it becomes *ignis* (Latin) and *ignition* (English). Vedic cosmology and cosmogns may be largely reconstructed from the fire-, light-, and sun-related vedic myths. For example, the finite visible world, *diti,* is said to be derived from *aditi* (infinite). It is well known that the relation between the finite (*diti*) visible and spatial-world-being and the boundless infinitive-being is central to the emergence of the world of sense and science. These metaphysical concepts are found meaningfully entangled into several mythical trappings, involving several godheads, male and female.

This symbolic view of myth has been profitably and intensively utilised and interpreted by thinkers like *Śaṁkara* and Sri Aurobindo. Both of them unhesitatingly recognize the mystical but constructive, not pejorative, implications of myth. Mythological knowledge is constructive because it stands for immediacy and transparency of intuitive knowledge, skipping over the intermediate levels of sense-information and conceptualisation found in common sense and scientific knowledge. Mythic knowledge is logical in its own, i.e. symbolic way.

To make the point clear, *Māyā* or the so-called magic is the principle of individuation, actualization and materialization, partly suppressive or *āvaraṇī* and partly expressive or *vikṣepaṇī.* The root word of *Māyā* is "*mā*", indicative of "measure" as evident from the Sanskrit words "*mān*", "*parimān*" and "*pramān*". The defenders of the mythological mode of knowing, as distinguished from the discursive one, point out that while scientific knowledge pre-supposes a pragmatic distinction or a separation between the subject and the object of knowledge, the upholders of the mythic and symbolic mode of knowing highlight the *essential* identity of the knower and the known in the primordial consciousness, the matrix of all forms of knowings and beings. Knowledge by identity and knowledge by difference are the two main recognized modes of knowledge.

The fact that myths, metaphors, analogies and other figures of speech cannot be dispensed with even in rigorous scientific and mathematical discourses, suggest that the mythic-symbolic underpinning of all forms of knowledge has to be properly understood, both in the *context of discovery* and also in the *context of validation*.

Sri Aurobindo persuasively argues in the *Secret of the Veda* that both in India and the Hellenic world scientific knowledge was born out of mythic knowledge, intuitions which are symbolically embodied in myths. In the ancient wisdom, secrecy, mystery and symbols played very penetrating and illuminating roles. Sri Aurobindo writes :

"[I]n ancient Europe the schools of intellectual philosophy were preceded by the secret doctrines of the mystics; Orphic and

Eleusinian mysteries prepared the rich soil of mentality out of which sprang Pythagoras and Plato. A similar starting-point is at least probable for the later march of thought in India. Much indeed of the forms and symbols of thought which we find in the Upaniṣads, much of the substance of the Brahmanas supposes a period in India in which thought took the form or the veil of secret teachings such as those of the Greek mysteries". [Sri Aurobindo, *The Secret of the Veda,* Birth Centenary Library, Pondicherry, 1971, p. 4].

Not only Sri Aurobindo (1872-1950) but also some other European thinkers like Ernst Cassirer (1874-1945) and A F Losev (1893-1988) engaged themselves in deciphering and bringing out of the hidden truths of myths and have succeeded in convincing us that the world of symbols and myths is not separated from that of metaphysics or even that of science. Symbolic truths are available in intuition; the metaphysical truths are explored by intuitively informed conceptual intellect; and scientific truths, though *discovered* by speculative intellect in the forms of hypothesis, are *validated* by experience and/or experiment.

4. From myth, through metaphysics, to science

Among the philosophers who brought out the scientific implication of myth and metaphysics very clearly, I think Cassirer and Popper, both intimately familiar with their contemporary science, deserve special mention. It is difficult to believe today that Cassirer, who wrote so extensively and incisively on myths and symbols, was among the first few philosophers who immediately after the publication of Einstein's famous three papers on New Physics in 1905 could professionally write on the fundamental philosophical significance of special Relativity. In *Substance and Function* (1910) he highlights the importance of the *functional* character of scientific concepts.

His functionalism paved the way of subsequent rise of operationalism (P W Bridgman) and verificationalism (Vienna Circle).

It is true that all myths are not homogenous, either in origin or in intent, (i) that some may be primarily theoretical or explanatory, (ii) that some may be mainly poetic and spiritual, (iii) that a few may be ordinarily practical or functional, and (iv) that a few may be for rationalizing or legitimizing purpose(s). Philologists and anthropologists like Max Müller, Boas and Bidney have drawn our attention to these different aspects or orientations of myths. At the same time it has been pointed out by thinkers like Cassirer and Susanne Langer, that all types of myths have a definite generic affinity, a common thread which holds them meaningfully together. And that thread is language, the paradigm of symbols. Cassirer writes: "myth, religion, art, language, even science, are ... so many variations on a common theme (language)" (Ernst Cassirer, *An Essay on Man*, Yale University Press, New Haven, 1944). Notwithstanding, or because of, the clear Neo-Kantian streak in his thought Cassirer would significantly draw upon the insights of Nietzsche, William James and Bergson and this fact substantially explains his success in assimilating non-intellectual cognitive capacities in his unified theory of language and myth. The heart of language is the symbol and in the formation of symbols humans are more or less freely creative, imaginative and intuitive, not necessarily guided by regimented or discursive intellection.

Besides Cassirer, another philospher, a junior contemporary of Cassirer and a lesser known Russian philosopher in the Euro-Amercian world, who deeply studied the relationship between myth and symbol, is Aleksi Fedorovich Losev. His areas of study were religion, Greek thought and culture, with special interest in language and symbolism. According to him, language is the expression of God's essence-energy. In his view, essence is to be equated with Plato's *eidos,* Idea or Form. Idea is manifested in myth, myth in symbol and symbol in the human person. He was influenced both by Platonic formalism and Husserlian phenomenology. The world, in general, and the *human* world, in particular, are vibrant because of the energy that is gradually, phenomenologically and dialectically disclosed in and through them. He was familiar with Cassirer's work and was very much influenced by the latter's view on myth and mythical time. But he misunderstands Cassirer when he says that he does not share Cassirer's theory that mythical truth and scientific truth are altogether different. As we have seen, Cassirer's was a *unified* view. He insists that mythical consciousness informs all cultures, is present in all of cultural forms, including the scientific culture. In this respect he echoes Sri Aurobindo's view of the sovereignty, i.e., all-pervasive nature, of consciousness, marked by expressive Force or *Śakti* ("The Life and Thought of Aleksei Federovich Losev", (1996), *Russian Studies in Philosophy,* 35:3–91).

Karl Popper, like Cassirer, was deeply influenced by Kant and Einstein. In spite of his professional scientific passion, Popper never fails to speak of the relevance of myth to science. What is more, he clearly perceives the presence of mythical intuition both in metaphysical speculation and scientific exploration. He emphatically asserts that "science must begin with myth and with a criticism of myth" (Karl Popper *Conjectures and Refutations* (C&R), Routledge and Kegan Paul, London, 1963, p.50). Popper's accents on criticism are intended to emphasize the role of analysis in bringing out the hidden import of myths.

He traces the origin of European science to the speculative theories of Thales (624-546 BC), Democritus (470-380 BC) and Plato (427-347 BC). To him, scientific conjectures and mythical symbols are cognates and roots of cognitive enterprise. The essential scientific spirit is infused with the conviction that the visible world has to be explained by some invisible principles of truth. In the vedic language it was said that the world of *Finite* things and beings (*Diti)* has to be explained in terms of the principle of boundless *Infinite (Aditi).* In a very related context, Popper recalls Galileo's "unbounded admiration for the greatness of mind of astronomers like Aristarchus (320-250 BC) and Copernicus (1473-1543 AD) who conceived the (heliocentric) system and held it to be true in violent opposition to the evidence of their own senses. This shows Galilean appreciation of the basic principle of scientific method that the known has to be explained by the unknown. By endorsing the same principle, Popper is obliged to recognize the contribution of myth and metaphysics in the development of science. According to him, myth represents a first-order enquiry carried out in terms of symbols and metaphysical speculation, while science carries out a second-order enquiry in terms of argumentative attitude and functional concepts. While metaphysical concepts are *inexact,* scientific ones are *exact.*

To buttress the above point both historically and conceptually, it may be recalled here that in his revolutionary helio-centric world-view, Copernicus, a Polish priest-scholar from Cracow, was deeply influenced by his Platonist teacher, Novara, at the University of Bologna in Italy. Popper traces the origin of his heliocentric hypothesis to the sixth book of Plato's *Republic* where he says that the sun plays the same role in the realm of visible things as does the Idea of Good, the highest Idea, in the realm of Ideas. Following the Platonic myth, Copernicus ascribes the visibility or intelligibility, vitality and growth of visible things to the sun which gives it the central position in the heavenly sphere. Similar myths are available in the vedic tradition centering round the myths of Aditi, Agni and Surya.

Sri Aurobindo interprets the *Rgvedic* themes of Sūrya or Light as the primordial symbol and source of truth and knowledge, both transcendental and empirical. The supposed antinomy and real interplay between the forces of Light and Darkness, partly enclose and partly disclose numberless faces of truth, the Infinite or *Aditi.* It is the symbol of power-consciousness. It is the mother of all things and gives birth to *Dakṣa,* the symbol of the discerning and individuative mind of the Divine. *Aditi* is *advaya* or unitary form of all things and beings. The world of multiplicity is due to *Diti,* the dualizing force. *Aditi* is hymned also as the wife of all pervading Viṣṇu, who has been represented as the younger brother of *Indra. Indra* gives Light *to Sūrya,* the Light of the truth which dispels the darkness and falsehood of our limited empirical vision. In the hierarchy of knowledge, *Aditi,* at the instrumentation of *Indra,* is brought down to the level of earthly forms of knowledge, philosophic and scientific.

Unless one deciphers the Vedic symbols and images, its hymns may appear as a confusing mythical and metaphysical mass. But when the symbols are properly interpreted, their implications are patiently brought out, the discerning mind finds a cosmic picture in which science and metaphysics, truths of *parardha* and *aparardha,* are harmoniously blended (Sri Aurobindo, *The Secret of the Veda,* Birth Centenary Library, Pondicherry, 1971, Vol. 10, pp. 421–429).

5. Logic, experience and intuition in science

It is common place in scientific conclaves to debunk mysticism and dismiss intuitionism lightly. Only a few scientists, philosophers and spiritualists of interdisciplinary gifts have cared to look into the matter very closely and carefully. Interestingly enough, most of them have drawn heavily on their own search for truth in their chosen areas and engaged in tackling problems and difficulties. Their accounts show one very general and basic truth. The passage from intuition, captured in symbols and myths, to metaphysical concepts and testable scientific hypotheses, though not easily ascertainable, can after all be traced, provided due pains are taken. The words of great scientists like Einstein (Albert Einstein, *The Origin of the General*

Theory of Relativity, Jackson, Wylie & Co., Glassgow, 1933), Charles Darwin (F Darwin, *Life and Letters of C Darwin,* John Murray, London, 1888), Hadamard (Jacques Hadamard, *The Psychology of Invention in the Mathematical Field,* Oxford University Press, London, 1945), Max Planck (Max Planck, *Where is Science Going?* Transl. by James Murphy, George Allen & Unwin, London 1933) and Poincaré (H Poincare, *Science and Method,* Transl. by F Maitland, Thomas Nelsons & Sons, London, 1914) indicate several related steps leading to great philosophical and scientific ideas, viz., (i) intensely living with the problem or preparation, (ii) chance or luck, (iii) speculation of imagination, (iv) intuition, (v) conjecture or hypothesis-framing, (vi) reason and reasoning, and (vii) strategic methods.

It is interesting to recall the emphasis which Einstein laid on intuition for *discovery* of fundametal laws of science. To quote him on the point : " There is no logical way to the discovery of .... element feeling for the order lies behind the appearance". He writes these lines in his preface to Max Planck's book, *Where is Science Going?*

Darwin himself did not develop any clearly articulated view on scientific discovery. The methodological elements to which he attached much importance are: (a) keen observation of objects of scientific interest, (b) ability to group or colligate the observed facts together meaningfully, (c) perseverance or doggedness, *sādhanā,* and (d) taking due notice of *exceptional* findings. His son writes about him [Charles Darwin] "there was one quality of mind which seems to be of special and extreme advantage in leading him to make discoveries. It was a power of never letting exceptions passing unnoticed". This implies that he was aware of the subtler laws in operation which run counter to the known and accepted laws. "Exceptions" are disclosive or indicative of the *Secrets of Nature.* Hadamard, the famous mathematician, attached much importance to the identification and elimination of errors in the quest of scientific truth. He seems to endorse the eliminative method, *via negativa,* or *neti mārga,* in the context of discovery.

But when he approvingly refers to another famous mathematician's, Gauss's, observation, "I (Gauss) succeeded ... like the sudden flash of lightning the riddle happened to be solved", it is clear that he was a believer in the role of intuition in scientific discovery. An insight into, or intuition of, what is true provides one the light to identify what is erroneous and therefore to be eliminated.

Similar experiences are autobiographically referred to, as indicated earlier, both by Max Planck and Einstein. Planck, while accepting his Nobel Prize, observed. "Looking back ... over the long and labyrinthine path which finally led (me) to the discovery (of the Quantum Theory) and vividly reminded of Goethe's saying that men will always be making mistakes as long as they are striving after something". The trained sceintist's problem of conscious striving after or search for truth is always guided by an intuition of the map indicating the path to truth.

In similar vein, Einstein referring to his discovery of the General Theory of Relativity writes, "there were errors in thinking which caused me two years of hard work before at least in 1915, I recognized them as such ..." This recognition was based on an intuition. His anti-inductive pronouncements are also strongly supportive of his commitment to intuition in the context of scientific discovery. He writes, "there is no inductive method which could lead to the fundamental concepts of physics". Not through the path of sense-experience, but through love of, or empathy (*Einfülung)* of the objects of experience, that a scientist gets to his solicited truth. In other words, *Einfülung* of the objects of experience has a deep *subjective* underpinning which takes experience beyond the realm of *objects,* to the light-like truth.

Poincaré is very emphatic in his support for intuition in the matter of scientific discovery. He said, "Logic has very little to do with discovery or invention". He refers to several autobiographical events of how with utter suddenness a solution came to his mind when he failed to hit it by intensive thought. He writes, "One day, as I was walking on the cliff the idea came to me, again with the same characteristics of conciseness, suddenness and immediate certainty, that arithmetical transformations of indefinite ternary quadratic forms are identical with those of non-Euclidian geometry".

Sri Aurobindo has his own way of vindicating the essential role of intuition in all types of knowledge, mythical, metaphysical and scientific. He goes further and tries to show that intuition also sustains in other forms of knowledge like philosophy (*darsana)* and religion (*dharma)*. His basic point is both simple and all comprehensive. Spirit is both knower and known. Intuition is the spiritual form of knowing, knowing by identity. Since spiritual identity, according to Sri Aurobindo, recognizes multiplicity in it as an integral totality, the knowing consciousness and forms of consciousness of the known are identical at the bottom.

Spirit articulates itself in different forms (*rupa)* and under different names (*nāma)* but its own nature (*svarupa)* is ineffable or unspeakable. Mythical knowledge, as said before, is both symbolic and mystical. When it is criticized on the ground that it is unprovable, it is conveniently forgotten that proof or provability itself is dependent upon a consistent set of actions which itself is arbitarily chosen. The primitives of a system are not provable within the system. Second, the spiritualist argues that spiritual experience is testable in a *suigeneris* fashion. Spiritual truth can neither be discovered nor validated by non-spiritual, i.e., empirical or logical methods. Spiritual peace and poetic genius are states of consciousness which do not lend themselves to external tests. However, the same are almost universally recognized as real (Sri Aurobindo, *Letters on Yoga,* Birth Centenary Library, Pondicherry, 1970, pp. 185–195).

Though the highest forms of truth are available only by intuition, this position must not be understood to mean that philosophy, religion and science give us no valuable forms of knowledge. In fact, all these disciplines embody different but convergent approaches to the ultimate reality, *Sat,* existence. While the task of philosophy is to present logically the eternal modes of Existence, that of religion is to organize practically the personal relations of what Exists with human beings, their thinking, feeling and willing. Science is said to be engaged in arranging the particular forms and movements of Existence, on the basis of observation, experience and experimentation (Sri Aurobindo, *The Hour of God,* Birth Centenary Library, Pondicherry, 1972, pp. 166–171).

Further, it may be pointed out that all these disciplines, philosophy or metaphysics, religion or dharma and science, on analysis, are found to have two different levels in them, intellectual and intuitive or spiritual. In its intellectual level, philosophy is abstract and ratiocinative; in its spiritual level it is insightful, vibrant and extremely persuasive. Comparable religion may be theoretical and argumentative, it may also be saturated with spiritual realization and engaged in trying to express the inexpressible, the spiritual, in terms of myths, symbols, metaphors and allegories. Science also exhibits two levels. In the context of discovery it may be intuitive but in the context of validation it is subject to some sort of test. But in the highest forms of spiritual experience, which also clarifies itself to be called science, it is itself self-validated. First principles of any domain of knowledge, which must be recognized, are self-evident and self-validated. Denial of this position lands every form of science, physical or spiritual to the fallacy of Infinite regress (*anavasthādoṣa).* Careful and critical scrutiny of all axiomatic systems brings out this inescapable truth.

Physics, body-mind and the beyond

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Abstract

The paper aims to show that Physics, Body-Mind and the Beyond form a continuum and are to be understood in terms of upward causation and downward causation. Matter, life, mind and the abstract durable entities constructed by the mind are causally interrelated. For the understanding of the said two-way causation, Uttaraṇa and Avataraṇa, the first advisable route to be taken is linguistic. Comparative philology and the associate development of ideas in different cultures are of profound help to my study. How the emergence of Life and Mind has been shaped by geophysical forces of Nature needs to be closely looked into. Fragments of Indian Naturalism. Reference to Hellenic Naturalism. Transition from Naturalism to Spiritualism via Vitalism. A footnote on Spiritualism. Fragments of European Naturalism and its physical, social, psychological and biological fallouts in the concerned disciplines. Naturalism to Mechanism.

Naturalism to Newtonian and post-Newtonian Mechanism. Anti-mechanist voices and arguments. Anomalous Mechanism of Kant and Kantians. Evolution, new Physics, Biology and Psychology. Contributions of Darwin, Marx, Freud and Einstein critically recalled. From anomalous Naturalism and Mechanism to Quantum Complementarity. Reference to J. C. Bose, Bohr and Schrödinger. New biology of Sherrington, Adrian and Eccles. Ascent (Uttaraṇa) and Descent (Avataraṇa) in and through Matter, Life and Mind. Abstract mental products, their nature and implications. The question of Beyond and self-transcendence. Primacy of Consciousness, Body and Mind are of the Self and not the other way round. The secular implications of the Beyond.

1. Prefator

The main three terms of existence (*sat*), Matter, Life and Mind, are practically recognised by all, from the layman to the scientist and the philosopher of science. However, regarding the intrinsic natures of the being designated by the terms, their ontological primacy claim and mutual relationships, the informed scientist and the reflective philosopher are not unanimous. While materialists like Cārvāka, Democritus and Marx accord primacy to material existence, vitalists like Bergson and Morgan maintain that life or the vital flow is the ultimate reality. In contrast, many classical and modern philosophers-cum-scientists like the Vedic seers, Śamkara, Hegel and Sri Aurobindo are emphatic in proclaiming the supremacy of consciousness.

The problem with which I am mainly concerned here is why the representatives of each group of thinkers on existence, under pressing practical reasons, are obliged to offer their accounts about the other two grades of existence. Are these three grades exhaustive and exclusive? Is there no other grade or grades beyond the mentioned three? Do the said grades form a series? Or do they fall apart? Do all grades have only finite or infinite number of sub-grades within them? These are some of the basic questions which have been tackled time and again in different ways by scientists and philosophers, both ancient and modern.

I will try to argue that after all types of the most insightful and critical scrutiny, i.e., linguistic, theoretical and experimental, our findings strongly suggest *the primacy of consciousness* and *the continuity between different grades and sub-grades.* Notwithstanding the quantum and the discrete features of some physical, biological and psychological phenomena it can be persuasively established that there is mutual, complementary and /or hidden continuous relations between the grades. What is more, I would affirm, on the basis of both scientific discovery and philosophical arguments, that there is a promise of the *beyond,* i.e., some existential development is yet to be unfolded.

2. Linguistic routes to reality

Let me first briefly indicate the semantic and ontological implications of the first term of existence (*sat*), which is matter. Some Sanskrit meanings of the term Matter are (*vastu, anātmadravya, bhūtātmkavastu, ghanavastu, śarīra* and *mūrti*) (Monier-Williams 1999). The discerning philologist with a scientific sense to his credit is bound to be intrigued by expressions like *ghanavastū* or dense Matter, *śarīra* which because of it very nature gets dissolved or destroyed, and *mūrti,* which is expressive of something beyond itself. If the Matter, in spite of its physical density, can be validly said to be expressive of something else like life, light or lighter, it can be safely asserted by *ānvīkṣkī,* i.e., the logician and the metaphysician, that material existence is not self-contained or self-explained, and it needs a higher principle for its explanation.

Let me try to explain the point a bit. In Sanskrit, we have two very well-known expressions *anna* (one of the meanings of which is *earth* or earthly matter) and *annamaya kośa,* which means encoded Matter. Rightly understood, Matter, like a cell, is a code enfolding many dynamic properties. It is enclosed with various potentialities, positive and negative, which, to start with, are not visible to, and perceptible by, the ordinary senses, *laukik pratyakṣa Koṣa* is a storage or sheath which holds something within it. In the Ṛgveda, a cloud has been described as a *koṣa* of *water.*

Matter has also been said to be *jaḍavastu. Jaḍavastu* is poorly energized, cold, slow, bewildered or enveloped, and, not surprisingly, a person of *jaḍabuddhi* is incapable of acquiring the wisdom of Veda. Yet *jaḍavastu* is claimed to be foundational and *promissory.*

The second term of existence, LIFE or *prāṇa,* is also philosophically very significant. It may be recalled that it is both *bhūtātmā,* the *Spirit* of Matter and, at the same time, interestingly enough, *kāvyātmā,* the *Spirit* of Poetry. It is *the* enlivening force. As *vāyū* or wind, it is (i) *prāṇa* at heart, (ii) *apāna* in the rectal-urinal tract (*mūlādhār*), (iii) *saman* at the navel centre, (iv) *ūdān* in the throat area, and (v) *vyān* all-pervasive in the body.

In the different Indo-European family of languages, *life* and its cognate expressions like living, alive, *zōos* (Greek), *vevere* (Latin), *Gyvas* (Lithunian), *zil'* and *zivaj* (Russian), *jīv-* and *jīva-* (Aestan) exhibit some interesting semantic characteristics. In some languages the verb "live" is expressed by "is living", "alive" (Buck 1949, 1988). There are few languages in which it cannot be so expressed. But the preferred expressions of the concept in different languages indicate noticeable difference. Besides words like "*life*" and "*live*" one comes across also the words like "*remain*" and "*be*". Needless to add, that within the Sanskrit words "*jīva*", "*jīvana-*", "*jīvant-*" and "*jīvita*", the difference of sense is considerable. The semantic, phonological and particularly, conceptual affinity between the Sanskrit words "*jīv*" "*jīva-*", "*jīvana-*", "*jīvant*", and "*jīvita*", and their Indo-European counterparts is striking and instructive. *Jīva* is embodied *consciousness* of different degrees of expression and organization. The root of all these words is *Ji* or *Jī* which stands for "life", "living" and has in it a nourishmental implication.

The very names of the disciplines dealing with life-related phenomena, viz, *Jīvavidyā* (zoology <Greek *zōos/zōom),* *Prāṇīvidyā* = (biology <Greek *bios,* course of life) and *Udvid-vidyā* = (Botany <Greek *botanikos*) include that these are all concerned with consciousness marked by different degrees of clarity and obscurity. It is interesting to note that the words like *plant* are used by the botanist to cover the whole vegetable vs. the animal kingdom. Several of the Indo-European words for plant carry the connotation of growth and, at times, even of decay. For example, the Sanskrit word *Oṣadhi* has not only medicinal but also degenerative implications. The vegetable world, in Vedic literature, is divided between *Oṣadhi* or *Vīrudh* plants and *Vana* or *vṛkṣka* (trees) (Macdonnel and Keith 1982). *Oṣadhi* has healing power (*rogajātaṁ nāśayati,* Nirukta) while *Vīrudh* is used as *generic* terms comprising both minor vegetable growths and also those plants without medicinal properties.

More evolved and complex than the life-related phenomena are the mind-related ones. Where exactly life ends and mind begins cannot be precisely indicated. It has been found that due to evolutionary development some pre-human anthropoids in their behaviour exhibit, at least in some cases, mind-like dispositions as well as actions, including the ability to symbolise and even to measure and calculate. The English concept of mind has found different expressions in the Sanskrit language, viz., *manas, buddhi, bodhaḥ, dhī, citta, cetanā, medhā, prajñā, bodhaśaktiḥ* and *cicchakatiḥ* (Monier-Williams 1986). Acts and exercises of the application of mind are captured in the words like *manoyogaḥ, manonibeśaḥ, and manovyāpāraḥ.*

One way of understanding the meanings of the Indo-European words for "Mind", "Soul", and "Spirit" is this. The words under "Soul" and "Spirit", e.g., *animā* (Latin), *gāst* (Old English), *geist* (Old and New High German), *urvān-* (Avestan), and *ātman* (Sanskrit), are intended to denote the seat of emotion, whereas "Mind" denotes the seat of intelligence. But this rule does not appear to be hard and fast. The semantic source of the most of the words for "Soul" and "Spirit" is "breath". But in some cases the source turns out to be mental or even physical agitation. Words like *manas* (Sanskrit), *nous* (Greek) and *manaḥ* (Avestan) are used to denote mental states in the widest sense, including feelings and thoughts, understanding and knowing. The Sanskrit word *citta,* properly speaking, stands for thought and observation, and *cit* for perception, understanding and reflection.

Let me add a few words on the nature of consciousness. It is self-revealing and also reveals all other things and beings. It also stands for knowledge, feeling and even the absolute. This consciousness as such is indivisible and all-pervasive. But because of the difference in adjuncts or conditions (*upādhi*) it *appears* individuated and differentiated. When consciousness is enveloped by nescience (*avidyā*) it appears as God. When it is determined by *antaḥkaraṇa* and related *saṁskāra* it appears as self. When consciousness is reflective of both the highest reality and subject to internal self-consciousness it is deemed to be the witnessing (*not* active) self. Consciousness is said to be four-fold, (i) objective (i.e., object-related), (ii) knowing subject-related, (iii) unknown (but knowable), and (iv) known consciousness. Śaṁskara is said to be of the view [in

Ātmabodḥ] that self-knowledge is the direct means to liberation. If this type of knowledge dawns on one, one ceases to act. The pure self is beyond the ken of time, really ageless but the stages of life are super impositions (*āropita*). In other words, the normal categories used for identification of objects and subjects like space, time, colour etc. are inapplicable to the pure self.

Bodies are said to be of three types – gross, subtle and causal. The gross body is a combination of five elements; the subtle body consists of five *prāṇas,* ten sense organs, *manas* and *buddhi,* and the causal body is *avidyā* or *nescience.* Though the self as such is eternal and omnipresent, it is clearly reflected only in the *buddhi.* By non-discrimination of the mixing parts of existence and consciousness with the variations of *citta* the idea of avidyā arises. When *avidyā* is destroyed by knowledge this self manifests itself as the sun in its full splendour without the cover of cloud or nocturnal darkness. *Brahman* is expressed in the universe only in a limited and temporary way. Strictly speaking, it never expresses itself in the universe. So the question of its transcendence beyond, or withdrawal from, the universe does not arise at all. This is merely a hypothetical issue, a pedagogically useful mode of clarification of a very profoundly meaningful but elusive concept for unrealised mortals.

3. Fragments of Indian naturalism

The full depth of the concept of consciousness can hardly be understood in the scientific context without referring to such basic concepts as brain and self. But, I think, it would be advisable for me, given the temper of our time, to approach the issue first from the physical standpoint and then from the biological one. Many physicists, classical and modern, have tried to establish the identity of body and mind.

To start with, let us have a quick look at the ancient Indian and Hellenic materialists or naturalists. In the Indian tradition it is Prajāpati Parameṣṭhin to whose naturalistic views and sceptical attitudes we may turn for a plausible beginning point of Indian science. He maintains that Water (*salila*) is the fundamental principle of all things. Water is the original substance of all that exists. He seems to have drawn his inspiration from the *Ṛgvedic* hymn (Wilson 1977). X.129.1 which Śaṁkara calls *Nāsadīya-sūkta.* The sūkta which is interpreted in a naturalist way by Parameṣṭhin is differently constructed by Śaṁkara. The latter seeks to establish that *Prāṇa* or Spirit is uncreated. Parameṣṭhin has been said to be the Thales of India, although, historically speaking, the former seems to have preceded Thales of Miletus (c. 600 BC). The naturalist tradition of Indian thinking was not peculiar to only Parameṣṭhin. It is also due to Bṛahmanaspati or Bṛhaspati who maintains that the clue to the origin of the world is to be found in the *Ṛgvedic* hymn X.72 (Wilson 1977). He is interested in ascertaining the nature of the world-ground, how the generation of heavenly beings and all ultimate forces were made possible. According to him, Being came out of non-Being. His doctrine of the relation between the Finite (*Diti*) and the Infinite (*Aditi*) resembles that of Anaximander (c. 600 BC), also of Miletus and a follower of Thales, who thinks that the sky is a complete sphere and not merely a semispherical arch over the earth. For the first time the notion of spheres was introduced in astronomy which ultimately culminated in the sophisticated but erroneous Ptolemic picture of the universe. Accordig to him, the ultimate reality is a formless mass and unobservable substance, *apeirom,* which means Infinite. Because of the similarity between Bṛhaspati's view of *Aditi* and Anaximander's notion of *apeirom,* Bṛhaspati has at times been described as the Anaximander of India (Barua 1998).

Another firm ancient naturalism is found in "Anila" of India and Anaximenes of Miletus (c. 500 BC). Both "Anila" and Anaximenes are of the view that *Vāyu* or *aer* is the ultimate reality of the world. The doctrine of "Anila" is traced to another *Vedic* hymn, namely, the hymn of XI.6 *Atharvaveda.*

These examples, drawn from the Indic and the Hellenic civilizations, show that the aim of the ancient philosopher-cum-scientists was largely directed to discover a *single* First Principle to explain *all* wordly phenomena. To resort to one single natural principle for explaining all natural and other phenomena is obviously pro-naturalist. Interestingly enough, this naturalism, though it appears to be materialistic in character, lends itself to spiritualist interpretation as well. What is more, the reflective philosophers and the mystic thinkers of the ancient times are of the definite opinion that apparent materialism or naturalism is an intended and symbolic cover of an underlying spiritual reality.

In fact the history of Indian materialims/naturalism has been reconstructed mainly from the fragments and writings of the anti-materialist and anti-naturalist writers. The two well-known traditions of Indian naturalism, viz., *Svabhāvavāda,* which claims that every power necessarily belongs to the material objects, and *Yadṛcchāvāda,* which maintains that the world process is a dance of chances, are often critically referred to by their mainstream Vedic opponents. For example, Śaṁkara refers to *Svabhāvavāda* in his commentary on the *Śvetaśvara Upaniṣad,* I.1.2. He tries to show that those who think that time, self, nature of material objects, and fortuitous combination of material objects are the causes of the world are basically mistaken. The rejection of *accidental* naturalism is a prelude to the establishment of causation, in this case *Śatkāryavāda.* But to Śaṁkara, as we know, Brahman is the ultimate cause of all that we see and can possibly know, including our own selves. In this connection one may recall the Vedantic criticism of Jaina naturalism defended by the thinkers like Guṇaratna. It is interesting to recall that *Yadṛcchāvāda* (accidentalism) and *Svabhāvavāda* (naturalism) are opposed to each other. While the naturalist accepts a kind of causalism, the accidentalist denies it. But both may be viewed as allies in their common opposition to *Adṛṣtavāda* (supernaturalism) and in their inclination, if not commitment, to positivistic naturalism which seeks to restrict scientific enquiry only to what is amenable to common human experience (*lokāyata*). Rejecting this sort of naturalism a *Vedantin* like Śaṁkara ascribes causality to God who, in addition to his own power, uses the help of time and self to regulate the course of the world [Sv. Up. 1.4].

For the most classical and comprehensive account of naturalism one is advised to turn to the *Sāṁkhya* thinkers. It is widely believed that the elements of *Sāṁkhya* philosophy may be traced to *Chāndogya Up., Kaṭha Up., Mahābhārata, Manusmṛti, Buddhacarita, Carakasṁhitā, Śuśrutasaṁhitā* and different *Purāṇas.* The development of the *Śāṁ*khya naturalism, perhaps one of the oldest traditions of India, is attributed to Kapila, Īśvarakṛṣna, Patañjali (of *Yogasūtra*), Vācaspati Miśra (*Sāṃkhyatattvakaumudī*) and Vijñānabhikṣu (*Sāṃkhyaprava-canabhāṣya*). About the original development of the Śāṃkhya naturalism, the scholars are not unanimous. Some writers attribute it to Kapila. Some writers like S N Dasgupta think that it has to be understood best in terms of the work of Vijñānabhikṣu of Vedantic persuasion. While B N Seal tries to give it a scientific interpretation in terms of number or enumeration (*Sāṁkhyā*), K C Bhattacharyya reads in it the principle of spiritual and spontaneous freedom. To Sri Aurobindo the concept of *Prakṛti* developed by *Sāṁkhyā* seems to be extremely important and he views it as the Executrix-Force of Consciousness itself.

The *Sāṁkhyā* system is dualistic in its appearence, consisting of two main principles – pure consciousness *(Puruṣa)* and primordial materiality (*Mūla prakṛti*). Besides, it speaks of twentythree other reals (*tattvas*), viz., intellect (*buddhi* or *mahat*), egoity (*ahaṁkāra*) and mind (*manas*), which is claimed to be both a sense capacity and action ability. Further, five specific sense capacities (visual, tactual etc.), five action capacities (speaking, prehending, moving etc.), five subtle elements (sound, contact, form, taste, etc.,) and five gross elements (space or *akāśa,* wind, fire, water and earth). Nature or *Prakṛti,* consisting of as well as constituted by three *guṇas* or qualities (luminosity or expressiveness, energy or power, and inertia or dullness), is ceaselessly active. *Puruṣa* (consciousness) is without any activity in it. This Consciousness is contentless, devoid of any sensation and action, initiative and enterprise.

If Nature is ever active and Consciousness is absolutely actionless and pure, naturally the question arises: how do these two principles "come together" for bringing about what is acknowledgedly shared wordly reality? *Sāṁkhyā* spells out an evolutionary naturalism and purports to show that all reals (*tattvas*) evolve out of Nature. Nature is partly unmanifest and partly manifest. The subsequent evolutes are claimed to be latently or promissorily preexistent in their causes. In technical language this is said to be *Śatkāryavādā.* All ontological entities, epistemological, psychological and physiological phenomena somehow or other are traceable to Nature and its qualities, their various progressive, stationary and regressive combinations. Even ethical or axiological activities and discerning faculties are rooted in Prakṛti or Nature. Yet, this *Sāṁkhyā,* because of its evolutionary character, refuses to be described as *reductionist.*

In their encounter with the defenders of the *Advaita Vedanta,* the proponents of the classical *Sāṁkhyā* had been understandably called upon to explain the precise relation between *Prakṛti* and *Puruṣa* in the context of explaining the world of sense and science. The explanatory analogy of the mutual cooperation between the crippled (*paṅgu*) Self or *Puruṣa* and the blind (*andha*) *Prakṛti* was dismissed by the *Vedantins.* They both attacked the *Sāṁkhyā* dualism and tried to assimilate its elements under the *Vedantic* monism with God at the apex as the necessary bridging, if not unifying, principle. In the process, Saṁkara-like *Vedantins* made liberal use of the *Sāṁkhyā's* commitment to verbal testimony (*śruti*) as a legitimate and reliable means of knowledge. The gradual emergence of God as the bridging principle, mainly due to the Yoga system of *Patañjali* and others, substantially explains the decline of the classical *Sāṁkhyā* dualism. This philosophico-scientific situation has a striking resemblance to the Cartesian efforts to counter or minimize the effects of anti-dualistic attacks on it mounted by the Christian theologian of Europe in the 16th Century.

Why I mention here this well-known point is scientifically central to our body-mind discourse. Though himself a Jesuit Christian, Descartes, under the mixed influences of dualist Plato, teleologically inclined Aristotle, mechanically disposed Kepler and Galileo, was almost logically led to the mind-body dualism and a mechanistic world-view. Yet, for theological (may be also to some extent personal) reasons, he wanted to give an honourable place to God in his system without disowning, however, his commitment to either mechanism or dualism. Descartes has offered three arguments in support of the existence of God – causal, cosmological and ontological. As a professional physicist and mathematician he was required to explain the existence of external, i.e., mind-independent substantial character of the world of physical bodies. Somewhat stuck up in his Ego or the knowing self, he was obliged to explain how could he plausibly and cognitively reach out to the objects of the physical world. To answer the question Descartes invokes the argument of *Veracitas Dei,* the veracity of God, which, he claims, has been implanted in us by God himself. *Distinct* and *clear* ideas of valid cognition of our own knowing self and, through it, of the world out there in space are said to be due to non-deceiving God (Cottingham 1992).

This sort of tortuous argument has been avoided in India by *Vedantins* like Sri Aurobindo in their bid to purge the *Sāṁkhyā* off its alleged mechanistic dualism by referring to and painstakingly elaborating three very important paired concepts, viz., *Brahman* and *Māyā, Puruṣa* and *Prakṛti,* and *Īśvara* and *Śakti*. All these they do on the proclaimed authority of the *Vedic* literature.[1]

IV. European naturalism and its fallout on philosophical, social, psychological and biological disciplines

It is true that in their philosophical basics Indian Naturalism and European Naturalism do have some similarities between them. But I will now try to show that the development of Naturalism in Europe has taken a strident mechanical turn, particularly in the last four centuries or so. Perhaps to take Newton as the high water mark of this approach will be methodologically warranted.

Newton, born in 1642, eight years before the death of Descartes (1650), was not apparently happy with Cartesian dualism and mechanism (Koyré 1968). But his deistic God, leaving all natural things, their actions, reactions and the resulting processes to the comprehensive care of the famous three Laws of Motions, had nothing non-mechanical to do with worlds of life and mind. His theological writings, relatively minor and practical exigency-related in character, were clearly critical of many aspects of Christianity. His natural philosophy was to see God through Nature, echoing Descartes's cosmological argument and anticipating Kant's teleological argument for the existence of God. Apparently this does not have any critical or constructive bearing on his mechanistic world-view. Somewhat unlike the Cartesian body-mind *interactionism*, the scope of his own version of interactionism is universal in terms of *gravity*. The power of Newton's mechanical physics proved far-reaching and overwhelming on the subsequent physiological, psychological and social thinkers.

Writing well before him, William Harvey (1578-1657), educated in Italy and open to the prevailing mechanical influence of Galileo (1564-1642) (Koyré 1978) and Francis Bacon (1561-1626) (Urbach 1987), had tried to show experimentally that the circulatory system of blood in the human body obeys the Law of Mechanics. Understandably, the apparent success of the mechanical approach in the area of physiology gladdened Descartes and received his whole-hearted support.

The whole British school of philosophical empiricism, notably represented by Locke (1632-1704) (Chappell 1994), Berkeley (1685-1753) (Brook 1973) and Hume (1711-1776) (Struod 1977) was under the overwhelming influence of Newtonian mechanics and the celebrated Laws of Motion. Locke is on record to have even said that the philosopher is nothing but an under-labourer of the scientist and engaged only to clear the path of scientific progress. Berkeley's theory of optics, of example, is Newtonian in its inspiration. Hume's skepticism is purely methodological, indicating the incurable questionability all scientific laws arrived at through *inductive* generalization. His three psychological Laws of Association – of similarity, of continuity, and of contrast, are on analysis found to be not-so-veiled adaptations of Newton's Laws of Mechanical Gravitation. It is easy to demonstrate by numerous examples the clear invasion of Cartesian dualism and of Newtonian mechanism into the fields of not only social sciences but also humanities.

Only a few like Leibniz (1646-1716) (Frankfurt 1972) and Vico (1668-1744) (Berlin 1976), had the genius and courage to swim against the strong Newtonian current of the time. By affirming that all monads or atoms, including God himself as the Monad of the monads, are essentially *spiritual* and mutually isomorphic, and that all the grades of monads – physical, biological, psychological – and the Divine form a continuum. In contrast to Newton's materialist model of science, Vico defends in his *New Science* (1725) the primacy of the cultural continuum marked by four different stages, poetic, theological, heroic and human. Notwithstanding his relative obscurity, this Neapolitan scholar from Italy succeeded in influencing widely different thinkers like Herde, Hegel, Marx, Comte, Coleridge and Croce (also from Naples). But the humanistic trend represented by the Leibnizian and Vician was more in the nature of departure from the mainstream European thought of the 18th Century than in the nature of a distinct and sustained identity of its own.

The then very new movement of the French Encyclopaedists (1751-1765) like D'Alembert, Diderot, and d'Holbach was essentially under the Newtonian influence and only partially under the influence of scientific thinkers like Bacon, Locke, Boyle and Montesquieu. For the most logical and consistent culmination of the Cartesian-Newtonian legacy, one must look into the works of La Mettrie (1709-1751), particulary his *Man, Machine and Other Writings,* 1747 (Thompson 1996). Medically trained, La Mettrie conceived man as a machine, obviously taking his cue from the Cartesian thesis that all sub-human animals are complicated clock-like machines. His view was so radical that even French Encyclopaedists like Diderot and D'Holbach, in spite of their deep indebtedness to La Mattrie's ideas, distance themselves from him to avoid the wrath of the powerful ecclesiastical authorities.

The typical Newtonian ambivalence between mechanical science and spiritual consciousness is perhaps best illustrated by the writings of Immanuel Kant (1724-1804). Like his famous French contemporary Laplace (1749-1827) but independently of him, Kant offered his most famous astronomical explanation of the origin of the Earth (1755) generally known as the Kant-Laplace hypothesis in History of Science. At one stage he went to the extent of asserting in a youthful and heroic vein, "Give me Matter, I shall fashion the whole world out of it." Like Laplace, he was also a staunch Newtonian and determinist. But, deeply moral in his personality, through this "Sage of Könisberg" (that is how he was known) is found to reject the man-machine analogy of La Mettrie. He had the true scientific modesty in him to recognize even the availability of parapsychological experiences. He points out that a machine has no *value* except when antique or rare. Human lives are intrinsically valuable. The man-machine analogy, for Kant, is not only scientifically untenable but, what is more, objectionable and also undermines humanistic ethics. He goes to the extent of even *defining* man as a "responsible being", differing from Aristotle's age-old definition as "rational animal". It seems he was not clear how to reconcile plausibly scientific epistemology (concerned as it is with the *phenomenal world* defined by the concepts and categories like space, time, causality, quality and quantity, etc.), on the one hand, with the *noumenal* or transcendental world, the sphere of God, Immortal Soul and Freedom, on the other. To Kant these transcendental "entities", "things-in-themselves", are "absolute presuppositions" of knowledge, which as such though not cognitively available, are truly indispensable for *theoretical* knowledge of the world of sense and science. Simultaneously, he points out that the *practical* availability of ethico-religious and aesthetic consciousness, Good Will and the sense of sublimity, strongly suggest that everthing in the world, from the movement of the celestial bodies in the heavens to human moral impulses, is subject to the *same* laws. However, even a sympathetic critic of Kant thinks that he also seems to have failed to overcome the die-hard dualism between Naturalism and Spiritualism, between the Pure Reason of Science and the Practical Reason of Ethics and Religion, between the realm of body and that of soul. He found no acceptable *unity* between the two and had to remain content with only their *affinity* (Brittan 1978).

In spite of the Absolute Spiritualism of Hegel, encompassing all things and beings of the world, the Newtonian hangover, mediated and somewhat diluted by Kant, apparently survived as it is evident from the works of thinkers like Condorcet (1743-1794) and Comte (1798-1857). While Condorcet, a mathematician by training, developed, following his *probabilistic* method, a monumental and secularized history of the dynamics of man's progress from the primitive state of Nature to modernity, Comte aimed to fashion all cognitive disciplines – physiology, social studies and even metaphysics and theology, in terms of *positive* sciences. To him psychology appeared to be a part of "phrenology" (science of brain), social studies as "social physics" (only later on he coined the term "sociology"), and religion as the worship of (an abstract entity called) Humanity. It is noteworthy that he is one of the earliest to anticipate the close relation between brain and mind (what is studied to-day in Cognitive Science).

It is difficult for a layman of today to believe that chemistry as an independent discipline was not there even 300 years ago. Biophysics, biochemistry, neurology and other frontier disciplines are of relatively recent origin. Not that the issue and problems studied in these disciplines were unknown *in principle* in earlier times. What I like to highlight is that the proliferation of frontier disciplines only shows that the frontiers of human knowledge are gradually and continuously receding like the seemingly distant horizon to a traveller. The horizonal expansion of knowledge is due (a) *mainly* to new findings and new researchers and (b) *partly* to daring hypotheses of the informed scientific thinkers. The issues and problems which philosophers discussed under the very broad heading of Matter, Life and Mind are now to be found under too many scientific specialisations to be exactly and fixedly enumerated. The process of specialisation encountered in life science is illustrated also by the history of scientific progress. And that persistent fact poses an instructive problem for the committed scholars of truly interdisciplinary studies. They have to try to prevent the *pulverization of the unity of science,* and also try to consciously refrain themselves from the temptation of flying to the dizzy heights of speculative philosophy. They are methodologically well-advised to steer clear of the deep sea of metaphysical generalization and the devil of over specialization. What is required of the interdisciplinary researchers is to avoid the twin dangers of (what I call) *theory-intoxication* and *fact-fetishism*.

In the light of the above observations, what I propose to do, within the limits of this paper, is to indicate in brief the relation between consciousness in general, and the human body, particularly, the brain. In the process, understandably, I shall be drawing upon the sign-post theories of physics and biology which are central to our themes of discussion.

V. Evolution, new physics, biology and psychology

It has been rightly observed that four of the chief architects of the modern scientific age are Charles Darwin (1809-82) (Kohn 1985); Karl Marx (1818-83) (Chattopadhyaya 1988), Sigmund Freud (1856-1939) (Clark and Wright 1988); and Albert Einstein (1879-1955) (Fine 1986). This is not in the least to forget the importance of the other great ancient, medieval and modern thinkers already referred to earlier. In fact it must be realized that the greatness of the moderns rests substantially on the time-tested heritage and wisdom of the ancients. The Naturalist Darwin, who started his scientific career as a geologist, ended up as an epoch-making biologist of the 19th century by upholding a new theory of evolution and defending the origin of the human species in terms of Natural Selection. Marx, who initially studied philosophy, history and law, shaped himself later on as the author of the new Labour Theory of Value and one of the leading economists of the last Century. Freud, who, to start with, studied medicine, got interested in neurology, and finally turned out to be one of the most influential psychologists and psychoanalysts of the 20th Century. Einstein, who, except for a brief spell as a junior official of the Patent Office at Berne, was a scientist from the beginning to the end of his professional life, never ceased to have deep interest in the areas of education, Zionism, culture and peace. Two things which are common to all these four greats are, first, their theoretical commitment to Naturalism and, second, their rejection of the classical mechanical Materialism. Both points are relevent to interdisciplinary scholars mainly for two reasons, namely, (a) one can be outstanding in a specialized area remaining, at the same time, reasonably conversant with developments in other neighbouring disciplines, and (b) creative scholars take always critical note of the findings of great predecessors and subsequent unsolved problems remaining.

At the very start of my presentation, I have spoken of three levels of reality, namely, Matter, Life and Mind, and also indicated another level by using the word Beyond. One very important trait common to the four great scientific architects of the modern era is thier various ways of rejection of reductionism. That is, they refuse to reduce all the said levels of realities to one single level of reality called mind or matter. Even Marx, the inveterate materialist, distances his own *dialectical* materialism, mainly due to Hegel, scrupulously distances himself from (what he calls) mechanical materialism of the French Encyclopaedists Darwin's Evolutionism, Freud's Psychology of the "Unconsciousness", and Einstein's Relativistic Physics, all acknowledgely committed to Naturalism; however, all of them refuse to be described as materialists in the received sense. I read this significant development (i) as the beginning of the decline of the Cartesian dualism and the Newtonian mechanism, and (ii) as the beginning of the rise of creative or emergent evolutionism with a promise of "the beyond" within it.

In this connection, I would refer specifically to some important contributions by a select group of physicists, biologists (including neuro-biologists) and, particularly, philosophers. Many of the philosophically inclined physicists, biologists and physiologists of the 19th Century, intrigued by the problems posed by the *interactive* relations between the main two levels of reality, namely, the physical and the biological, started researching and writing on life science. That physical objects are causally influenced by their environmental conditions was well-recognized for a long time but the interest in their quantitative properties was yet to make satisfactory progress. Gradually some discerning scientists working on the frontier between the physical world and the life world realized that even plant life, not to speak of animal life and human life, was distinctly responsive to natural and environmental stimuli. It is true that in the ancient literature of India and some other countries one comes across clear reference to this relatively unexplored area. To record and report the observable impact of the natural on plant life is one thing and to study it scientifically under experimental conditions is another thing. Admittedly, the former has a clear explorative bearing upon the latter.

It is instructive to recall that J. C. Bose (1858-1937), a well-known Indian physicist, who, taking cues from Maxwell and Hertz, carried out promising experiments concerning the transmission of electrical energy and also with the possibilities of radio communication, and steadily developed research interest in plant life (Scribners 1981). Though Bose is said to have demonstrated radio transmission in Calcutta as early as in 1895, the credit of inventing successful Radio communication went to Marconi of Italy and he was awarded the Noble Prize on this account. Bose started measuring the response of plants to such stimuli as light, sound, touch and electricity. He was persuaded that there were no clear-cut boundaries between the nervous systems of plants and those of animals. For the purpose of his investigation he invented an instrument, the Crescograph, which was capable of magnifying the movements of growth in plants about 10 million times. Though later on many other distinguished life scientists like C S Sherrington (1857-1952)[2], Adrian (1889-1977) (Adrian), L J Henderson (1890-1967) (Henderson 1958), Dobzhansky (1900-75) (Dobzhansky 1976), Rene Dubos (1910-82) (Dubos 1975) and Ernst Mayr (Mayr 1982) made significant contributions to the nature of the complex relationship between environment, heredity and organisms, in this relatively unfrequented field of enquiry Bose's work deserves pride of place. Bose was at times unduly criticized for his alleged introduction of a heavy dose of Indian philosophy into his scientific work.

Besides Bose, another physicist who also made notable contributions to the understanding of the relation between the physical world and the life world is the famous Neils Bohr (1885-1962). Because of his understandable fame for initiating and pioneering many works in the area of Quantum Mechanics, the significance of Bohr's work in the area of life science and social science has gone relatively unnoticed. In the last years of his life he expressed deepest satisfaction with the spectacular advance of molecular biology. In the last paper he wrote, "Light and Life Revisited". Applying his well-known *principle of complementarity,* he tried to show that there is no incompatibility between the functional concepts of biology and its physical description (Bohr 1985). On the contrary, he anticipated unlimited prospects of articulating biological processes in physical terms without prejudice to an equally rich account of their functional aspects. It may be recalled here that Bohr's interest in the philosophical issues, particularly, the epistemological ones, regarding the relation between life and the world, was partly due to the influence of his father on him. His father was a Professor of Psychology at the Copenhagen University and a close friend of the famous Danish philosopher, Herald Höffding. Bohr also speaks of the complementarity between modernity and tradition, relating the latter, i.e., tradition, to the *hereditary* transmission in determining the essential elements of culture. In order to forestall the then emerging (Nazi) racial implications of heredity he pointed out that both the modes of description of biological phenomena, namely, physico-chemical and functional, must be accorded comparable and complementary importance. In his epistemological scheme of thought, complementarity figures as the logical relationship referring both to (i) the linguistic ways of describing and communicating our experience of the world, and (ii) the world itself in which we occupy a singular position – the position of being both spectators and actors.

Another very distinguished physicist-philosopher and contemporary of Bohr who contributed much to our clearer understanding of the relation between matter, life and mind is Erwin Schrödinger[3]. After he succeeded in discovering and then establishing, with the help of Hermann Weyl, the basic identity of matrix mechanics and wave mechanics, he turned his attention partly to philosophical questions pertaining not only to science but also to essentially humanistic issues. It is perhaps due in some measure to his temporary stay (after leaving Germany) at the Pontifical Academy in Rome, before his travel to his last scientific home at Dublin, provided by the President of the Country, De Valera, himself a talented mathematician. Convinced of the limits of science and of the irrelevance of Heisenberg's uncertainty principle to the age-old question of human free will, he started delving deep into the ancient Hellenic and Indian philosophical systems. He sincerely shared Albert Schweitzer's *respect for life.* Without being forgetful of his professional first love for the physical world, he like Neils Bohr felt that the biological process of growth could be understood on the basis of quantum theory according to the schema "order out of the order". Though his views have been superseded by subsequent research, during his own life time (as Francis Crick tells us) he motivated many promising physicists to study biology. The posthumous publication of his *My World-View* confirms his intimate familiarity with the ancient *Vedantic* philosophical view of life.

That a scientist's preoccupation with one particular branch of knowledge, physics in this case, does not prevent him from being professionally familiar with other branches of knowledge has been clearly understood by the life and works of scientists like Bose, Bohr, Schrödinger, Helmholtz, Von Neuman and Norbert Wiener. Also in this connection one must justly recall the outstanding works of Sherrington. When he, together with his junior colleague, Adrian, was awarded Noble Prize for physiology/medicine in 1932, in his citation the Noble Prize Committee specifically acknowledged, honouring him specially, that biological research inspired solely by philosophical questions and free from any practical concern with immediate medical application would some day go a long way to the experiment of the human life. In his later life it is clear that Sherrington became more and more interested in philosophical questions. In his two famous books, *Man on His Nature* (1942) and *Integrative Action* (1947), he relates the results of his very late years. While he draws a necessary distinction between the purely motor integration of the decerebrate animal and the complete conscious one of the sensing being, his position should not be construed as dualistic. For Sherrington speaks of two complementary syntheses which simultaneously take place in the normal functional nervous system. While the physico-chemical process induces man to behave like a goal-seeking machine, the psychological process articulates his emotions, aspirations, volitions and memories. He was not quite sure whether these two processes are commensurable. Up to the 1940's he did not like to attach any religious connotation to his scientific works. But John Eccles tells us that when he met Sherrington, immediately before his death in 1952, the scientist told him that "now my concern is soul".

VI. Ascent (*Uttarana*) and descent (*Avatarana*) in and through matter, life and mind

What I have stated above would indicate my conviction that the relations that obtain and work between the three *main* scientifically ascertainable levels of existence, Life, Matter and Mind, are complex and interactive. In this concluding section I will try to show, though briefly, that the nature of these interactions may best be brought out in terms of the conjoint implications of *e*volution and *in*volution, upward causation and downward causation. In arriving at my conclusion the views which proved very helpful to me are those of my own teacher, Karl Popper, a physicist turned philosopher, then social scientist and finally evolutionary theorist of knowledge, John Eccles, a brain scientist turned philosopher, and Sri Aurobindo, a true polymath trained in history, who could easily move from history, culture and revolutionary politics to Vedic studies, Yoga and epic poetry. Close scrutiny of the writings of these thinkers clearly shows their internal difference. Let me say how I read them.

First, when I use the word "causation", obviously I have neither the Cartesian push-pull view nor the Newtonian gravitational view of it at the back of my mind. I am not clear about the implications of the probabilistic-cum-chance view of causality defended by the most Quantum physicist. To make my point clear I would denote, purely for heuristic purpose, the three main Levels of existence, Matter as L1, Life as L2 and Mind as L3. Personally speaking, I am inclinced to accept the seven levels of Being referred to in the Vedas and persuasively elaborated, among others, by Sri Aurobindo. However, for our present limited purpose we may concentrate only on the stated three levels, – L1, L2, and L3. L1, mainly consisting of physical and chemical forces and phenomena, is studied in such disciplines as physics, geology and chemistry. L2, mainly consisting of biological and psychological forces and phenomena, is studied as botany or zoology, and biology in the most extended sense, including molecular biology, neurobiology, psychology, and epistemology. L3, mainly consisting of the abstract and durable products, *mainly* of the human psychological workings of level 2, is illustrated, among other things, by tradition and culture, language and numbers, archaeological remains and musical notations, surviving theories, world-views and unsolved problems. Indirectly L1 has its upward impact on L1 mediated through and by L2. Conversely, L3 has its downward impact on L1 mediated through and by L2. These two processes are increasingly complex in evolution and decreasingly simple in involution.

On most of these issues, I suppose, Popper and, particularly, Eccles, are likely to agree with me. But Popper does not believe in the existence of any level beyond L3, beyond the products of the human mind. He rules out the very possibility of evolution beyond L3. He does not believe in any Supermind or God. Even the term "soul" is not to his scientific taste because of its alleged theological undertone. He prefers the term is "self". This is evident from his works like *Objective Knowledge* and *The Self and Its Brain*. The latter has been jointly authored by Popper and Eccles. Their Dialogues in Part III of the book make the difference between the two abundantly clear. While the philosopher in the experimental scientist, Eccles, is willing to recognize the transcendental promise of biological evolution, the scientist in the philosopher, Popper, is clearly non-committal on the issue.

While I agree with both of them in their criticism of, and common opposition to, the main two forms reductionism, viz., materialism and panpsychism, I find that Popper's formulation of panpsychism is clearly mistaken and even that of Eccles's unsatisfactory. For example, when it is said in the true Vedic tradition that "all is consciousness" or "*sarvaṁ idaṁ caitanyaṁ*", it certainly does not fail to recognize the distinction between L1, L2 and L3 and the promise jointly held out by all three levels. The main reason for most Euro-American thinkers' failure to see this clear distinction drawn by Indian thinkers between the empirical world (*Jagat-prapañca*) and Brahman or God, or between the Buddhist's *Nirvāna* and *Śunya* as reality, is their lack of exposure to the Indian ways of thought as expression. Preoccupied with the Cartesian form of body-mind interactionism and the Spinozistic forms of body-mind parallelism, they, in most cases, are unable to fairly assess the Indian theories of relation between body and mind. As said before, it is substantially because of their unfamiliarity with, and indifference to, the eastern modes of spiritual thought. While most of the Indian thinkers, philosophic and scientific, take the welcome trouble of closely studying the Euro-American schools of thought, they do not reciprocate this open-mindedness. Unfortunately, our mind is thoroughly colonized by western influences, particularly of English-speaking writers and we uncritically accept the ideas of globalization, coming from the West and sweeping all our spheres of life and learning, – economic, philosophical and even scientific. I must emphatically add here that I do not believe in chauvinism in the field of learning. But learning in the modern context should be a mutually respectful process of exchange.

Once the materialist or the naturalist rejects, explicitly or implicitly, emergentism, or creativism, they land themselves wittingly or unwittingly, in a number of difficulties, anomalies and inconsistencies, if not outright contradictions. To the materialist, the universe seems to be a mere collection of things. The seemingly higher-level objects are merely by-products of the interaction between and within material bits of things. Only forms of matter are claimed to be durable, if not eternal entities. All other things are taken to be merely temporary and destined to perish soon or late. This formulation of reductive materialism, inspired basically by a particular *theory* of matter *from above* can hardly stand the scrutiny of experimental findings *from* *below.* We have already reffered to some disconfirming findings earlier. I would briefly refer to some additional findings and arguments to show the infirmity of this position.

First, many modern physicists are of the view that matter because of its inherent motion or contrary electric charges wihtin it can never retain its structural identity over a long period of time (Feinberg 1977). The *formal* identity that it outwardly exhibits is not truly reflective of its inner changes. That formal identity and material change may and do go together may be cited as the only or main evidence of continuity, identity and reidentifiability of human persons through the passage of time. This purely physicalist argument "from above" appears shaky, if not very metaphysical.

Second, the materialist defender of the body-mind identity theory fails to explain why bodily changes and mental changes do not *interact* instantaneously (Popper and Eccles 1977). The parallelist among the materialists fail to tell us why the terms of the bodily process and those of the mental process do not exhibit any one-to-one, particular-to-particular or even general-to-general, *correspondence.* There is always an element of time-lag between, or the non-instantaneous character of, the allegedly *parallel* or *interactive* courses of somatological and mental events. This suggests that all mammals, certainly from the level of developed apes to human beings, have an interpretative inability within them which intervenes between physical stimuli, neural intakes and actual behaviour. The behaviourist is wrong in thinking that the existence of the supposed mental events and actions are merely due to our inverse and illegitimate inference from the visible or the perceptible to the "inner and invisible" space. The statements about the somatic signs can hardly be taken as premises from which mental phenomena can be validly inferred. The latter, i.e., invisible mental phenomena, cannot also be logically taken as mere bodily *dispositions.* For example, knowledge itself, which ordinarily turns out to be dispositional and not episodic, cannot be validly attributed to the mere biochemical processes of the brain. The *truth*-claim of our thought is determined not by the laws of biochemistry but by those of logic. For example, a computing machine, though supposedly obeying the laws of physics, is clearly and fully obedient to the laws of logic as well. Primacy of logic does *not* support the primacy of materialism (Goldman 1995).

Third, the irreducibility of consciousness to the physical/material conditions of our existense may be shown in another way. For example, when we get up from deep sleep or even shallow dreams, often we find our time-sense becomes blurred or/and misplaced. A patient, immediately after gaining post-operative consciousness, is found to ask a typical question, "where am I?". That shows that his post-surgical consciousness, though consciousness in the true sense, is not in consonance with his immediate environmental conditions. Even when we sleep in a totally new and different place, away from our customary place, we find it difficult to be sure of our position or, to take an example, where exactly to put our fingers for switching on the light. This is also proof, though admittedly somewhat weak, of the gap between our bodily consciousness and the environmental conditions within which it is placed. This "gap" clearly indicates the *independence* of consciousness–independence from physical settings and conditions.

Fourth, the ways of functioning of our memory also convincingly bring out the inadequacy of the physicalist account of consciousness[4]. Memories are very central to the understanding of consciousness. Psychologists who deny the possibility and prospect of self-introspection find it often very difficult to explain the retrieval systems of past memory or lost memory. Does not introspection help us in our retrieval efforts? How can one deny it reasonably? Some memories of the past, on demand of the will, can certainly be recalled immediately or mediately and retrieved but some others cannot be. The reservoir of the really forgotten is indeed very vast. In the case of aging people, with the loss of memory of *proper* names starts the expanding area of increasing forgetfulness. Memory may be passive or become active. It is at times due to need and will and at times due to external stimulation or provocation. Memory is activated not only for the purpose of *retrieval* of our past experience but also for *recognition* of the items of experience and their objective references. Memory, though in different minimax ways found in differently developed animals, is available in its best form only in human beings. All these considerations again suggest the irreducibility of self-consciousness and self-recognition to somatic or even simply conscious experience. To maintain the differences between consciousness and self-consciousness, between simple retrieval and recognizable retrieval, is essential to a sound understanding at the human mind.

Fifth, some philosophers and psychologists often speak of the *elusive* character or thinningness or even the non-existence of the self[5]. However, their use of language appears opposed to their theoretical conviction. That shows that they develop theories disregarding their own practical experiences and also their conscious linguistic behaviour. Unless one believes in the existence of one's self there is little meaning in one's utterances such as "these are *my* memories", "these are my mental states". These are not instances of grammatical inadvertence but of theoretical misconception about the very nature of self.

Sixth, it is not surprising that many philosophers and philosophically oriented biologists take the concept of body as essential to that of persons. To avoid the difficulties of explaining the identity and unity of self-consciousness to espouse a concept like person seems to be basic and therefore unavoidable to many thinkers. Admittedly, to recognize body is *necessary* for personal identity but it is *not* sufficient to explain some of the phenomena like *recognition* of lost memory after a long time-gap. Self-consciousness, particularly some forms of yogic consciousness, is relatively independent. The interdependence of body and mind is not of identical extent.

Seventh, what I like to affirm is that consciousness is certainly due to integral functioning of our nervous system. However self-consciousness cannot be explained exclusively in terms of this integral functioning. Brain, as a part of the body, is certainly necessary for understanding consciousness, but consciousness, both human and sub-human, has a definite inherent element of self-transcendence in it.

Finally, I would like to conclude my brief survey on the relation between body and mind in this way. Self-consciousness works on our consciousness and our consciousness works on our body and also as a part of it on our brain. Not that brain has no impact on consciouness and consciousness on self-consciousness but what is most important in the context of *uttaraṇa* or upward causation and *avataraṇa* or downward causation, between material body, consciousness and self-consciousness is the primacy of the last term.

However, *primacy* should not be confused with *finality*. If we really believe in the self-transcendent capacity of consciousness, then, as a token of the same logic, we have to recognize that human self-consciousness has in it a promised level beyond itself. In other words, there is no really final foreclosure of human consciousness. The question is logically and widely open.

Notes

1. *Gita,* XIII, 17 & 20, *Taittiriya Upanisad,* II. 1 and *Sv. Upanisad,* IV, 10 & VI, 1,7,8,11.
2. See, for example, Sherrington C S (1975) *Man on His Nature* (Cambridge University Press)
3. See, for example, the entry on Schödinger in *Dictionary of Scientific Biography,* Charles Scribner's Sons, New York, Vols. 11 & 12 (combined). See also, J S Bell, *Speakable and Unspeakable in Quantum Mechanics,* CUP, (1987): J A Wheeler and W H Zurek, (eds.), *Quantum Theory and Measurement,* Princeton University Press, Princeton, J J 1983; and David Bohm, *Wholeness and the Implicate Order,* Routledge and Kegan Paul, London, 1982.
4. For the Vedanta View see, for example, Padmapada's *Pancapadika,* tr. D Venkatramiah, Gaekwad's Oriental Series 107, Baroda, 1948
5. In this connection one may profitably look into the works of the early Wittgenstein, Ryle, Foucault and Derrida.

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Challenges to philosophy and religion from development in life-sciences

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Abstract

In the 19th and 20th Centuries, advancement of knowledge in the physical sciences had a tremendous effect on philosophical thought, introducing a 'revolution in philosophy'. And many physicists contributed much towards philosophical speculation, during the first half of last century (e.g. Einstein, Heisenberg, Schrödinger, Weizäcker etc.). Their discoveries in physics contributed much towards the growth of metaphysical speculation. Similarly contribution to life-sciences, especially the doctrine of evolution, inspired many philosophers and scientists to contribute substantially to philosophical speculation (e.g. Bergson, Lloyd Morgan, Julian Huxley and Sri Aurobindo in our own country).

But it appears that the new life-science and its far-reaching discoveries have not inspired many philosophers. We can trace certain landmark discoveries in this field, that can change the nature of speculation of the philosophers about man and about life in general significantly. In our view, even psychology has not been able to meet the challenges posed by

the outstanding discoveries in the field of genetics, that can change their views on man's mind and behaviour to a large extent. From Mendel's earliest formulations in the 19th century, to the discovery of chromosomes (by Flemming and Waldeyer), formulations of the concept of 'mutation' (by Hugo de Vries), establishment of the concept of the 'gene' (by T H Morgan), discovery of DNA as constituting the hereditary material, isolating the functions of the RNA, discovery and the 'cracking' of the genetic code (by Nirenberg and Khurana), application of genetic transformation to medicine, cloning of several species, and the possibility of cloning a human being are only some of the stages in the development of this science during its short history of only 150 years.

Philosophy and Religion have been somewhat static in their attitude to the three basic problems: God, Self and its immortality, and the external worlds. They ignore the various life forms almost completely when they talk about 'cosmos'. In my view they did not completely succeed in meeting the challenges of discoveries in the physical sciences, both in the sphere of the macrocosm and of the microcosm. In their attitude to the world of living beings it is either negative or indifferent. Taking the example of consciousness, which the philosophers and theologians have regarded as unique to man, it can be shown how obscure and ambiguous this term means even to the philosopher. The idea of 'God' both in philosophy and religion has meant quite a lot of things and philosophers and theologians (even when they belong to the same faith) are not entirely in agreement. We are awaiting a new philosophy that can meet all challenges.

Post-renaissance Europe has witnessed a tremendous growth in knowledge which has no parallel in the entire intellectual history of the world. During the twentieth century, in particular, the advancement of science has been so rapid that it has become highly difficult even for scientists themselves to keep pace with the developments, not to speak of philosophers, historians and social scientists, who find these developments beyond easy grasp. Above all, the men of religion, the theologians, are hopelessly lagging behind in their assimilation and appreciation of the new scientific knowledge.

I

3As far as the physical sciences were concerned, philosophers were highly struck by the new revelations regarding the cosmos which led to a somewhat revised outlook on the external world. God, self and the nature of the physical world have been the three fundamental metaphysical problems in the philosophical traditions of both the East and the West. Immanuel Kant in the 18th century declared that two things had inspired wonder in him: 'the starry heavens above and the moral order within'. The Baconian-Galilean-Newtonian outlook regarding the external world and the Copernican revolution in astronomy modified our philosophical vision of the world beyond us, but philosophers continued to assert that knowledge alone was not enough; it had to be guided by faith. This was some sort of a concession to the religious world-view, which had been guided by dogmatism based on the scriptures. Gradually the chasm between philosophy and theology became wide, the former leaning more towards science and the scientific world-view, so much so that it was said early in the last century that philosophy and theology were not on speaking terms; the situation has not changed very much now.

If 18th and 19th century British empiricism was influenced by what the American philosopher E A Burtt has called 'Baconian-Newtonian-Galilean world-view'; then as the twentieth century began some philosophers found the explanations and discoveries of physics inaccessible, owing to lack of training (especially in mathematics). But still, the students of philosophy, with a little hard work, could comprehend the basic concepts of modern physics like quantum mechanics and relativity. Philosophers like Russell wrote understandable treatises on new science. Besides, we also come across writings on philosophical problems of modern physics by scientists (e.g. Einstein, Schrödinger, Heisenberg, Jeans, Eddington etc.), though many of them are no longer read. Some scientists indeed became philosophers (e.g. Whitehead, Pascual Jordan, and Weizäcker).

II

Around the beginning of the 20th Century, psychology broke away from philosophy, as both its anti-metaphysical assumptions and its experimental methods were found to be out of tune with those of philosophy. However, psychology as a science (unlike biology) has failed in my assessment, to make a lasting impression on modern cultural history, owing to its failure to provide more information about the human mind than was already known, and became bogged down in its mechanistic methods and conclusions. The new science of genetics is more successful in this regard, as it pursues the same goals about knowing more about life by following a more rigorous method. It was remarked somewhat laconically a few decades ago, that psychology first lost its soul, then its self, then its mind and finally it lost even its consciousness. Anthropology too offers less information about man than genetics.

During the middle of the 19th century, Darwin took the intellectual world by storm, and gave a new fillip to the development of biological sciences by his doctrine of evolution. Its main theses, its modifications, reformulation etc., during the 100 or more years of its history are not relevant here, while some philosophers at the beginning of the last century saw contradictions in the doctrine (when applied to a scheme of reality), others like Henri Bergson, Teilhard de Chardin and Samuel Alexander built their own metaphysical systems based on the doctrine of evolution. Some biologists themselves built their own metaphysical theories (e.g. Lloyd Morgan and Julian Huxley). To some extent, the great Indian philosopher, Sri Aurobindo, seems to have been very much influenced by the doctrine of evolution, judged by the way he treats problems of human life, history, and human mind. There is no need to elaborate them here.

Some other philosophers abandoned their interest in the problems of the physical world, of life, of history and of man and fell back into understanding and analysing the language of the various sciences and their logic. In the thirties of the last century, they published an Encyclopaedia of Unified Science, and under the latter they brought in language and logic of physics, biology, social sciences etc. There is need to bring forth a work on logic of genetics. Thus we see that not all philosophers were ready to face the challenges of science. It is true to a large extent that the philosophers' interest in the problem of life in general has been indifferent and their attitude towards the world has also been negative, as some of them have been asserting the phenomenality, the unreality and even the illusory nature of the physical world.

Even in the West the interest in the problems and values of life has been comparatively of recent origin. It may have started from the period of renaissance in the 16th and 17th centuries, and received an additional fillip after the so-called phase of *Aufklärung* or enlightenment in European cultural history, after the eighteenth century.

III

Modern science came to India only after the middle of the 19th century. Some scholars may dispute this statement, but it is a fact that the Asian continent as a whole was ignorant of the methods and secular goals of modern science till the end of the 19th century. In ancient Indian cultural history, one does come across a kind of science, e.g., astronomy, medicine, mathematics etc. Ayurveda did initiate studies of anatomy. In spite of all this, modern tools of research like the microscope, telescope etc., were totally unknown, not to speak of computers. There is no need to develop an 'inferiority complex' about this, because European science before the renaissance and enlightenment was exactly in the same position as India of the early 19th century. Science to-day has crossed geographical and parochial boundaries, and there is no point in talking of Indian or European Science, or Christian or Vedic science. It has to be admitted, however, that Ayurveda did give a credible account of the human body and the Yoga system attempted to probe into the working of the human mind.

However, the ancient Indian philosophies that deal with human consciousness (e.g., the Advaita Vedānta, the Vijnanavāda school of Buddhism and the Yoga system of Patanjali) lead us to a lot of ambiguities, which are caused by their statements on consciousness and self-consciousness, which are either partly or wholly unintelligible (the terms used in Sanskrit are *'prajnāna'*, *'vijnāna'*, *'citta'* etc.) and the various commentaries do not help us much in understanding them. The parallels in European thought are found in the philosophies of Kant and Hegel (who writing in German use the term 'Bewusstsein', which is better translated as 'awareness', as the term 'consciousness' sounds more like a hypostatized thing, rather than a process), and these philosophies have attracted the immediate attention of Indian Vedantins because of the similarities between the two concepts, Indian and Western. Needless to say that the entire approach was based on epistemology or an outdated human psychology and was made long before human physiology and experimental psychology developed as exact sciences. It was pointed out early in the 20th century that many philosophical concepts have their origin in 'fictions' (using that term in a somewhat technical sense). Such 'fictions' include consciousness, mind, reason, intellect and even the so-called 'self' or 'the ego'; such concepts are empty shells without content and impossible of scientific verification. This view has of course been disputed by many so-called phenomenologists and existentialists, whose starting point is the affirmation of the reality of the self ('the transcendental ego' for the phenomenologists), but we will not elaborate the thought of these systems for want of time and relevance.

IV

Philosophers, it may be asserted with some confidence, were never seriously concerned with the problems of human life, much less with life in general. At best, the problem was approached negatively, and in this it was definitely influenced by a theological outlook, which relegated life here as something full of misery and not worth living, as compared to an eternal life beyond, a vision of which was put forth by almost all religions. The history of the life sciences during the last two centuries has changed this attitude of the philosophers, who have left the dogmatic theologians far behind. The affirmation of the reality of the human person is one of the prominent features of 20th century philosophy. Life sciences themselves in this short life span of a little more than 200 years have brought about a formidable change in man's attitude towards himself and to other forms of life, which he had ignored earlier. From William Harvey's discovery of the circulation of blood and Leeuwenhock's discovery of micro-organisms through his new tool, the compound microscope, in the late 17th Century, to the cracking of the genetic code during the sixties of the last century and the deciphering of the entire human genome as well as that of other animals is a far cry with highly significant consequences, that throw formidable challenges to the traditional outlook on human life and existence.

The science of genetics itself has had a short life of 100 years, the word itself being introduced by Bateson in 1903, though the geneticists have not forgotten the pioneering work of Mendel. Prior to that, as is well-known, there were quite a few who were interested in finding out what characters of a living organism were passed on to other organisms taking birth from it, and what were acquired. There were philosophers like Lloyd Morgan who spoke of new qualities, which become 'emergent' during the course of evolution of life through various stages. Bergson had spoken of evolution being 'creative'.

The doctrine of evolution or a study of the nature of the world of life or even of the problems of heredity and environment do not throw any challenge to traditional beliefs about man. They have in fact opened new vistas in man's understanding of himself, isolated or in relation to the cosmos. But a transition from such problems to far-reaching discoveries regarding the nature and origin of life, and further into what has come to be known as 'cloning', i.e., creation of forms of life identical to the one the scientist is having before him, from a single cell. Genetic engineering promises to re-design the world of life. It has already found ways and means of eliminating human suffering by offering genetic therapy. One also hears of the boast that man in the near future will play the role of God, creating new species and eliminating the old.

V

The transformation of a mere biological challenge to traditional beliefs into a genetical one is an invitation to man to throw away many of these beliefs, some of them bordering on superstition, in favour of more acceptable and verifiable facts, which seems to be unavoidable. If human intellect cannot keep itself abreast of these developments it is lost. In fact, the developments have been so fast that it is not possible even for the biologist to keep pace with them. The discovery of chromosomes, mutation, genes, DNA and RNA, the construction of a genetic code and its so-called 'cracking', application of genetics to medicine and the recent human genome project have all happened within our lifetime, and we do not really know what is going to happen in the near future. All these scientific events have taken human civilisation by surprise, amidst outcries against such developments and that all these go against the laws of nature and against God's will (as if we know what they are!). More than the philosophers the theologians have talked of a Cosmic Purpose, a Divine Will and man's impudence in disturbing God's acts of creation. Sometimes Scriptures are quoted in support of objections to scientific advancement.

But one has to be wary of over-enthusiasm. What has happened is not merely a new genetics or even a new biology, but the discovery of a new world, at the microcosmic level comparable to the discovery of the new world by the explorers in the 15th Century. Indeed man is well-set to re-design and reshape the life-world on his own, attempting to change history, which has come down to us after millions of years of evolution, and above all trying to create new meanings and values of life. He assumes the role of God (perhaps it is only a metaphorical way of describing man's stupendous endeavours) in designing and creating new organisms by genetic engineering. Aided by supercomputers, geneticists now seem to know the intricate structures of various species, the 'genomes' of various species, including the human. This also involves the discovery of the so-called 'chemical spelling' of the biological types. It has been reported that bio-scientists have found the new data revealed by their painstaking investigations so powerful that they are now in a position to lay bare and compare the 'genomes' of various animals with that of man. They are now even able to probe into man's past (even before the species *homo sapiens* came into being) in its most minute genetic details. We are now told that the discovery or rather the deciphering of the human genome is as complete as those of most other species. This completes the picture of biological evolution in its minutest genetic details. Scientists are also able to pinpoint clearly the genes that cause many deformities and diseases. This has completely changed our picture of the world of life and of man and his place in the world.

VI

The discoveries made by these researches into genomes can come as a stunning blow to many of the traditional philosophical beliefs about the nature of man. The need has arisen to revise many of the traditional metaphysical concepts like the self, mind, consciousness, thought etc. Above all, the effect of such a scientific revolution on the realm of values is yet to be assessed. It has probably landed us in a mechanistic world-view, though it can be asserted in favour of the scientist that but for his freedom of thought and action, these discoveries would never have been made. The Western world has in my view broken out from its theological past to a more open and free world of scientific and philosophical inquiry. It also follows from this development of thought that man is solely responsible for his future evolution, and that he can shape the future of man and of civilization, thus eliminating any reference to a supernatural, transcendental agency, which has so far been regarded as responsible for man's appearance and his history. Man has become the sole arbiter of his own future destiny.

But the entire project has been commercialized to such an extent that these far-reaching discoveries are not available to the world at large. The firms, especially the pharmaceutical companies which have pumped in billions of dollars in genetic research, have kept the discoveries a closely guarded secret, to prevent the human community all over the world from benefiting from them in the control and prevention of disease, infirmities and deformities. Mechanization and commercialization of human culture and civilization had been foretold more than 100 years ago, in response to science and technology.

Another important challenge thrown open by this new science of genetics consists in the fact revealed by its latest researches into the genetic structure of man and other animals, that man is no different from other animals. A few submicroscopic genes are all that matter. This conclusion shocks many who hold the traditional view about the basic differences between man and other animals. But the reaction of the theologians this time is not so sharp as when Darwin propounded the evolutionary hypothesis. The theologians then encountered him an *argumentum ad hominem*, whether Darwin accepted that he was descended from apes. The dogmatic theologian and the religious man have always had suspicions about science and scientific progress. He was also indifferent to forms of life other than his own. Even humanism as a philosophical doctrine is one-sided, though it has an emotional appeal, because it directs the main attention to the human species only. It may in this connection also be observed that Western religions (i.e. the so-called Semitic religions) are not friendly to life forms other than man. Contrary to this, Eastern religions (i.e. Hinduism, Buddhism and Jainism) have a more sympathetic attitude to all forms of life. Life has been treated as a totality. This is confirmed by modern researches into the human and animal genomes, which demonstrate that there is very close kinship between them. The fact that the human genome is no different from that of a dog or a rat may disturb our minds, influenced as we are by centuries of dogmatism and superstition. It remains an irrefutable fact that geneticists have been able to cross what are described as 'species barriers'. In the plant kingdom, biotechnology with the aid of genetics has been able to produce better and high-yielding varieties of food-grains, and has helped to usher in a green revolution. Judged by the speed with which genetic research is progressing, it may not be long before we are presented with a new race of supermen, relatively free from disease and capable of living for hundreds of years.

What effects such results of genetic research would have on our traditional values and cultural norms are yet to be assessed, and is beyond the scope of this essay.

Human consciousness in metaphysical and scientific perspectives

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Abstract

The paper seeks to discuss the presuppositions of a theory of consciousness in general. For this three models of classification of human consciousness are being taken up for discussion, namely, Kantian, Marxian, and Sartrian. These shall be examined in the context of contemporary scientific thinking on the problems of mind and/or consciousness. An effort will be made to take stock of divergent perspectives of the structure of consciousness, i.e., moral, aesthetic, and scientific-epistemic. In this context the views of such theoreticians of morality who describe moral consciousness as the basis for moral experience, moral judgments, moral disagreements and the resolution of moral controversies have been taken up. A discussion on comparative frameworks will be taken up to illuminate the continuity of thought from the ancient (Hellenic) to the contemporary times to show how the evaluations of character traits refer to structures of moral consciousness in different historical epochs. A similar treatment of presuppositions will be taken up for elucidating aesthetic experience and the structure of feelings.

Lastly, the contemporary perspective on the nature of consciousness as provided by sciences like physics, biochemistry, biophysics, neuro sciences, anthropology etc., will be taken up for in-depth analysis and to see whether any points of convergence could be found in these scientific studies. The view points of eminent scientists like Ilya Prigogine and Hans Morgenau will be taken up for examining the relationship between Physics and Philosophy. Can the 20th Century consciousness of science be meaningfully related to the theories of consciousness provided by philosophers of the 19th Century? This question has been seen in the context of Immanuel Kant's analysis of structure of human consciousness in general. How rich the insights of Indian philosophy are in the context of our understanding of mind and consciousness is the last question which has been raised and answered in this paper.

Among the theories that have been handed down to us, materialistic and idealistic, metaphysical and scientific regarding mind and consciousness, the following deserve our attention for deliberation and critical reflection.

The first formulation perhaps was made available to us by Anaxagoras, who spoke about Nous as the world mind which conceives and regulates all that happens in the cosmic order. The second formulation comes to us from Leibnitz. He conceives the self as consisting of monadic substances each reflecting the whole universe at its circumference, thus explaining consciousness as a cosmic phenomena of reflection on the surface of monads which enables the substantial reality of the monad to be aware of what is happening in the universe. In fact, by positing the notion of a monad, which is eternal and encapsulated, Leibnitz formulated a theory of immanent evolution which looks only upwards and presupposes an idea of irreversibility of time even though Leibnitz had paved the way for Kantian and Einsteinian theory of relativity of time.

By presupposing that the two primary functions of the monad are (a) perceptions (b) appetitions, he paved the way for a theory that during the course of time monads only move towards higher and superior perceptions and appetitions. This position constrains him to lay down the foundations of a theory that this world is the best and the most perfect available to us of its kind. Leibnitz further proposed a three-layered conception of consciousness in the vertical hierarchy of the living world namely "apperception" for human beings whose soul shall be not the ordinary soul but "spirit", this level of consciousness being accompanied by the illumination of reason itself. At the second level, i.e., at the level of animals it was maintained that there exists mere consciousness without the element of reason. And at the third and lowest level it was suggested that there are only minute and unconsciousness perceptions. The highest monad has been described as being divine, i.e. God Himself and is conceived as having the highest content and purity of consciousness which enables him to see through all that exists.

Next to Leibnitz, Immanuel Kant seems to have formulated a significant theory which has had deep impact on the development of science in the 20th Century. For the first time in the history of philosophy consciousness was visualised as endowed with the element of empirical reality and transcendental ideality at the same time. Immanuel Kant in his *Critique of Pure Reason* describes the whole process of acquiring knowledge as based on the general possibility of experience. However, this possibility must be restricted to the possibilities provided by the structure of consciousness in general. This entitled Kant to call his study a transcendental study of consciousness, which includes the elements of sensibility, understanding and reason. Perhaps nowhere else such a comprehensive approach to the conditions of scientific certainty of knowledge is made available other than in Kant's treatment of the structure of consciousness in general.

He specifies the role of "time" and "space" as the inner and outer forms of sensibility and explains how imagination makes a transition from the domain of "sensibility" to that of "understanding". Through the doctrine of categories Kant explains how at this level of consciousness these principles of unification provide the much needed elements of necessity and universality to an otherwise heterogeneous and divided content of sense manifold.

Kant further makes it plain that unless reason regulates the whole content already schematised by the imagination of the level of categories, no unity of apperception can be achieved and no knowledge would be possible. In fact the structure of consciousness has to be brought within the fold of this unity of apperception so that consciousness in terms of its empirical content and transcendental ideality can render knowledge possible. Therefore Kant defines an object of knowledge as "that in the concept of which the manifold of a given intuition is united". A mere sensation becomes an object of knowledge only when it is brought within the field of unifying consciousness by means of its relation to the unity of apperception.

It is here that we need to emphasize that categories, *a priori* belong to consciousness. Kant expresses this in the statement that all unification of sense presentations supposes a principle of unification, which is the structure of consciousness, in general.

We shall see how contemporary scientists imbibed these insights of Kant and explained the role of *a priori* factors in the acquisition of knowledge. Next to Kant, the materialistic perspective of consciousness expounded by Marx has a definite place in our present enquiry. Therefore, before we examine the scientific explanations of consciousness and mind, it would be appropriate to discuss Marx's theory of consciousness.

The concept of consciousness is of crucial importance in Marxist Epistemology. The whole Marxian system and particularly the theory of change depends upon it. Marx's effort was consistently directed towards expounding the profound meaning of events, making plain the process, the necessity and the rules of social and historical development, and solving the riddle of the essential relationship between man and nature, and man and society. His objective was to enhance the "self awareness and life awareness" of man as he was gripped by the class system[1].

He wanted to liberate man from an ambiguous, fragmented individuality, from the dread of an insecure and inhuman existence, in and through the consciousness of the entire social reality and the laws in accordance with which a fundamental change can be brought about in social reality. In other words, his aim was to restore the lost unity of man with his own self, with nature and with society.

In Marx's framework, the whole process of history forms the basic given fact of human existence. He says in the German Ideology "The first premise of all human history is, of course, the existence of living human individuals"[2]. These individuals are not mere abstractions, but real conscious individuals engaged in practical activity, living under certain material conditions and simultaneously creating new conditions. All human action is actualised through consciousness which alone gives it practical shape.

Marx's emphasis on action is substantially clear from his XI Theses on Feuerbach where he says " The philosophers have only interpreted the world in various ways, the point, however is to change it"[3]. The importance of the other aspect that it is men who change the world is clearly demonstrated by Marx in his Third Thesis on Feuerbach; and by Engels in his "Ludwig Feuerbach and the End of classical German Philisophy"[4]. Marx says in this thesis "The Materialist doctrine forgets that it is men who change the circumstances and that it is essential to educate the educator himself" and he continues in the same thesis "The co-incidence of the changing of circumstances and of human activity can be conceived and rationally understood only as a revolutionizing practice"[5]. The realization of this revolutionizing practice is possible only through the consciousness of men[6].

Man as a conscious being is the point of departure for Marx[7], the basic reality. Making man the standard of judgement, Marx condemns the prevalent social order which only increases human bondage and impoverishment. Marx proclaims the authenticity of human existence which manifests itself through the consciousness of man and through consciousness makes man "a universal and therefore a free being"[8].

The physical existence of man implies that man is a species being. The whole character of a species is contained in the character of its life activity according to Marx. In the case of man it is "The free conscious activity which is his species character"[9]. Man makes his life activity itself the object of his will and of his consciousness. This is precisely what directly distinguishes man from animal[10]. While an animal is identical with its life activity and produces only under an immediate physical need, man produces universally and freely. It is precisely in creating an objective world by his practical activity that man proves himself a conscious being. He duplicates himself not only intellectually in consciousness alone, but also actively in reality giving rise to the object of labour which Marx calls, "the objectification of man's species life"[11].

Another important consideration with regard to consciousness is that Marx does not accept the notion of abstract consciousness, for him particularity of thought and consciousness remains an essential feature of reality. In this context he says "Thought for example, is the thought of a particular, definite individual; it remains his definite thought, determined by his individuality and the conditions in which he lives"[12].

Marx explains the material nature of the relationship between consciousness and language. He calls it the practical consciousness. It is "Spirit cursed with the burden of matter which appears in this case in the form of agitated layers, of air sounds, in short of language"[13]. Language, Marx explains, originated from the necessity of intercourse with other men and as such consciousness is a social product from the very beginning and shall continue to be so as long as men are in existence.

The evolution of consciousness starts with the awareness of the immediate surroundings and of nature in general. This stage of consciousness Marx calls the "animal consciousness" because in it nature appears to man as an all powerful, unassailable and completely alien force. This was the stage of natural religion when nature was deified as an all-powerful god.

Then arose the necessity for the historical transformation of nature for maintaining the very existence of human race. Here man felt the necessity of associating with other men around him and from this emerged the "herd consciousness" amongst men which bound them together almost instinctively. The horizons of this stage widened through the increase of productivity which in turn gave rise to the division of labour. Finally, industry emerged in its true anthropological character as a true historical relation between man and nature. As such Marx conceived it as the exoteric form of the realization of the essential human faculties[14].

The whole argument points in one direction that consciousness always corresponds to a definite stage of social existence. Man's consciousness changes with every change in the conditions of his material existence, in his social relations and in his social life[15]. Marx says in this context "The ideas of the ruling class are in every epoch the ruling ideas i.e., the class which is the ruling material force of society, is at the same time its ruling intellectual force"[16].

Marx identifies consciousness with conscious existence and conscious existence itself is nothing else but the actual life process of men[17]. Strictly speaking Marx gives ontological priority to being over consciousness in his treatment of the relationship between thinking and being. According to him consciousness is determined by life. In his "Preface to the Critique of Political Economy" he says, "The mode of production of material life conditions the social, political and intellectual life processes in general. It is not the consciousness of men that determines their being but on the contrary, their social being that determines their consciousness"[18].

This is the wedge which has divided interpreters of Marxist Epistemology into two divergent and mutually exclusive groups[19]. But it appears that there is really no contradiction involved in the two view points, namely that all change is possible through human action, human action itself being actualised through consciousness, and that consciousness is of derivative importance in so far as it is determined by the life and the being external to itself.

Marx here perhaps only wanted to emphasize the objective character to consciousness from the point of view of truth, to which it must correspond. He only wanted to eliminate the abstract, purely subjective, speculative and purely ideological elements from the realm of our consciousness of the social reality. He wanted reality to be represented as it actually exists. He held the correspondence theory of truth as the basis of his epistemological position[20]. True consciousness is that which reflects the true reality. Such a consciousness alone could be the genuine spring of human action and motivation.

Consciousness is very essential but there are other forces at work as well. This has been amply made clear by Engels when he admits that both the factors are of equal significance; neither has the absolute validity or existence in so far as the history of mankind is concerned. Engels says, "Everything which sets men in motion must go through their minds; but what form it will take in the mind will depend very much upon the circumstances"[21].

The process of history works towards a certain ideal set in advance. The actors are all endowed with consciousness, they are men acting with certain deliberation and passion towards definite goals. "Nothing happens without a conscious purpose and without an intended aim"[22].

However, this consciousness itself is conditioned by a reality external to itself. In reciprocal action consciousness enables man to comprehend the social reality, to increase his determination to make it more human and more worthy of mankind. For instance the Moses of Michelangelo was not only the artistic image of Renaissance man, or just the embodiment in stone of a new self-aware personality, it was also a ringing call to the men of Michelangelo's generation for positive human action[23]. Thus consciousness helps man to uncover new social relationships with the specific purpose of recreating unity, so that feeling of collectivism flows even from the brimming subjectivity of man, so that individual life is not lost in the vast unison of human reality. As such an individual no more stands in isolation from society but in fact merges with its concrete reality and becomes one with it.

In the grand vision of Karl Marx the whole march of history was a gradual evolution from the conventional moral consciousness to higher dynamic moral consciousness, a dynamic aspiration of the soul of each for the love of all humanity. Marx conceives the true function of consciousness to raise man from the fragmented dehumanised state into that of a whole integrated being, not only to enlighten and stimulate action, but to change the whole social reality. To move towards true humanism – in the direction of deification of man and as such towards a true religion of man.

From the above account it becomes clear that within the Marxian framework emergence of consciousness is explained as a "leap of consciousness". During the course of evolution somewhere man emerged as a conscious being, consciousness being an endemic natural quality of his species being. It simply means that consciousness is an innate disposition which has the capacity of moulding itself in the myriad forms of objects that it engulfs. But here we have to ask the following questions.

If it is in an emergent of evolutionism, what then, is the specific role of time in our contemporary discussions of consciousness? Is time real or an illusion? If it is real, is it reversible or irreversible? The idea of evolution can be sustained only if time is ultimately found to be real and irreversible. In fact, the Spectre of time haunts while we live in this realm of the "between", i.e., perennial and temporal existence and non-existence, being and nothingness, finitude and infinity.

While answering these questions, dimensions of existence, consciousness and mind are woven into our fabric of thinking. It is in this context that the current philosophical concepts and contemporary scientific knowledge about the nature of being, consciouosness, mind and time, assume significance in the domains of scientific and metaphysical thinking.

Antiquity stressed upon the metaphysics of the object, believing in one single authentic reality: the idea and concept of substance. However, the next epoch asserted the predominance of science in so far as the conception of the fact and the language expressing the science of facts came to the fore. Today we witness a symmetrization of stresses, the object and the subject, the word and the concept, and consequently science and metaphysics become complementary aspects of the relationships in which man finds himself engulfed and struggles to grasp the reality.

Therefore, it is not a mere accident that the rediscovery of Consciousness in the context of physics is occurring at a time when human existence is subjected to extreme acceleration of transition in human history. In this context philosophic and the cultural contexts have to be synthesized. We have also to incorporate the complex relations between "internal" and "external" determinations of scientific concepts. Perhaps the confluence of the two traditions, i.e., of the Eastern and the Western, and the scientific and the metaphysical is nowhere as clear as in the problem of microscopic foundations of consciousness.

The past one hundred years have been marked by several crises that correspond closely to the description of Thomas Kuhn[24], e.g., discovery of the instability of elementary particles or of the evolving universe. The recent history of science is also characterized by a series of problems that are the consequence of deliberate and lucid questions asked by scientists who knew that the questions had both scientific and metaphysical aspects.

For most of the founders of classical science, even for Einstein science was an attempt to go beyond the world of appearances to reach a timeless world of supreme rationality. But perhaps there is a more subtle form of reality, i.e., the consciousness which needs to be explained in the context of laws, and games, time and eternity.

Consequently, there appeared on the horizon an irreducible opposition between the classical reason with its a temporal vision and our existence with its vision of time at the Centre trying to unravel the mystery of consciousness. The first defined the metaphysical search of a man lost in the wonder of Eternity and the second reasserted man's resolve to remain grounded to perceptible reality and to look for scientific certainty. This posed a dilemma which appeared irretrievable and irresolvable. Indeed, the dilemma of man's existence is that we have to make a tragic choice between timeless reality with alienation as its consequence and an affirmation of time with its rootedness in scientific rationality.

The spectacular developments in science are making us aware of the fact that on all levels from elementary particles up to cosmology, science is rediscovering the nature of consciousness in the framework of time and that we are engaged in the process of re-conceptualization in physics. It is in this context that the relation of science with human existence and human values can be explored meaningfully, which will have far reaching consequence for human development and excellence in human pursuits. In fact it is being emphasized increasingly that all science is bound up with human values and culture and that scientific findings, however advanced and esoteric, are meaningless outside the cultural context[25].

The philosophy of nature today has an endemic relationship with disciplines of physics, mathematics, biology and linguistics, and explores the nature of "complementarity" and "system theory" etc. Philosophers like Quine, Putnam, Rorty and Kripke ask for a return to ontology and enquire into historico-cultural context of the scientific and philosophical language. Yet another emerging trend is that of neo-transcendentalism with philosophers like

Quine, Strawon, Hintikka and Noam Chomsky examining such *a priori* concepts as 'community of communication' and the 'language of matrices'. Philosophers like Donald Davidson speak from a personalist perspective and uphold the centrality of the person in the integration of science thus placing all invention and creativity within the matrix of consciousness[26].

This is the most notable trend as it attempts to substantiate a new "philosophy of nature", conceiving human consciousness and existence as a system and placing science in the perspective of human values and the cultural matrix.

Ilya Prigogine happens to be an important exponent of this trend of philosophy of nature trying to establish minimal sets of categories and principles within a coherent theoretical framework in which both being and becoming, entropy and negentropy, reversibility and irreversibility, causality and finality can find simultaneous place.

Prigogine is recognized for his work on "dissipative structures" arising out of non-linear processes in non-equilibrium systems. He has set the Second Law of thermodynamics in a fresh perspective. He examines the goals, methods and the epistemology of science in th context of human values and vindicates that science is an open system embedded in society and linked to it. This, therefore, reiterates the necessity of a new philosophy of science within the context of new awareness and a definite emphasis on the new philosophy of consciousness.

Prigogine, in his Tanner Lectures on 'Changing perspectives in science and their impact on human values', has tried to answer some of these fundamental questions, in the context of emerging trends in the philosophy of science. He makes us aware of our responsibility to our future and to the future of mankind. Thus he recasts the problem of consciousness and human values in the context of social and scientific realities. He calls it the dialectics between what is in time and what is beyond time, 'between external truths' and 'time oriented existence'. This synthesis is found by him to be a singularly unique feature of Indian philosophical tradition[27].

Prigogine describes human consciousness and existence as an engima of incertitudes and of open questions. Yet he pleads for a world view which in spite of all asymmetry and disequilibrium is capable of weaving itself into an integrated view of human reality through human consciousness.

Speaking about a fascinating dialogue between Einstein and Tagore on the nature and meaning of reality he has shown the dilemma posed by the viewpoints of these two great minds. While Einstein had come along and put the observer at the heart of the system, Tagore emphasized that "science had to be independent of the existence of observer". Tagore had emphasized that "even if absolute truth could exist and had a meaning it would be inaccessible to human mind"[28]. This controversy between Einstein and Tagore assumes meaningfulness if man is conceived as separate from nature. But Prigogine on the contrary is of the opinion that if as a self-conscious being, man is embedded in nature and this fact is taken into account, human truths cannot be divorced from the truths of nature.

Prigogine gives a concept of time which does not separate man from the nature but rather expresses his belongingness to nature. Therefore, it stands for the affirmation of his being rather than his alienation. He gives an elaborate analysis of the concept of time, links it to human consciousness and human existence, nature, society and values. This provides for a notion of consciousness centring around a belief in the synthetic unity and convergence of a vision of a social world around us and a moral world within. It binds the finitude of man and his consciousness to society and to the goal-oriented human existence[29].

Prigogine admits the role of conceptual contribution through forms of consciousness in constructing the concept of reality. This is also clearly expressed by Bohr to Heisenberg in the reflections of their visit to Kron Berg Castle wherein he says, "... how this castle changes as soon as one imagines that Hamlet lived here? As scientists we believe that a castle consists only of stones, and admire the way of architect put them together ... and yet it is changed completely. Suddenly the walls and the ramparts speak a different language..."[30].

This raises some fundamental questions about the nature of reality and the role of consciousness as an *a priori* factor in constructing reality. Time, human consciousness, reality and concepts are seen to be intimately related. But is this necessarily so?

Henry Bergson attempted to defend the cause of multiplicity of co-existing "lived" times against Einstein. However, Einstein categorically rejected the "philosophers time" which is founded only in Human Consciousness. He asserted that lived experience cannot save what has been denied by science.

Bergson's "lived time" referred to the basic dimensions of becoming, the irreversibility which Einstein was prepared to accept only at the phenomenological level. For him distinctions among past, present and future were outside the scope of physics. This spells the distinction between what a Philosopher seeks in the metaphysical realm and what a Scientist seeks to establish in the scientific domain. One is sensitive to the mysteries of the deeper layers of consciousness, while the other restricts the authority of consciousness to what can be delivered within the precincts of precision and scientific certainty.

Einstein's position can be understood in the context of the statement that time basically is a geometric parameter that makes it possible to follow the unfolding of the succession of dynamical states. This position had been the manifestation of the basic category of human reason within the structure of human consciousness for the last three centuries which sought to eliminate time. Einstein, therefore, appeared as a symbolic representation of this drive towards formulation of a physics in which no reference to irreversibility would be made on the fundamental level.

To the question, what is irreversibility? What is its relationship to the laws of physics? Einstein answered again and again "irreversibility is merely an illusion produced by improbable initial conditions"[31]. This is a strange and mysterious world. For us, convinced physicists, the distinction between past, present and future is an illusion although a persistent one.

Prigogine examines the question why Einstein was so strongly opposed to the introduction of irreversibility into physics. Perhaps Einstein in his desire to perceive the laws of physics identified the 'intelligible' with the 'immutable'. Having lived during the two world wars perhaps Einstein was haunted by the spectre of time, through which victory could be negotiated only through science. Yet strangely, Einstein's world was full of observers, placed in multiple co-ordinate systems in motion with one another, situated on various stars, exchanging information through signals all over the universe.

Prigogine has commented that objectivity of communication which was in fact what Einstein wanted most of all was closely related to irreversibility. Prigogine calls illusion mentioned by Einstein as the symbolic power of the mind at the level of consciousness which determines that men must think in a particular way. The ripples of consciousness flow on the matrix of time and spell out the scientific and the metaphysical dimensions of the reality that they encounter. Correspondingly, the two dimensions become the two sides of the same pursuit one delineating on nature within the parameters of objectivity, the other within the framework of rationality intertwined with intuition and sensibility, seeking the semblance of objectivity. Both seek to unravel the domains of immutability and eternity and at the same time grasp the nature of that which appears to the consciousness and defines its emphemerality and transiency.

Homer's Iliad in this context provides an interesting insight as it centres around the problem of time. His reflections prove that for us men, immutability, freedom from change, total security and immunity from life's agonies will come only when we depart from this life by dying or becoming gods. His Odyssey is the dialectical counterpart to Iliad. Odyssey has the choice between ageless immortality and return to humanity and ultimately to old age and death. Still he chooses time and over eternity, human fate over God's fate. Achilles, on the other hand, embarked on the quest for something permanent and immutable. But such glory could be attained only at the cost of one's humanity.

Why do things happen the way they do? Perhaps we cannot proceed from the assumption that in some sense all is given in the form of a finished model. Within the framework of what may be called illumination, the elements of irrationality, creativity and invention can be highlighted as necessary and integral parts of human consciousness which explains the wide diversity of human responses to forms of life. In this context, the significance of constructive contribution of imagination can be pointed out.

Determinism militates against anthropomorphism and the freedom of man. If it is attributed to the gods it will be a grave irony and will even defy any attempt to comprehend the universe. It may however be concluded that determinism is only possible for an observer outside his world while we describe the world from within. Therefore, with the givenness of consciousness as a matrix, there can only be the view point of an insider from within the system.

Tagore seems to have envisioned the direction that scientific enquiry was to follow. The verdict of Einstein declaring time to be an illusion was not indeed final and therefore the paradoxes of time and human existence to which the Einsteinian conception of time gave rise, could at last be resolved. This restored the entitlement of man to claim this life, world and nature as his own by what Prigogine calls the concept of "Embedding of life in Consciousness and matter as well as of man in life"[32]. This brings back the lost relationship of man with nature, society and values.

Prigogine says in this context, "I am convinced that we are only at the beginning of a deeper understanding of the nature around us." He obviously means that the world view created by classical physics with its predominant concept of basic processes being deterministic and reversible, has been substituted by a world view envisioning randomness and irreversibility. The models considered by classical physics seem to us only to correspond to limiting situations which we can create artificially.

Prigogine concludes that it is only the unification of dynamics the thermodynamics through the introduction of new selection principle that gives the Second Law its fundamental importance as the evolutionary paradigm of the sciences. This paradigm is associated with the concept of bifurcation and the idea of irreversibility in which life appears much less isolated and having much deeper roots in the basic laws of nature. This has, indeed, changed our entire perspective on science, its relation to consciousness, human existence and the domain of human values. At the human level consciousness is a fundamental concept which for us is inseparable from the meaning of our existence. It is symbolic of our participation in a world dominated by an evolutionary paradigm. However, it relates us and our position to the world that we try to describe in our humble effort whether in scientific terms or at the more abstract level in metaphysical terms. Yet at best we can only attain approximations to that which is real, for all our endeavours to build paradigms ultimately elude the reality and at best can be described only as fleeting visions of the givenness of this wonderful but mysterious manipulation of the divine nature.

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Section 2

Why a "neural correlate of consciousness" is not just a metaphor

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Abstract

A frequent criticism of the neuroscientific approach to consciousness is that its theories describe only "correlates" or "analogues" of consciousness, and so fail to address the nature of consciousness itself. Though often presented as a simple intuitive point, this criticism relies on some substantive assumptions about the nature and evolution of scientific explanations. In particular, it is usually assumed that, in expressing correlations, neural correlate of consciousness (NCC) theories must fail to capture the causal structure relating the brain and the mind. Drawing on work in the history and philosophy of science, I argue that this assumption – along with the related claim that even a correct NCC theory would fail to explain consciousness – is grounded in an inadequate conception of the way in which scientific explanations develop. Examination of parallel developments in early 20th century biology suggests that, under the right circumstances, seemingly crude analogies can play a crucial role in the development of new conceptual resources. In closing, I provide some examples to suggest that NCC theories are poised to play such a role in the study of consciousness.

Neuroscientists who aspire to explain consciousness face a daunting array of methodological hurdles. Like all their peers in cognitive neuroscience, they must guard against criticism from above and below: neuroanatomists may accuse them of over-interpreting the data, hastily generalizing across species, and abandoning the realm of the empirical for that of the speculative; psychologists and philosophers may lodge charges of reductionism and determinism. This multi-front battle is challenging, but in fighting it the neuroscientist can fall back on the usual canons of scientific virtue: define your terms, gather lots of data, eliminate confounding factors, and develop tests to distinguish your hypothesis from each new competitor. This is a game that conceptually ambitious scientists in any discipline must learn to play.

But there is a different sort of criticism that seems to be the special burden of those who would propose a neural correlate of consciousness (NCC). "That's a very nice theory you have there," their critics may say, "but you must realize that it doesn't explain consciousness at all. We've known at least since Hume that correlation is not causation; you may have established what goes on in the brain *at the same time as* consciousness, but that tells us nothing about the nature of consciousness itself."

It's important to understand what a radical criticism this is. It doesn't allege that the theory is false; it says that, even if true, the theory is simply *irrelevant* to the fundamental problem of consciousness. What we want to know, the critic says, is what consciousness is and where it comes from; if indeed it comes from the brain, we want to know *how* and *why* it comes from the brain. It seems that NCC theories – however well-supported by evidence – cannot answer these questions, but merely recast them in narrower terms: "How and why does the brain produce consciousness?" becomes "How and why does 40 Hz oscillation in the visual cortex produce subjective visual experience?"

The logic of this argument seems simple, and many find it compelling (Searle 1992; Chalmers 1995). At the root, it seems to be a variant on the old (and eternally relevant) point that many different causal models can underlie an observed pattern. Deep Humean worries aside, statisticians have taught us to be wary of quick inferences from correlation to causation. If (for example) a correlation is found between coffee consumption and mean annual risk of death by heart failure, one *might* conclude that the coffee is causing the heart attacks; but one would have to conduct further investigations to test that causal hypothesis (C → H) against others, such as the possibility that heart trouble makes one thirsty for coffee (H → C) or that type-A genes or a stressful lifestyle predispose one both to coffee drinking and to heart attacks (F → (C & H)). From this perspective, the NCC theorist who claims to have explained the causal basis of consciousness seems to be making an elementary logical error.

It's even fairly easy to see why this problem plagues NCC research in particular. The gold standard for resolving causal ambiguity is the elucidation of a *mechanism* that produces the observed correlation. In the coffee case, researchers arguing for the C → H model would try to elucidate the precise physiochemical pathway from coffee to cardiac arrest. And indeed, one can draw several direct connections: coffee contains caffeine, which blocks the effects of adenosine, leading to an increase in both heart rate and blood pressure. Caffeine also increases calcium availability in heart muscle tissue by opening membrane channels in the sarcoplasmic reticulum, an intracellular storage structure; calcium plays a profound role in all nervous and contractile tissue, and increased calcium levels in heart tissue can speed and destabilize the cardiac rhythm.[1]

This detailed mechanistic explanation is possible because the entities involved all belong to the same approximate domain: call it the domain of "middle-sized organic objects and their biochemical constituents." Even though no specific scientific discipline encompasses all of the entities involved, there are multiple overlapping chains of disciplines connecting coffee and heart function (for example, organic chemistry to biochemistry to physiology to cardiology), and each step in the causal story can be tested using data and methods from the relevant fields.

It's hard to imagine where one would even begin constructing such a bridge between (say) synchronous oscillations in sensory cortex and subjective perceptual experience. "The neurons oscillate together, which in turn ..." ... what? There are no – or at least, too few – intermediate disciplines to bridge the gap between neurons and experience. And if, as a consequence, we can't fill out the steps of the causal story, then it seems that even our best neural models won't be able to give us the sort of satisfying causal explanation we want; they won't be able to tell us *how* or *why* the observed psychophysical correlations hold.[2]

But at this point, one must ask: is the NCC theorist really in the same position as an epidemiologist studying population variables? Unlike the epidemiologist, the neuroscientist is in a position to intervene directly in the systems under study (or, in humans, to examine cases where nature or accidents have "intervened" to cause brain damage). The experiments that underlie modern NCC theories generally involve *manipulating* perceptual stimuli, in realtime, and observing the resultant changes in neural activity. This method of establishing causal linkage is at least as old and well-entrenched as the explication-of-mechanism method; it's fallible, to be sure, but so are they all. Unless and until somebody can make a useful model out of pre-established harmony or epiphenomenalism, there doesn't seem to be any important alternative to the hypothesis that there is some direct causal relationship between neural activity and subjective experience.

The question of whether NCC theories are *explanatory* is a little trickier, though. Before we can address it directly, we need to look a little more closely at the structure of the theories in question. When one proposes a neural correlate of consciousness, what kind of proposal is one making?

First off, it's important to realize that there's something misleading about the "correlate" part of "neural correlate of consciousness." The term naturally focuses attention on correlational sources of evidence for NCCs, such as Nikos Logothetis' experiments in which the activity of single cells was correlated with the monkeys' reported percepts. But all good neural *theories* of consciousness also draw on broader anatomical, comparative and/or evolutionary considerations, and in most cases they incorporate causal/functional arguments which relate the putative neural basis of consciousness to structures known to be implicated in related phenomena such as memory, dreaming and emotion. The relation between (on the one hand) the neural model and (on the other) the structure of consciousness is thus something much richer and more complex than mere correlation; it is an isomorphism, a drawing of connections between entities, structures and dynamics in two different realms (the neural and the mental).

In other words, "correlate" here means something like "analogous structure."[3] Contra (Searle 1992; 1997), the structures described by NCC theories are not meant to be *causal precursors* of consciousness; rather, they (or their dynamics) are meant to *be* consciousness. The goal is not to produce a causal model on which consciousness stands apart as a *product* of the brain, but rather to find the patterns of consciousness *in* the structure and dynamics of the brain. The methodology for pursuing this goal has already been charted out by researchers studying memory and perception: in roughest outline, it involves functionally decomposing the cognitive process, functionally and physically decomposing the brain, and trying to find matching patterns amidst the bits on each side. This process is fundamentally analogical, even if its ultimate goal is something closer to identity.

At first, this may seem an odd sort of goal for neuroscience. Why analogy? Why seek vague metaphors instead of precise, direct, literal descriptions?

This is one of those questions that almost seems self-answering, once you look at it the right way; but it helps to understand a set of advances that took place in analyses of metaphors approximately thirty years ago.

The received view of metaphors – both in science and in language generally – had long been that they were convenient shortcuts, ways of compactly (if unreliably) expressing something that would require far more time and effort to express literally. It was believed that the role of scientific metaphors (such as "the atom is like a little solar system" or "planets curve space like balls on a rubber sheet") was pedagogical: they allowed scientists to express their complex technical ideas to students, or to layfolk who lacked the background required to understand the literal versions of the theories as expressed in definitions and mathematical laws. This paralleled the broader view of metaphors as primarily poetic devices, tools whereby one broad statement ("man is an animal") could, given a particular context, stand in for one or more specific ideas ("man is governed by instinct rather than reason," or "the human species evolved from non-human species").

Within linguistics, this view was first seriously challenged by Max Black (1962). Black argued for what he called "the interaction view of metaphor," as opposed to the "substitution view", which held (as above) that metaphors merely stand in for some long list of literal statements. The interaction view has three principal components:

1. "A metaphorical statement has two distinct subjects, to be identified as the 'primary' subject and the 'secondary' one ..."
2. "The secondary subject is to be regarded as a system rather than an individual thing ..."
3. "The metaphorical utterance works by 'projecting upon' the primary subject a set of 'associated implications,' comprised in the implicative complex, that are predicable of the secondary subject ..." (Black 1979).

In other words, metaphors work by transferring some of the implied properties of the secondary system onto the primary system. Later researchers extended this line of thought to show that metaphor plays a similarly ineliminable role not just in language but in thought more generally (Lakoff and Johnson 1980). According to these theorists, the very structure of much human thought is best thought of as metaphorical, in that it works by assimilating unknown systems to known ones and then exploring the extent and validity of the implicative projections.

Boyd (1979) took the "interaction view" into philosophy of science, in a way consistent with his emphasis on the historical and dialectical nature of science. The resultant model assigns metaphors a central and irreducible role in scientific discourse. According to Boyd, the open-endedness of metaphors is a virtue, for at least two related reasons. First, it allows scientists to put a name and tentative structure to some set of phenomena that they only vaguely understand: for example, the "atom as solar system" metaphor makes it possible to begin discussing and investigating electron "orbits" without committing researchers to any particular story about how exactly electrons are moving about the nucleus. And second, it allows metaphors to suggest directions for research, since negotiating the meaning of the metaphor requires working out which aspects of the systems do and do not correspond.

(Planetary orbits can decay – can electron orbits decay? If so, what happens when they hit the centre? Are there elliptical electron orbits? Do electrons nearer the nucleus orbit faster?)

Boyd presents the use of digital computer metaphors in cognitive science as an example of how the analogical links can be more fundamental than any of the properties that would be used to describe them. These metaphors can be traced back even farther, to Turing's original formulation of an analogical model for human computation. (See *figure 1* for examples from both eras.) For anyone familiar with mid- to late 20th century psychology, it seems impossible to deny either of Boyd's essential premises: that these metaphors provided the structure for most theorists' conceptions of the mind, and that they did so largely in the absence of any literal definitions of the concepts in question.

	from Turing	
idea	↔	physical symbol
thinking	↔	syntactic manipulation of symbols
thinking person	↔	Turing Machine (TM)
algorithm	↔	procedure implementable in a TM
complexity of a problem	↔	worst-case time/space required to solve a problem using the best TM program
	from cognitive science	
brain	↔	computer hardware
mind	↔	computer software or operations
thought	↔	information processing
memory	↔	information storage and retrieval
volition	↔	executive control
consciousness	↔	feedback or monitoring

Figure 1. Mind–computer analogies. Some of these elements went to make up different models, though no one model contained them all. For a contemporary list of computer metaphors that were current in the salad days of classical cognitive science, see Boyd (1979).

What can we conclude from this example regarding the role of NCCs? One clear lesson is that an analogy can be an important tool for developing our understanding of an abstract, mysterious domain. Neural analogies can help us to see new structure and distinctions within the realm of consciousness: for example, in the wake of anatomical localizations it has become a commonplace that spatial and linguistic reasoning are separate mental faculties. In my own experience, I found that learning that the olfactory system codes smells primarily by identity and similarity (rather than on some abstract set of axes like frequency or sweetness) helped me to better conceptualize the way that olfaction interacted with the other senses and with memory.

This role alone would make neural theories of consciousness worth pursuing ... but at the same time, one must suspect that something more is supposed to be at stake. After all, NCC theorists choose to investigate the brain because they assume that it is directly causally involved in consciousness, not just because its structure provides for especially handy metaphors. Shouldn't the fact that the mind is *made of* the brain make some difference here?

The historical limitations of the computer analogy provide at least the beginnings of an answer to this question. For all its metaphorical power, the computationalist approach in cognitive science relied on an assumption that was not borne out: the assumption that evolved, wet brains and designed, silicon computers were functionally equivalent at all the functionally interesting levels of analysis. As it turned out, the differences are just too deep and too pervasive to be ignored as matters of "implementation." The more we learn about the brain, the deeper the disanalogies seem to run: see *figure* 2 for a few examples. This does not mean that the original metaphor has lost its utility; but it now seems that we've run up against the *limits* of that utility, and consequently there is less confidence that new and interesting mental structure can be discovered by looking for parallels with known structures in the realm of formal computation. With respect to consciousness in particular, the prospects of developing a full-fledged model in terms of computer-inspired concepts such as "executive control" and "monitoring" now seem quite dim.

But again, is there any reason to believe that brain-based analogies will do any better? In particular, does the fact that we're made of neurons (and not of logic gates) make any difference?

I believe it does. To see why, it will be necessary to make one more brief detour, through the history of another field that has made extensive use of metaphors: the science of heredity. One way of understanding the novelty of Gregor Mendel's famous approach, published in 1866 and rediscovered in 1900, is to look at its metaphorical structure. (See *figure* 3.) Mendel reconceptualized the organism as a container, and its properties or "factors" (such as seed colour and shape) as independent objects within that container. This metaphor provided him with a simple and mathematically tractable "marbles in boxes" system whose dynamics mirrored the dynamics of heredity.

Brains	Digital Computers
Components are imprecise and fault-tolerant	Components are precise and fault-sensitive
Architecture is affected by activity	Architecture is fixed
Massively parallel processing	Serial or weakly parallel processing
No central timekeeper	Central timekeeper is essential
Processing mechanisms are content-specific	Processing mechanisms are general
Evolved primarily for sensorimotor integration	Designed primarily for symbol processing

Figure 2. A few brain–computer disanalogies

Organism	↔	container
Factor	↔	contents
Inheritance	↔	random pairwise mixing of contents

Figure 3. Mendel's analogy for heredity

The advantages and disadvantages of Mendel's metaphor strongly parallel those of the computer metaphor in cognitive science. It provided a way of formalizing heredity, opening the way for abstract, even mathematical treatments of the subject; it postulated a set of entities and dynamics which scientists could start looking for in real organisms; and it provided impetus to a number of research projects that can be understood as attempts to check whether, and how, various implied properties of the source domain could be extended to the target domain. At the same time, the source domain was *so* abstract that it made implementation seem utterly mysterious: how are the objects randomly assorted, what are they made of, and how are they transmitted by a sperm cell? In reducing the organism to a container, it also left no room for questions about the relations between heredity and development; as T H Morgan complained in 1909, Mendel's "factors" conflated the characteristics of the adult organism with their physical medium of transmission.

Morgan, whose background was in embryology, extended the reach of the model by redefining "factor" as first and foremost a physical entity that resided *in* the organism, was passed from parent to child, and guided the child's development. (Its precise physical identity was left open, though it was already assumed that hereditary material resided in the cell's nucleus, and Morgan eventually accepted the identification of factors with loci on the chromosomes.) This allowed him to integrate Mendel's organism-as-container metaphor with the organism-as-machine metaphor which had been gaining popularity among turn-of-the-century embryologists, and around the same time Wilhelm Johansen coined the term "gene" to refer to the other half of Mendel's original factor concept, the heritable trait of the adult organism. (See *figure 4*.)

Wilhelm Roux (1890s)		
Organism	↔	machine
embryonic development	↔	mechanical movement
hereditary material	↔	mechanical part
Thomas Hunt Morgan (1915)		
Factor	↔	mechanical part that guides assembly
inheritance	↔	division and duplication of above parts
Wilhelm Johansen (1910s)		
heritable trait ("gene")	↔	characteristic of complete machine
Watson and Crick (1953)		
DNA	↔	plan or blueprint
Development	↔	decoding and following plans

Figure 4. Further development of analogies for heredity

This finer-grained metaphor could now be used to pose questions about the physical basis of heredity and its relation to development, but there remained one major inadequacy. Nothing in the metaphor accounted for the way in which the hereditary material *guides* development so as to reliably achieve the same adult form. In 1930 it was possible (just barely) to imagine a machine that added parts to itself, but how could a machine – a physical system without intrinsic purpose, without teleology – rebuild its own missing parts in the right shape, or produce a tiny new machine that would grow into a duplicate of itself?

What was missing was the idea of *encoding*, the notion that form could be stored in matter without being literally expressed. The only familiar concept that had something like this structure was writing, and so early thought on this subject was dominated by the metaphors of written language and the "book of life" (Kay 2000). With the discovery of DNA and the elucidation of the transcription process[4], the metaphor shifted a bit to become one of *instructions* or *blueprints* to be read and followed by the organism-as-machine.

Despite its complexity, this extended metaphor – of a physical part containing a plan for the organism, a plan which is read and carried out by other physical parts – is perhaps the most successful scientific metaphor of all time. It has made accessible, even to the lay imagination, a system whose literal description is both extremely daunting and still far from complete. Anyone with a grade-school education can use the metaphor to discuss the phenomena of heredity – fallibly, to be sure, but with a reasonable chance of capturing at least some of the properties and dynamics that are central to genetics. And, in fact, the metaphor is now so fundamental to our thought about heredity that it has, in some respects, ceased to *be* a metaphor. Genes aren't *like* instructions, they *are* instructions; the body isn't *like* a machine, it *is* a machine (albeit a very complex and squishy one).

It's important to understand how this state of affairs developed. In its early days, the metaphor had to be a metaphor because the relevant literal concepts hadn't been developed far enough yet. One could distantly imagine a machine adding parts to itself, but there was no model or technical vocabulary for describing how this might actually be done. One could speak vaguely of development as the following of instructions by a machine, but there was no body of theory explaining how such machines would work or what the instructions would look like. The conceptual resources for describing these things came long after the metaphors that picked out the relevant dynamics.

This pattern has direct consequences for the evaluation of theories of consciousness. It seems likely that a mature theory of consciousness will require at least as much new conceptual apparatus as did our mature theory of heredity – and probably much more. If we accept (following Boyd) that metaphorical theories should be evaluated pragmatically, it becomes apparent that one very important pragmatic criterion should be the extent to which a theory is likely to drive the development of new conceptual resources. Theories that assimilate consciousness to another mystery (like the soul) are unlikely to do this; so, too, are theories which begin by declaring that consciousness is irreducible and basic, since this blocks the "decompose-analogize-reconceptualize" strategy which has proven to be such a powerful engine of conceptual development. A promising metaphor will be one that hints at finer-grained structure *within* consciousness, structure that can be explored and developed within the framework provided by the metaphor.

And this gets back, finally, to the "why the brain?" question. The problem with analogies like Turing's and Mendel's is that, in decomposing the target system functionally rather than mechanically, they sacrifice the open-endedness of the metaphor. A part *defined in terms of* its function neither stimulates nor permits the development of new conceptual resources, because it's already bound by its very definition into the old system of concepts. By contrast, a *physical* part can be picked out long before one has any good idea of what it does, and this provides a powerful stimulus for research.

Chromosomes played just such a role in the study of heredity. In the mid-19th century biologists using the best available microscopes reported that, during cell division, the nucleus could be seen to disappear and a mass of what came to be called "spindles" would appear in its place and then divide into two masses which became the sites of the new nuclei. By the 1880s, Walther Flemming was able, by fixing and staining cells at all stages of division, to show that there were persistent nuclear structures (the chromosomes) which were divided and distributed during this process. This strongly suggested that they played a role in heredity, and once Mendel's theory gained currency, scientists were quick to note the parallels between the behaviour of chromosomes during cell division and the Mendelian assortment of factors. A turning point in Morgan's work was when he concluded, around 1915, that the statistical patterns he was observing in his fruit fly work could be well-explained by the assumption that factors were laid out linearly along the chromosomes.

It seems likely that neurons will play a similar role in the study of consciousness. We know they're there, we know they're intimately related to mental activity, and we can observe their individual behaviour in detail – but yet, as any honest neuroscientist will admit, we have precious little idea what exactly they're doing on a larger scale, and this ignorance mirrors our ignorance about the fine structure of consciousness. As a result, NCC theorists are often in the position of *simultaneously* proposing novel analyses of consciousness and developing novel accounts of neural function to underlie them.

Let me briefly describe what I believe to be the most exciting example of this phenomenon. (For a fuller discussion of the technical details of these models, see the book by Banks, Farber and Churchland, forthcoming.) Perhaps the clearest and best-known case is the development of models which attempt to resolve the perceptual "binding problem" (Singer 1994; Llinás and Ribary 1994). Before much was known about the architecture of the sensory systems, it was regarded as relatively unproblematic that we could perceive whole objects *as* whole objects. There were Kantian questions about the types of structure that we impose on our perceptions, but the very *imposition* of structure wasn't seen as an especially challenging step in perception. Look at the organization of (say) the visual system, though, and things begin to get a bit puzzling: as it turns out, information about different aspects of the perceptual world (shape, colour, movement, even the presence of faces) is extracted in different parts of the brain and *never converges on any single area or small group of areas*; in other words, there is no "Cartesian theater," no central viewing screen in the brain. The question arises, then: How is it that we can put all these properties back together so as to have a unitary experience?

Christof von der Malsburg dubbed this puzzle "the binding problem," and it has been a substantial goad to empirical and theoretical progress. Though there is not yet a well-elaborated consensus solution, attention has focused on synchronous oscillation as a possible mechanism of binding. (See *figure 5*.) The idea here is that an integrated percept can be represented by the *synchronized* activity of neurons distributed widely across the brain. The parallels with the structure of subjective consciousness are sharp. These dynamically-bound "clusters" have an enhanced impact on associative processes such as memory, emotion and motor response, paralleling the way in which a conscious percept is more likely to drive such associations than is an object which is perceived but not consciously attended to (Edelman and Tononi 2000). Limitations on the number of available frequencies for synchronous oscillation mean that only a small number of objects may be simultaneously represented in this way, though each object may have many features associated with it (Singer 1994); this mirrors the severe limitations on our ability to consciously attend to multiple separate objects without grouping them into larger, aggregate objects.

Quale	↔	local feature representation
Image	↔	set of feature representations firing in synchrony
"core" or "general" consciousness	↔	approximately 40Hz oscillation sweeping across cortex ("binding wave"), driven by intralaminar nuclei of the thalamus
specific contents of consciousness	↔	feature representations firing in synchrony with binding wave
consciousness vs. unconsciousness	↔	presence or absence of binding wave
waking vs. dreaming consciousness	↔	ability or inability of sensory input to reset binding wave
memory, motor choice	↔	associations driven by the greater associative power of representations oscillating in the 40Hz band

Figure 5. Recent ideas about the neural correlates of consciousness. The above framework is my synthesis of related ideas proposed by Wolf Singer, Francis Crick, Christof Koch, Antonio Damasio, Gerald Edelman and (most centrally) Rodolfo Llinas. See text for references.

In some cases, this work has even led to novel results regarding the subjective nature of consciousness. Working backwards from theoretical implications of his particular model of synchrony-based binding, Rodolfo Llinás calculated that there should be a "temporal quantum" of consciousness: in other words, conscious experience should be divided into "chunks" of approximately 12–15 ms, and below this scale finer distinctions should not be possible. Subsequent experiments bore this out: if two fast "clicks" are played in succession, a subject will hear them as separate if they are divided by at least 13 ms, but will hear only one click (of normal duration!) if the two are divided by less than 12 ms. This distinction is also visible in the "resetting" once or twice of a trans-cortical 40 Hz oscillation wave that normally resets in response to each consciously perceived click. For this and other reasons having to do with the frequency of oscillations originating in the intralaminar nucleus of the thalamus (Joliot *et al* 1994), it now seems extremely plausible that conscious experience is "quantized" into discrete chunks of approximately 12.5 ms duration. This is an interesting discovery about the structure of conscious experience – admittedly, a modest one, but one which came not from introspection but from the elaboration of analogies between the structure of consciousness and the structure of the brain.

None of this is to suggest that consciousness should become the sole dominion of neuroscience, for the same reason that the brain should not become the sole dominion of consciousness studies: both systems should be approached using whatever resources help us to understand their respective structures in finer detail. But it has long been an (underacknowledged) problem that nobody has been able to offer a concrete model of what a successful theory of consciousness should *look like*; given the celebrated gap between the subjective and the objective, many have been tempted to declare either that some sort of revolutionary insight is required, or that we will never be able to find relations deeper than mere psychophysical correlation. The lesson I draw from history is that progress will require the gradual development of new conceptual resources, and we can expect much of that progress to be driven by theories which establish analogical relations between the structure of consciousness and the structure of the physical system in which it inheres.

Notes

1. The reader may be relieved to learn that in this case, despite the presence of a plausible mechanism, the correlation itself has not been observed: even fairly high levels of coffee consumption do not significantly increase the risk of heart failure in normal subjects.
2. John Searle (1997) exemplifies this approach in *The Mystery of Consciousness*: he surveys a number of scientific models of consciousness in separate essays, often with some excitement, but at the end of each one he winds up concluding more or less the same thing: that they've completely failed to address the fundamental question of "how the brain produces consciousness," and hence that "the mystery remains."
3. With the important addition that the neural structure is presumed to causally underlie the structure of consciousness, more will be said about this below.
4. Along with the development of information theory, itself a profoundly metaphorical discipline. Information theory has had a profound impact on the development of metaphors in the life sciences; for a brief discussion of this with respect to consciousness, (see Farber 2000). Kay (2000) gives an in-depth treatment of its role in genetics.

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Why consciousness cannot be deconstructed: Towards a positive theory of consciousness

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Abstract

The present paper concerns the construction of a positive theory of consciousness which can provide a method for understanding consciousness as a metaphysical reality. Scientists and philosophers have been grappling with the problem of consciousness for long as it is one of the most fundamental facts about the universe. But there has been no final understanding of the facts regarding consciousness. It is not known why there is consciousness at all and how it has been possible to be conscious beings on our part.

Sciences of the brain/mind have offered causal explanations of the how and what of consciousness. But they have failed to explain the why of consciousness. There have been attempts by scientists and philosophers alike to prove that there is no consciousness at all as a positive reality. Their claim is based on the ground that consciousness is causally supervenient on the material universe and that all conscious phenomena can be explained by mapping the physical universe. The resulting

picture of the universe is one of physical reality minus the conscious subjective reality of the mind.

My argument is basically to counter this picture of the universe. Admittedly the universe is more open-ended to accommodate conscious forces than the scientists are ready to admit. The fact of the matter is that consciousness is presupposed by the sciences themselves and the depth-structure of consciousness is still beyond the grasp of the sciences. Therefore philosophers are at pains to suggest that consciousness is a deeper metaphysical phenomenon and that it can be explained, but cannot be explained away by the known sciences.

In this paper I would like to argue for a theory of consciousness that can account for why consciousness is a deeper phenomenon and how it can be situated as a primary phenomenon in the universe. It is a fact that consciousness is manifested in the natural world and is associated with natural phenomena like language, physical behaviour, the human brain etc. But consciousness cannot be identified with any one of them, nor can it be derived from the natural phenomena themselves. Thus there is a gap between what consciousness is and how it can be explained in terms of its manifestations in the physical universe.

I would argue that consciousness can be understood independently of the material world with which it is associated.

1. Consciousness in the natural universe

There are two ways in which consciousness can be explained: one is the naturalistic way which makes consciousness intelligible as part of the universal natural order; the other is that which makes it intelligible as part of the higher order non-natural phenomena. While the first is how the natural scientists – psychologists and the neurophysiologists – generally explain the phenomenon of consciousness; the second method is how some philosophers approach the problem. It is the naturalistic way that has been the most successful so far because of the fact that scientific data have supported the general theory that consciousness is part of the natural order and that in itself is not very different from a sophisticated natural phenomenon. The brain sciences have shown that consciousness is causally conditioned by the brain and that the conscious phenomena are supervenient on the latter. However, it is still a mystery how consciousness is caused by the brain, that is, how a material object like the brain produces a characteristically different phenomenon called consciousness.

Philosophers raise the question: Why does consciousness appear at all in the universe? Given that there is a brain, it does not necessarily follow that there is consciousness. Scientists, however, claim that consciousness is a function of the brain that has emerged in course of the evolution of the universe. Even if the story of evolution of consciousness were true, it still has to be explained how this takes place in the absence of clearly established psychophysical laws.

There have been attempts to reduce the so-called psychological laws into the laws of physics and thereby to abolish the problems of consciousness altogether. But that has not satisfied philosophers because the problems of consciousness remain unsolved even when the problems of the physics involved are solved.

Consciousness is a deeper phenomenon. It is the "biggest mystery... the largest outstanding obstacle in our quest for a scientific understanding of the universe" (Chalmers 1996). Any easy explanation of consciousness leaves the problem as it is. Therefore there are no short-cuts to a genuine explanation of how consciousness arises in the universe.

2. The conscious centre of the universe

The most important feature of consciousness is its subjective character, that is, its belonging to the first-person (Searle 1994). This itself underlines the fact that we cannot understand the consciousness phenomenon without positing a conscious subject or an "I" which has the conscious experiences. The experiencer is not a material body or a physical system that produces the conscious states; it is the subject over and above the material system which causes consciousness. It is the non-material nature of the conscious subject that provides a clue to the mystery of consciousness.

Now the question is: What is the nature of the self or "I" which is the subject of consciousness? Is there any physicalistic explanation for the emergence of the self in the world? There is a physical and a biological way to explain how a particular organism comes into being. But can there be an equivalent method of explaining how the self comes into the world? The answer is obviously in the negative because even when every bit of my body is examined and explained, the mystery of the "I" still remains. The "I" is neither the body nor the psychological experiences attached to it; it is something more and is deeply metaphysical (Wittgenstein 1961).

The self or the subject of experiences constitutes the virtual centre of the universe precisely for the reason that it is from the point of view of the self that we situate the universe. That is, we construe the universe as "our universe" (Wittgenstein 1961), because we weave a mirror-image of the universe out of the fragments of our mental experiences. This I-centric point of view or the "first-person point of view" is the unique feature of human consciousness.

The I-centric nature of consciousness does not preclude the possibility of a third-person point of view but cannot be replaced by the latter. The objective world-view or the "the view from nowhere" (Nagel 1986) sits ill-at-ease with the first-person point of view for the reason that subjective experiences are inalienable from the universe. The cosmo-centric world-view has to accommodate, nay, yield primacy to the I-centric world-view in order to facilitate our understanding of consciousness.

The bridge between the self and the universe is thus at the core of the phenomenology of consciousness which the philosophers offer as an alternative to the scientific explanations of consciousness. While the sciences in general offer an easy solution, the philosophers offer a better model of taking consciousness more seriously (Chalmers 1996).

3. Evolution of consciousness

As already indicated, there is a way of explaining consciousness as an evolutionary phenomenon. Scientists as well as philosophers have sought to explain consciousness as emerging out of the material matrix of the universe (Morgan 1923; Broad 1925). This approach has yielded results showing that consciousness is a late arrival in the evolutionary process of the universe. Besides, it has been shown that consciousness has properties, which are supervenient on the properties of the material world.

The supervenience thesis argues that the material universe remaining what it is in its basic structure, the mental properties can be predicted. That is, the mental properties have a supervenient base in the material stuff of the universe (Kim 1984; Horgan 1997). Supervenience is thus determined by the nature of the dependence of the mind on the material world. This dependence can be characterized by strict nomic necessity depending upon whether the mind is caused by the material world or only conditioned by the latter.

In any case the evolutionary view of consciousness does not explain how the unconscious material world can give rise to the conscious mind. If the universe is inherently material in nature, it cannot allow for the conscious mind to emerge. Besides, if the universe is materially closed, it cannot make room for consciousness as an independent phenomenon.

All that the emergenist view can argue for is that consciousness is deeply embedded in matter and that through a mapping of the natural universe we can predict the emergent mental properties of evolving natural organisms. But the fact of the matter is that no amount of mapping can predict what the mental properties of the organisms will be. It is an open question what conscious phenomena the organisms will have at any particular stage of evolution of the universe. Thus there is no natural necessity about the occurrence of mental phenomena because it can be imagined that the material world remaining the same, there is no conscious phenomenon at all.

If the evolutionary view of consciousness is valid, then there is no reason why evolution should stop at the emergence of the mind only. It can go further and produce the supermind. But the materialist world-view offering a deterministic evolutionary scheme of things denies the possibility of supramental consciousness. This leads to the paradox of evolutionism. If it is true then it denies its validity, that is, it proves that materialism is false. The evolutionary view of the universe embedded in materialism is thus bound to fail because it is based on unacceptable premises.

4. Why supervenience does not work

Supervenience as a relation between matter and consciousness does not work for the reason that it does not specify how exactly material conditions prevailing in the universe determine conscious states. The fact that material properties are associated with mental properties does not make the relation between the two types of properties clear. First of all, there is no logical identity between the two and so they do not share a common logical structure. Even the hypothesis of a contingent identity (Smart 1959) does not make sense in the absence of any solid proof that the conscious states are exactly the same as the brain states. Since identity fails, supervenience is supposed to be the next best alternative for explaining the relation between matter and mind, that is, between the brain and the states of consciousness. Supervenience seeks to bridge the gap between the two by incorporating psychophysical laws into the natural order (Chalmers 1996).

However, it is arguably true that no logical supervenience is possible because we can imagine possible worlds which are identical with our world in their material structure and yet do not have conscious phenomena at all. That is, consciousness cannot be guaranteed in every possible world which is materially identical with ours (Chalmers 1996). Therefore the only alternative to logical supervenience is contingent or natural supervenience that claims to postulate supervenience of conscious states on brain functions. The natural supervenience thesis intends to explain consciousness as causally dependent on the material body because of the presence of psychophysical laws in the universe.

The natural supervenience thesis is likely to fail because there are no psychophysical laws in the universe (Davidson 1980). If there were such laws possible, then we could have mapped the nature of consciousness by understanding such laws. But we have not so far succeeded in understanding the phenomenon of consciousness in its true nature. This therefore establishes that we have not discovered any bridge between consciousness and the material world.

5. Why consciousness cannot be deconstructed

The heroic attempt to deconstruct the mind and consciousness (Churchland 1984; Dennett 1991; Stich 1996) does not lead to any concrete results because consciousness can in no case be eliminated. All elimination strategies are built upon the assumption that consciousness is a product of the material causes in the brain. This does not sound coherent because the functions of the brain can only logically cause other brain states and not the conscious states which are different from the brain states. The conscious states have certain properties which cannot be traced back to the brain states. Therefore we have to admit a gap between the functions of the brain and the conscious phenomena.

Elimination of the conscious states into brain states fails because conscious states are themselves presupposed rather than explained by the deconstruction procedures. The latter are designed to make consciousness redundant in the universe. The standard argument in all such cases is that mind makes no difference to the universe and that it is causally inefficacious. This argument is obviously false because the mental states are not redundant and in fact they are inalienably there in the universe. Besides, mental states do make a difference to the world as evidenced in human thoughts and actions. Thus every attempt to eliminate the mind reiterates its presence.

The states of consciousness demand autonomy in the sense that they can be treated independently of the physical universe. The possibility of autonomy is open in view of the fact that the conscious mind is real and that it is different from the material world. The conscious mind is nested in the material universe and yet does not belong to the causal history of the physical world. It is *sui generis*. This may lead to dualism. But that presents to us the real state of affairs in the universe because consciousness is posited against the physical universe in all our understanding of the universe.

6. Primacy of consciousness

The crux of the matter is that consciousness is a primary fact about the universe. It is a fact of a higher kind because conscious states arise only against the background of the material universe. The universe in that sense houses consciousness but cannot causally situate it. The conscious subject introduces an element of surprise into the universe; the universe cannot account for it and yet the subject is a central fact about it.

The primacy thesis defended here presupposes that there is already consciousness in the universe and that it is ontologically primary to all other entities in the universe. This primary datum is sometimes called mind or intelligence scattered throughout the universe. From this primary intelligence has arisen the concept of self or the subject as a manifestation of higher consciousness. It is the possibility of higher consciousness that makes the mind superior to the material conditions which provide the background for the conscious mind.

The conscious mind thus (1) has an irreducible non-materiality about it, and (2) can generate new forms of consciousness. Because of its non-materiality it remains unaffected by the material universe and its causal forces. As a creative self-evolving phenomenon the conscious mind retains a trans-material dimension that makes consciousness autonomous.

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Genetics, first-person methodologies, and the "hard" and "easy" problems of consciousness

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Abstract

The completion of the Human Genome Project promises to be of great value in helping us understand all aspects of human existence, including human consciousness. Human consciousness is essentially a subjective phenomenon, however, so to be really useful here the "third-person" (objective) knowledge of genetics must be complimented by "first-person" knowledge of consciousness gained from within. Unfortunately, however, the scientific study of consciousness is still quite primitive. While our physical sciences in general, and genetics in particular, employ highly sophisticated, objective investigative methodologies, the subjective methodologies used in the scientific study of consciousness are generally still quite primitive, often relying merely on simple, commonsensical sorts of introspection. Eastern meditation traditions, on the other hand, have been employing sophisticated meditation techniques to explore consciousness for many centuries. Study of their techniques is thus a natural beginning point for developing the first-person approaches needed by a genuine science of consciousness. More than two thousand scientific studies using such methodologies have

now been completed, and it is clear that some of the methodologies are capable of producing significant results. Developing a sophisticated science of consciousness may thus be a real possibility.

This possibility, together with the results of the Human Genome Project, in turn suggests that it may be possible to identify the physiological underpinnings of the deepest structures and dynamics of human consciousness. This would clearly be a major advance in human knowledge. Nevertheless, it would at best resolve only the so-called "easy," correlational problems of consciousness. The "hard" problem of explaining the very existence of consciousness in a material universe would remain untouched. This latter, "hard" problem is often held to be unsolvable in principle. Reflection on specific procedures and claims from texts of ancient meditation traditions, however, indicates that the difficulty in solving this problem is only an empirical, and not an 'in principle' one. Nevertheless we cannot at present perform the relevant experiments.

1. Introduction

"The Human Genome Project" has recently been completed, at least in rough outline. This is a milestone in human knowledge. With it comes the possibility of explaining all sorts of facts about humanity, including our evolution, kinships, morphology, metabolic processes, and behaviour. Indeed, it might seem that we are on the threshold of being able to explain, at least in principle, every aspect of the human organism. When we turn our attention to human consciousness, humanity's most distinctive feature, however, we find some unique difficulties. The first of these involves the current lack of a well-developed science of consciousness. The second involves the distinction between the so-called "hard" and "easy" problems of explaining consciousness.

2. The present and potential contribution of genetics

Modern science takes it as given that our consciousness is a product of the activities of our nervous systems. Consciousness itself, however, is a subjective phenomenon. Thus there are two main sides to the study of consciousness. The first involves examination of the subjective phenomena of consciousness as known through the reports and other activities of conscious individuals. The second involves examination of the physiological causes and correlates of consciousness and its contents. The completion of the Human Genome Project has enormous significance for this latter aspect of consciousness studies, for it promises to help us identify the physiological structures and processes that underlie every type of human consciousness.

Behavioural geneticists look for direct correlates between genes and particular sorts of behaviour, and by implication in the case of humans at least, conscious awareness as well. Some striking correlations have already been found between the presence and/or absence of individual genes and gross behaviour in a few primitive organisms (e.g., sexual preference in fruit flies, aggregate feeding in microscopic worms). And it is well-known that there is a significant genetic component to a number of features of human consciousness such as colour vision and intelligence, even where (as in the case of intelligence) the underlying particulars of nervous system structure and functioning remain completely unknown.

Very few such direct correlations between genes and human consciousness have so far been found, however. This should not be surprising. The human genome has only recently been largely decoded, and we still have almost no knowledge of what the bulk of the sixty thousand or so genes it contains, actually do. Furthermore, the brain and human consciousness are both extraordinarily complex. Indeed, it is often said that the number of potential connections between neurons in the human brain is comparable to the number of primary particles in the universe. Moreover, we at present have very little detailed knowledge of the relationships between our genome and the micro- and macro-structures and processes of the brain. But even if our knowledge of these relationships were complete, this by itself would not tell us much about human consciousness. This is because understanding the relation of these physical structures to our conscious experience requires that they be correlated with components and activities of consciousness that experimental subjects have to identify subjectively from within their own awareness. And this sort of identification raises some severe empirical scientific problems.

The problems I have in mind are not the well-known philosophical ones raised by people such as Wittgenstein and B F Skinner. They are instead purely practical, scientific ones that derive from an asymmetry in the ways the objective and the subjective components of psycho-physiological correlations are identified. Researchers regularly use sophisticated "third-person" (objective) methodologies (EEG, fMRI, electron microscopy etc.) and theories to identify the typically unobvious components of the physical correlates of subjective experiences and processes. But the experiences themselves are generally quite ordinary, easily recognizable subjective phenomena (visualizing a simple shape, remembering a sequence of terms, willing the motion of a limb etc.) chosen in the absence both of any deep theory of consciousness and sophisticated "first-person" (subjective) investigative methodologies. In short, this sort of work is a blend of sophisticated third-person neuroscience with what amounts to crude "Aristotelian" first-person investigations of consciousness itself.

Such work of course is quite necessary, but it is also necessarily preliminary, and given the extraordinary complexity of human awareness, necessarily rather hit-and-miss. Thus there is no reason to expect great progress in identifying, much less explaining, the deep structures and dynamics of consciousness in this way. Adding the results of work in genetics to this mix cannot in itself be expected to do anything to alleviate the problematic asymmetry. What is needed is a genuine, sophisticated science of consciousness, utilizing sophisticated theory and exploratory methodologies rather than mere commonsense introspection. Only then might we reasonably expect significant results to emerge systematically from correlational studies. How such a science might be developed is not a trivial question, and we will return to this topic later. But first let us turn to the distinction between the so-called "hard" and "easy" problems of explaining consciousness.

3. The Hard problem

The so-called "easy" problems of explaining consciousness we have been discussing so far are the problems of identifying what the physical correlates and conditions of consciousness are. These problems, of course, are not at all easy, as we have seen. Indeed they are extraordinarily difficult. But they are also very different from those that comprise the so-called "hard" problem. For this latter problem is not concerned with the empirical task of discovering physical correlates of and conditions for consciousness, but the conceptual one of explaining why in a material universe consciousness should ever exist at all. And this problem turns out to be so difficult that it is often held to be insoluble *in principle*, making the first seem "easy" by comparison (Shear 1997).

Why should the problem of explaining the existence of consciousness be so difficult? Modern science as it has developed over the past several centuries is straightforwardly materialist. The universe is conceived of as fundamentally physical, beginning with a "big bang," and evolving over billions of years before consciousness appeared. Consciousness on this view is a very recent product of a long sequence of purely physical processes. There is good reason, of course, for the physicalist orientation of modern science, for it has proven enormously successful in explaining all sorts of phenomena that once seemed to require non-physical elements for their explanation. The list ranges from "acts of God" such as lightning, floods and earthquakes, to biological processes such as metabolism, evolution, reproduction and the very processes of life itself. Organic chemistry, molecular biology, and genetics have all played major roles here, and the results of the Human Genome Project promise to contribute even more to our understanding. Nevertheless the existence of consciousness poses unique difficulties for this physicalist explanatory programme.

Physics is generally taken as the paradigm for the objective sciences, and it is widely held that all natural phenomena ought, at least in principle, to be describable and explainable in terms of an ideal, complete science of matter. There are of course technical problems with this view, including those arising from paradoxes in the theories of quantum mechanics. But for the purposes of our discussion let us simply take it for granted here that the modern scientific view is physicalist, and that physics gives us our clearest notions of what it is for something to be physical. The first thing we should note is that physics describes the world purely in geometric terms, that is, in terms of shape, size, position, time, fields and dynamic potentials for spatio-temporal entities defined in this way to influence other such spatio-temporal entities. The second thing to note is that it does this without referring at all to the subjective qualities – such as colours, sounds, tastes, feelings, hopes, etc. – that constitute the bulk of the contents of our ordinary awareness. Indeed, such subjective entities, called *qualia* in the contemporary jargon – appear so different in kind from the contents of the theories of physics that it does not seem possible for purely physical theories even to describe, much less imply or explain, them. For nothing that one says about actual and potential transformations of purely colourless, soundless, tasteless shapes will by itself ever imply the existence of even a single colour, sound or taste, much less the rich diversity of our subjective experience. In technical language, purely topological (spatial) concepts will never imply the existence of *qualia* (subjective experiential qualities).

This is not to deny, of course, that purely physical theories can identify the physical conditions for the existence of qualia, such as, for example, the experience of a colour or a sensation of joy. Indeed, this is precisely the sort of thing that neurophysiological research often does. But, as we saw, this work is essentially correlational and requires the existence of conscious experiencers to report the relevant subjective experiences (colour, emotion etc.). Without such reports there would be nothing to correlate with the neurophysiological parameter, and they would remain mere descriptions of physical processes, yielding no knowledge of even the mere existence, much less the experiential nature, of qualia at all.

A simple thought-experiment adapted from one originally devised by the philosopher Frank Jackson should make this clear. Imagine a neuroscientist, Mary, who, although entirely colourblind herself, knows all the physical science there is to know about how the central nervous system processes colour vision. That is, she knows everything there is to know about the interaction of wavelengths of light with the human optical system, including the neural processing of the effects of interactions with these wavelengths on the retina, the optic nerve and the brain as a whole. None of this purely physical knowledge, however, would tell her what it is like to see blue, or the contrast between red and green, or to enjoy the colour play of a Kandinski painting at all.

For this requires a kind of knowledge that lies entirely outside the realm of the purely physical sciences, and comes only with direct experience of the relevant qualia. Purely physical theories, no matter how complete they might be, by themselves neither say nor imply anything at all about the purely subjective quality of such phenomena.

This however makes consciousness scientifically utterly problematic. If, as many believe, the theories of physical science are in principle able to account for all objective phenomena, then the existence or non-existence of consciousness would make no difference at all to anything in the objective world, since all objective phenomena would already be accounted for. In other words, the presence or absence of consciousness would make no difference at all to any material process. This of course would make it impossible to give any scientific explanation of the existence of consciousness. Thus, for example, it would be impossible to give any biological evolutionary account of consciousness. For if all animal and human actions are already accounted for without reference to consciousness, consciousness could serve no purpose, and therefore no evolutionary purpose, at all. As the philosopher David Chalmers put it, such considerations would appear to make it impossible to answer the question of why everything in nature does not go on completely "in the dark," that is, without the existence of any consciousness at all. On the other hand, the existence of consciousness is rationally undisputable; it is an obvious, indeed perhaps *the* most obvious, feature of our existence. So the problem of not being able to explain consciousness is not just a problem about consciousness, it is a problem directly confronting the enterprise of science.

It might at first seem odd that science should have developed in such a way that it is incapable of accounting for the conspicuous existence of our everyday awareness. From a historical perspective, however, it is not hard to see something of how this has come about. One of the most basic needs of scientific method is to distinguish objective fact from subjective bias. Another is to formulate theories as precisely and testably as possible, and this has led to the extensive mathematization of scientific theories. As a result scientists, in accord with Descartes' proposal centuries ago, have generally come to remove as many features of consciousness as they could from their descriptions of the objective world, and to describe it as much as possible in exclusively mathematical, qualia-free terms. Thus, ironically, having worked for centuries to remove elements of consciousness from the content of its theories, science is now faced with the problem of accounting for what it has removed.

One more difference between consciousness and the physical world that is often taken to contribute to the hard problem is worth noting here. Consciousness, in addition to being qualia filled, appears to be non-spatial, and non-spatiality contrasts strongly with our basic notions of the objective world. It makes no sense to ask if one's hope is to the left or right of one's understanding of a theorem of mathematics, or if an itch is above or below the location of a fanciful dream one had last year. Thus, while many of the contents of consciousness, including in particular our perceptions of the world, can be organized spatially, it is clear that many of them cannot, and consciousness, taken as a whole, does not appear to be spatial in nature. The objective world appears by contrast to be spatial through and through, as Kant pointed out. For in our ordinary understanding all of its contents are necessarily organized in a spatial fashion. And it is very difficult to understand how something thoroughly spatial, that is, the physical world, could give rise to something so non-spatial as consciousness.

Now let us note some of the basic responses to the hard problem. One is to point out that, as we mentioned above, solid scientific explanations have been developed for phenomena that were once held to be *in principle* outside the grasp of scientific explanation. It was once held, for example, that "celestial phenomena," that is, the phenomena of the heavens, obeyed different laws than the terrestrial, and that earthly scientific laws would never be able to explain the movements and nature of the planets, sun and stars. Newton's work overturned this, and modern astrophysics and space exploration have made its rejection complete. It was also once held that life processes such as respiration and reproduction were intrinsically beyond the grasp of materialist science, and required reference to some kind of non-material "life force." Now the scientific community is virtually unanimous in holding that organic chemistry, molecular biology and genetics have made it apparent that whether or not such a "life force" exists, reference to it is completely unnecessary to account for the observed phenomena. Thus our past experience with the ability of science to explain phenomena seemingly in principle outside its proper domain suggests that the same thing should happen with the phenomena of consciousness – that is, that consciousness, too, will come to be explained scientifically.

This response, insofar as it suggests that the hard problem of consciousness will in time come to be resolved within the framework of objective scientific theory as we know it today, by itself seems to me to be inappropriate. Analogies from the past cannot help us much here. For they all involve objectively observable spatial phenomena coming to be explained by more advanced objective, spatio-temporally articulated theories. Thus, in all the past examples *both* the phenomena to be explained and the theories that have explained them are objective, spatio-temporally defined and qualia-free. Yet the hard problem is one of explaining *subjective*, *non*-spatio-temporal, qualia-*filled* phenomena in objective, spatio-temporal, qualia-free terms – a different kind of problem entirely. As a result, the simple-minded response of "Don't worry, science will ultimately resolve this hard problem, too," is as it stands little more than an act of faith ignoring the specific problems involved.

There are, to be sure, other, more radical responses to the hard problem, responses that take the problem more seriously and try to meet its challenges head-on. These include, among other things, suggestions (i) that we need to include consciousness as a fundamental property of the universe along with electromagnetism, gravity etc., (ii) that quantum mechanics has transformed our scientific notions of matter in a way conducive to resolving the problem, and (iii) that we will need deeper knowledge of consciousness, based on systematic first-person methodologies, before we can even understand the full implications of the problem. In other words, the problem may well prove to be amenable to scientific resolution, but this resolution will require some major changes in our basic scientific paradigm of the world, and/or significant expansion of our notion of what constitutes appropriate methodologies for studying consciousness scientifically.

4. First-person methodologies

A genuine science of consciousness will, as we saw earlier, surely requires development of sophisticated first-person scientific methodologies. We do not, however, need to begin the task of developing such methodologies entirely *de novo*. Asian cultures have worked for many centuries on developing systematic meditation procedures for exploring the subjective domain of consciousness and analysing their results. Many meditation traditions, for example, report systematically evokable experiences of what they hold to be the ground and basic structures of consciousness. Such claims, if true, would be directly relevant to the questions both of developing a science of consciousness and of the so-called "easy" problems of consciousness that we have been discussing. Other experiences and claims, as we shall see, will also prove to be relevant to the "hard" problem. Western researchers accordingly have over the past half-century begun to investigate various Eastern meditation procedures and their reported results, and perhaps two thousand psychological, physiological and behavioral studies of meditating subjects have by now been published in scientific venues.

The results of these studies have not been entirely consistent, however. Given the newness of the field and the large number of very different meditation procedures involved, this should not be surprising. The earliest studies generally examined small groups of individuals, or even single individuals, so questions of individual variance could not be adequately addressed. And the early literature reviews often tended to lump all sorts of meditation procedures together and look for effects of "meditation" in general, ignoring the fact that the very different types of procedures studied might well be expected to have different effects on any particular variable. Such simplistic reviews naturally failed sometimes to find any significant effects at all from "meditation" considered generically. More discriminating analyses were clearly called for.

When enough individual studies became published in the scientific literature, it became possible to make more discriminating analyses, using the sophisticated techniques of "meta-analysis" designed specifically to clarify the results of multiple individual studies by separating out individual causal factors, enhancing statistical power, and reintegrating the data. A number of meta-analyses examining studies of the most widely researched meditation procedures has now been published. These procedures include, in particular, the Transcendental Meditation (TM) technique from *Advaita Vedanta* as taught by Maharishi Mahesh Yogi, several Zen Buddhist techniques from Japan and China, and the "Relaxation Response" procedure put together by Herbert Benson at Harvard. The results of some of these first meta-analyses will, I think, prove both informative and suggestive.

One of the earliest and most basic questions asked by researchers is whether there is any reason to believe that meditation procedures have any real, objectively measurable effects at all. Since meditation traditions around the world claim that meditation can significantly reduce overall metabolic activity, even to the extent of producing cessation of perceptible respiration, physiological parameters are a natural place to begin. More than forty studies of meditation practices and respiration describing reduction of oxygen consumption, CO_2 elimination, and respiration have by now been published in the scientific literature. In an early literature review of such research published in the *American Psychologist*, Holmes (1984) concluded that meditation does not differ significantly physiologically from simple eyes-closed rest. Three years later, however, Dillbeck and Orme-Johnson (1987) published a careful meta-analysis in the same journal that examined different procedures and types of procedure separately and came to a different conclusion. Since the majority of published scientific studies used the TM technique, either alone or in comparison with others, the authors focused on this procedure. The data from the thirty-one relevant studies showed significant larger effect-size than eyes-closed rest for basal skin resistance, plasma lactate, and respiration. This result indicated that something objective was in fact taking place, and that at least some meditation techniques are capable of producing metabolic and respiratory effects in the direction described in the traditional literature.

The traditional literature also, as we saw, makes claims about respiration that go quite beyond this. For we often find claims to the effect that in the deepest state of meditation, where the meditator experiences what can be called "pure consciousness" (the simplest state of awareness with no sensations, thoughts, feelings, or even sense of extension etc.), perceptible respiration becomes entirely suspended. Several studies now provide support for this claim as well. Badawi *et al* (1984), for example, report very high correlation ($p < 10^{10}$) of respiratory suspension (as indicated by "flat-line" pneumotachygraph tracings) with reports of episodes of pure consciousness experiences in meditation (as indicated by button pushes during meditation by advanced TM practitioners).

Research on pure consciousness and respiratory suspension involving multiple subjects has, to my knowledge, to date been conducted on only one technique, the TM technique. The studies of this one technique nevertheless have larger implications. In the first place, they clearly support the claim found in the literature of diverse meditation traditions (Yoga, Zen, Taoism etc.) that respiratory suspension is a physiological correlate of the experience of the completely settled state of pure consciousness. Indeed, it would strain credulity to think that so many different traditions, developed in different cultures, and with different, often conflicting metaphysical beliefs, would correlate the same unusual physiological state (respiratory cessation) with the same equally unusual experience (pure consciousness) except on the basis of actual observation. The cross-cultural commonality of the experiential reports also strongly suggests that they reflect the natural experiential correlate of this unusual physiological state, rather than somehow being congruent products of different techniques and diverse, often conflicting, beliefs and cultural factors. In short, the research on this technique directly supports the claims that it is possible to experience a completely settled, contentless state of awareness accompanied by respiratory suspension, as reported in the literature of diverse meditation traditions. Of course, questions of which procedures can produce this experience on what particular populations, and over what time frames, remain to be determined.

Another claim commonly made by meditation traditions is that successful meditation can produce positive psychological effects. Many studies have now been done in this area as well, enough for some meta-analyses to have been published. A meta-analysis by Eppley *et al* (1989), for example, analysed relevant studies on reduction of trait-anxiety, one of the most reliable measures in clinical psychology. Another by Alexander *et al* (1991) evaluated studies of self-actualisation, the most widely reported construct of positive psychological outcomes in the meditation literature. In both cases the results indicated that the TM technique had an effect size significantly greater than placebo (two and three times that of placebo for trait-anxiety and self-actualisation respectively), with other procedures and groups of procedures generally having effect sizes comparable to placebo.

The difference between the effect sizes associated with the TM technique and those of the other procedures studied needs to be accounted for. Perhaps it is a product of the standardization of the TM technique and training of instructors, and the general absence of such standardization for the other procedures studied; or perhaps the relevant factor could be the mechanics of the various procedures themselves. In any case, even if most of the procedures studied so far do not appear to produce results on enough people quickly enough to be distinguished from placebo, this does not indicate that significant results are not produced by a wide variety of procedures. Indeed here, as in the case of pure consciousness and respiration, the results suggest that the claims of reduction of anxiety and growth of self-actualisation found in a wide variety of traditions must have some basis in fact.

5. Meditation-related research and the "Easy" problems

Let us now take it as given that some, if not many, traditional meditation procedures are capable of producing experience of pure consciousness, and speculate about the significance this might have for consciousness research in general. Many meditation traditions claim that this experience of consciousness in its simplest, most settled state can not only be experienced but also be used as a platform for uncovering and exploring the most fundamental structures and dynamics of consciousness in general. Two analogies might help make this claim seem somewhat plausible. The surface tension, ripples and subtle fluctuations that give rise to gross wave activity are clearly more isolatable and observable in a quiet body of water than one filled with waves. Moreover a common strategy for studying the properties of new substances is to isolate them in their pure state, introduce simple inputs, and evaluate the way the substance reacts. Not surprisingly, both silence and interaction with simple inputs are emphasised in the research strategies of various Eastern meditation traditions. Tibetan Buddhist *Shamata* practice, for example, emphasises the use of completely settled consciousness for exploring the nature of consciousness, as does the *Yoga Sutras* of Patanjali (1957). And the *Yoga Sutras*, the basic text of Yoga, devotes one of its four chapters to *samyama* procedures designed to allow the settled state of consciousness to interact with selected simple inputs in order to display details of the nature of consciousness. Such traditions then often go on to claim that consciousness has a universal deep structure and dynamics discoverable by such methods. Unfortunately, however, the catalogs of fundamental structures and dynamics described in different Eastern systems are, to put it mildly, often less than completely consistent, although there are many points of congruence as well. Thus plausibility is one thing, reality is another, and established fact another thing yet.

Evaluating the many traditional procedures and theories scientifically will require careful research. Ideally such research should employ highly trained meditators from different systems conducting internal explorations using appropriate "blind" protocols, such as the meditators' exploring without prior knowledge of particular experiences and structures supposed to exist and be discoverable within (or not) by the theories of different systems. Carrying out such research would be a major undertaking. But the results could really be worthwhile. For if the ancient accounts are even roughly correct, it could open the possibility of uncovering a detailed map of the fundamental structures and dynamics of consciousness – the "genome" of consciousness itself, so to speak. And this, together with the results of the Human Genome Project, could be expected to contribute greatly to the so-called "easy" task of locating in detail the biological mechanisms underlying the basic contents and dynamics of human consciousness.

6. Meditation and the "hard" problem

We are of course nowhere near uncovering any such "genome" of human consciousness. And even if such a "genome" of consciousness were to be discovered, this by itself would bring us no closer to resolving the "hard" problem of explaining how consciousness could even exist in the universe. This will require something more radical. One such radical response, as we saw, is to suggest that we need to include consciousness as a fundamental property of the universe. This response has taken several forms. One argues that the intractability of the hard problem itself shows that consciousness needs to be included as a fundamental property of nature. Another argues that consciousness is in some sense prior to matter, because it is needed for the quantum-mechanical "collapse of the wavefunction" that gives rise to matter. A third comes to similar conclusions from considerations of the nature of knowledge.

Each of these suggestions has serious contemporary defenders who offer forceful arguments in their support. But they all suffer from the major difficulty that they are grounded entirely on very theoretical considerations. Thus, even if the hard problem, the nature of quantum mechanics, and the nature of empirical knowledge, each separately actually does imply that consciousness must be inferred to be a fundamental property of nature, the inference remains just that – a theoretical inference. Indeed, even if one finds this inference conceptually appealing, psychologically it is opposed by the weight of both the enormously successful materialist paradigm of modern science and well-known universal factors of human cognitive development. It is also clear that there is at present nothing even remotely resembling consensus that this inference is required on any one of the above grounds, much less all three together. Resolving the hard problem clearly requires something more.

The hard problem is a problem of explaining an empirical fact, the existence of consciousness. Thus to be really convincing, an explanation should be well-supported empirically as well as conceptually. But it is hardly obvious how one could go about demonstrating scientifically that consciousness is a fundamental feature of nature. Clearly the world does not *look* that way. Ancient meditation traditions, however, suggest some interesting approaches here. For many of these traditions base their claims about consciousness as a fundamental, all pervading feature of nature on reports of how the universe is said to be experienced by advanced practitioners in "higher" states of consciousness with sufficiently refined perceptual abilities.

Such experiences might at first glance seem to be just what is needed to support the above sorts of inferences about the relation of consciousness to the objective universe, and ancient texts (and contemporary accounts) leave little doubt that psychologically speaking they do prove quite convincing. But from a scientific perspective much more is needed. For by themselves such experiences provide no evidence that they are anything more than remarkable – if remarkably satisfying – artifacts of the individual experiencers' nervous systems. The claim that consciousness is the ground of the universe is a claim of objective fact, supposedly true independently of individual subjective perspectives. Establishing the truth of this claim therefore requires objective data, evaluatable independently of the existence of these unusual individuals' assessments of their own experiences.

Once again the hard problem might appear empirically intractable. But if we dig a little deeper into the traditional meditation literature we also find descriptions of procedures that suggest that the claim in question is, in fact, empirically testable. For in addition to holding that consciousness is a fundamental, pervasive feature of the objective universe, they also often maintain that procedures exist for interacting with the field of pure consciousness within and obtaining knowledge of any given objective fact about the universe whatsoever. If this latter claim were true, it would be possible for a suitably adept practitioner to use the relevant procedures (e.g., from the *Samyama* chapter of the *Yoga Sutras*) to go within and come out, for example, with knowledge of events outside of what physicists call "the light cone." That is, one could gain objectively evaluatable knowledge of events which according to relativity lie too far away to be known at that time and place (such as, knowledge on earth of sunspot activity that occurred less than eight minutes ago). Such experiments would be easy to design. And if they turned out positively, they would provide striking objective support for the thesis that the "pure consciousness" experienced within either was, or was at least in intimate contact with, something radically more fundamental than matter as modern science understands it.

Unfortunately, however, accomplished practitioners capable of such performances do not appear to be available for such experiments, either because they do not exist, or they are unwilling or uninterested. Nevertheless, the above "thought experiment" shows that the hard problem of explaining consciousness need not be intractable in principle as often thought.

7. Conclusion

Let us return from these imaginative flights and draw some practical conclusions. The science of genetics is at the forefront of our human sciences, and the success of the Human Genetics Project show how deep such knowledge can become. This success also highlights the need for comparable efforts to develop a genuine science of consciousness, the most important aspect of our uniquely human nature. It is also clear that sophisticated first-person investigative methodologies are going to be needed if we are to have any reasonable chance of unfolding knowledge of consciousness in the deep way that genetics is unfolding knowledge about the physical side of human nature. The centuries of work of Asian meditation traditions in developing and using systematic procedures for exploring the deep structure and dynamics of consciousness should prove most useful here. Some serious scientific work evaluating these procedures has already been done, and much more is needed. It is worth noting that ancient meditation traditions suggest that it may be possible to develop something comparable to knowledge of the human genome, a "genome" of consciousness. Such knowledge would obviously have enormous practical as well as theoretical usefulness.

So far, everything we have said about a potential future science of consciousness has been in terms of its intellectual value. Its greatest value however, it seems to me, would be in terms of how it might help us understand human fulfillment, individual and collective, and attain it to the maximum extent possible. Here, too, I think, ancient meditation traditions can give us direction. Indeed some relevant research has already been done here as well. But this is another topic altogether.

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Consciousness expanded

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Abstract

Many kinds of human states of consciousness have been distinguished, including colourful or anomalous experiences that are felt to have spiritual significance by most people who have them. The neurosciences have isolated brain-state correlates for some of these colourful states of consciousness, thereby strengthening the hypothesis that these experiences are mediated by the brain. This result both challenges metaphysically dualist accounts of human nature and suggests that any adequate causal explanation of colourful experiences would have to make detailed reference to the evolutionary and genetic conditions that give rise to brains capable of such conscious phenomena. This paper quickly surveys types of conscious states and neurological interpretations of them. In order to deal with the question of the significance of such experiences, the paper then attempts to identify evolutionary and genetic constraints on proposals for causal explanations of such experiences. The conclusion is that a properly sensitive evolutionary account of human consciousness supports a rebuttal of the argument

that the cognitive content of colourful experiences is pure delusion, but that this evolutionary account also heavily constrains what might be inferred theologically from such experiences. They are not necessarily delusory, therefore, but they are often highly misleading. Their significance must be construed consistently with this conclusion.

This paper addresses the nature and operations of the relatively unusual, typically colourful states of consciousness that are of enormous spiritual significance to most people, including especially religious people. Other scholars are producing much needed neurophysiological theories and philosophical interpretations of consciousness in its ordinary operations – important efforts on which this venture depends. The limited aim here – and surely it is adventurous enough – is to give an organized description of the relevant experiences. Space permits only an outline of this organized description. For the sake of economy of expression I shall refer to the experiences in question as "vivid experiences".

A comprehensive account of vivid experiences would require at least the following five components:

- phenomenology of vivid states of consciousness;
- neurophysiology of vivid states of consciousness;
- sociology of vivid states of consciousness;
- evolutionary interpretation of vivid states of consciousness; and
- philosophical and theological assessment of the significance of vivid states of consciousness.

This paper deals only with the first of these five components. This is valuable in itself, however, because an organized and comprehensive phenomenological description of vivid experiences is the precondition for effectively working on the other four issues.

My motivation for this study is three-fold. I am curious, of course. And I am often concerned by fanatical interpretations of vivid experiences that seem to produce socially undesirable effects. But I am also in search of an interpretation of vivid experiences that is capable of helping the many people who are confused by such experiences come to terms with them. The three associated elements of inquiry, criticism, and pastoral concern may not be especially evident in this paper because the focus here is on description. Hopefully, subsequent work will be able to express more directly these equally strong elements of my motivation.

Vivid experiences are far more diverse than one might think. Mystics think first of mystical experiences, New Age enthusiasts of shamanic journeys or psi-related phenomena, traditional religious people of corporate worship or ritual experiences, and nature lovers of feelings of peace and awe while hiking or sitting beside a still mountain lake. There is no comprehensive phenomenology of the full range of such experiences. Rather, there are many partial phenomenologies directed by the interest and attention of the researcher. Here I present several such partial phenomenologies and also make an attempt to coordinate them into a richer account of vivid experiences by indicating the overlaps and relationships between the various fields of description.

Religious experiences

"Religious" experiences are the most diverse and elusive category to be discussed here. Religious involvement is associated with a host of experiences from the spectacular to the mundane, from the individual to the corporate, and from supportive to disruptive of ordinary social processes. The result of oversimplifying this diversity tends to be superficial or culturally slanted accounts of religious involvement and its significance for people. Yet any attempt to capture the diversity in a working definition seems futile. Defining religion is itself a famously difficult – by now, perhaps a humorously hopeless – task. The diversity of experiences associated with religious involvement is at least as complex.

For my purposes, the way to proceed is to make use of the vagueness of "religion" and simply refer "religious experiences" to the experiences people have by virtue of being religious or being involved in religious groups. This does no more than distinguish religious experiences from non-religious experiences, of course, but at least it establishes a modicum of resistance to oversimplifying treatments of religion.

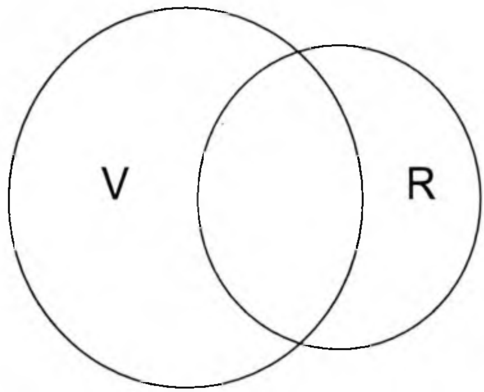

Figure 1. Overlap between vivid [V] and religious [R] experiences.

As the description of vivid experiences unfolds, it will become clear that some religious experiences are vivid and some are not. Likewise, some vivid experiences are not associated with being religious or with religious involvement. Thus, the relation between religious and vivid experiences is one of significant overlap, with vivid experiences probably being more diverse than religious experiences and neither being a subset of the other.

Vivid experiences

Vivid experiences can be thought of as constituted by two major overlapping classes of experiences: anomalous experiences and ultimacy experiences. Within these two classes are other types of experience that have received phenomenological attention and they will be discussed presently. First, though, I discuss the two major classes. Their relationship to each other and to religious experiences can be sketched as follows.

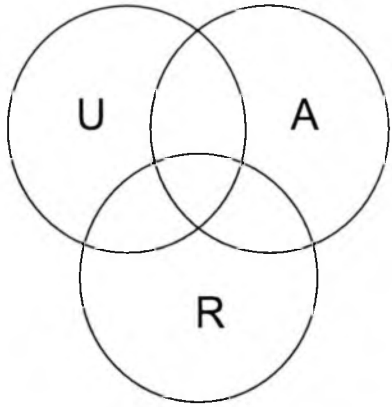

Figure 2. Relations between religious [R] experiences and vivid experiences, where the latter class is constituted by ultimacy [U] and anomalous [A] experiences.

Anomalous experiences

The term "anomalous experiences" refers to experiences that apparently violate the operations of the world, as these are understood in normal life. The word "abnormal" has unwarranted negative connotations but in some sense anomalous experiences are classifiable as such precisely because they are not normal – which is to say nothing about the normalcy or mental health of those who have them.

Though anomalous experiences are diverse, psychologists have studied many types. For example (Cardeña *et al* 2000) offers survey articles on a number of types of anomalous experiences, including hallucination, synesthesia, lucid dreaming, out-of-body experiences, alien abduction experiences, anomalous healing experiences, past-life experiences, near-death experiences, psi-related experiences, and mystical experiences. Other anomalous experiences include mental phenomena associated with drug-induced altered states, psychiatric disorders, extreme circumstances, ecstatic states, group frenzy, snake-handling, fire-walking, possession, as well as more marginally anomalous experiences such as dramatic self-deception and uncanny insight. There are also anomalous experiences associated with severe brain trauma.

The investigation of anomalous experiences is in its early days. Neurological studies have been conducted in some of these cases but not to any great extent. Experiences linked to brain trauma have received a great deal of attention in the neuropsychological literature because they help establish correlations between brain regions and functions. Only in the last couple of decades have careful investigations disclosed the devious magician-like techniques associated with some anomalous experiences, such as psychic healing and cold reading (see Randi 1982 and *Skeptical Inquirer* magazine). And survey data on the frequency and effects of such experiences have barely begun to be collected. Thus, it is difficult to draw stable conclusions about the causes and dynamics of anomalous experiences. Several vague and generalized comments can be made, however.

First, anomalous experiences are usually felt to be out of the control of those who have them. Even when they are sought after, which is sometimes the case with out-of-body or lucid dreaming experiences, typically the experiences themselves feel beyond the control of the subject.

Second, despite the first point, the study of anomalous experiences shows that some of them are reliably reproducible under the right conditions. For example, bright and fast-changing lights, loud and rhythmic music, a dynamic central personality, and an intensely supportive social atmosphere are recurring factors in cult conversions, group frenzy, anomalous healing experiences, and dramatic self-deception. Certain neurological conditions may be relevant also, making a person more likely to experience a whole range of anomalous experiences.

Third, anomalous experiences are emotionally and cognitively potent. They produce powerful convictions in those who have them, convictions about the nature of reality and the significance of key events within it. These convictions are driven home by equally powerful, confirming experiences that are often felt to be the most important experiences of a person's life, determining many other decisions and commitments of time and energy.

Fourth, anomalous experiences often have little to do with religion and spirituality. Of course, they do sometimes occur in the context of religious involvement – indeed, some religious groups make unconscious use of the environmental factors that render people more likely to have anomalous experiences. They commonly occur in non-religious contexts, however, where they are usually (but not always) felt to have great spiritual significance. A common situation is the occurrence of anomalous experiences outside the context of religious involvement, followed by the construction of an idiosyncratic spirituality based on the cognitive and emotional impact of the experience and a search for like-minded people with whom the experience can be shared safely. These rather impressionistic remarks indicate the importance of further research in this area. Anomalous experiences are more common than many people who have not experienced them might estimate. Their impact on personal self-understanding and worldview is easily underestimated, accordingly. They are vital factors in any attempt to understand how people come by their convictions and why they make the decisions they do. They are a colourful part of the experiential fabric of human life.

Ultimacy experiences

If anomalous experiences are defined by objective unusualness, ultimacy experiences are defined by subjective judgments of ultimate significance. These are experiences that a person feels are of vital importance for his or her life. They bring orientation and coping power, inspire great acts of courage and devotion, underlie key life decisions, and heavily influence social affiliation. They overlap with anomalous experiences but anomalous experiences occur without the subjective judgment of ultimate importance and ultimacy experiences occur in recognizably normal fashion, so the overlap is significant without being dominant.

When the parsing of experience begins from subjective judgments of ultimate significance rather than objective judgments of unusualness, very different distinctions emerge. Most prominent is the need for a distinction between short-term and long-term ultimacy experiences. The obvious phenomenological difference between discrete states and extended experiences is directly attributable to neurology: short-term states are tied more directly to discrete brain episodes whereas extended experiences usually require a rich social context to sustain them. It is discrete ultimacy experiences that overlap most significantly with the anomalous experiences just reviewed. Both types have recurring characteristics (see Wildman and Brothers 2000) that can be reviewed here.

Extended ultimacy experiences seem to be of two basic sorts: those that serve the need for orientation and those that facilitate personal transformation. Orientation ultimacy experiences are vital for the stability of human social life. The embedding of ultimate ethical and religious commitments in social patterns (see Durkheim 1915; Berger 1967) is a process that only achieves coherence and conviction for individuals when supported by orientation ultimacy experiences. People also need to change, to break free from oppressive social constraints, to transcend their culturally limited imaginations. Whether sought or not, transformation ultimacy experiences facilitate such change.

Both types of ultimacy experiences have the same recurring characteristics in different relative weightings. Both types are existentially potent. They are embedded in a social context to various degrees, which is particularly important in the case of orientation ultimacy experiences. They also involve the transformation of behaviour, personality, and beliefs. These changes are important in both types of ultimacy experiences; whereas transformation ultimacy experiences obviously require change, orientation ultimacy experiences more subtly require changes that serve to conform individuals comfortably to the regularities of a social environment.

Discrete ultimacy experiences have very different characteristics, which are to be expected given the association with short-term brain states. They involve any combination of the following factors: a wide variety of sensory alterations, dramatic alterations in the sense of self, feelings of presences, compelling cognitions, and potent emotions. Discrete experiences often occur at the beginning of a process of personal transformation and then sometimes recur within that process; this is one way in which discrete and extended ultimacy experiences are related.

Like religious experiences, vivid experiences are constantly in danger of being misunderstood through the reduction of ultimacy experiences to anomalous experiences or vice versa. Either of these errors trivializes the complexity of human experience and leads to the underestimation of the significance of vivid experiences for healthy human beings. In fact, my impression is that almost everyone has ultimacy experiences of one sort or another even when they never get close to any anomalous experience. To put this point in another way, while an evolutionary interpretation of human experience could perhaps set aside anomalous experiences as, well, anomalous, ultimacy experiences have to be placed front and centre in any evolutionary account. The collapse of the distinction between ultimacy and anomalous experiences is potentially disastrous for a well-rounded understanding of human life.

Meditation experiences

The area of vivid human experiences profiting from the most extensive phenomenological, physiological, and neurological study has been and continues to be meditation experiences. South Asian and Buddhist traditions, particularly, include vastly elaborated distinctions of states of consciousness achieved in meditation.

The most comprehensive survey of meditation effects is that of Jean Kristeller (2001), who has developed a multi-modal developmental model to organize the relevant data. Kristeller distinguishes six types of meditation effects: physical, cognitive-attentional, emotional, behavioural, relation to self/others, and spiritual. For all of these types, she distinguishes between effects achieved early in the practice of meditation, those that require moderate meditation expertise, and those that tend to appear only in advanced practitioners. Together, the "modal" and the "developmental" axes constitute a two-dimensional grid upon which can be placed a host of recognized meditation effects (these effects are not shown in *figure* 3).

Apart from its intrinsic interest, Kristeller's model has significant value for clinical psychological and medical intervention. If impulse control or self-awareness is a problem for a client, for example, then a clinical recommendation of meditation may be appropriate because increased impulse control and heightened self-awareness are effects that can be expected quite early in the process of developing meditation skills.

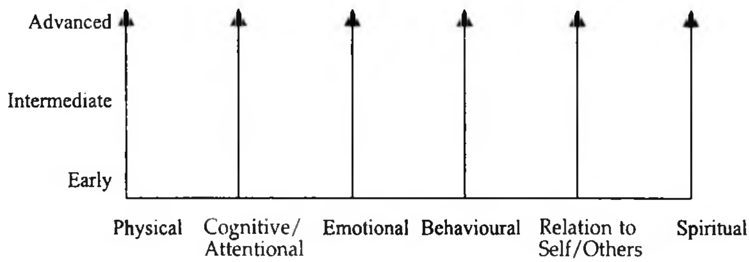

Figure 3. Schema for Kristeller's multi-modal developmental model of meditation effects.

Further research is needed to evaluate claims about the therapeutic effectiveness of meditation but there is no question that those who practice meditation report positive changes. Account also needs to be taken of the fact that some engaging in meditation report terrifying and personality-disintegrating experiences, and others seem immune to at least some of the reported effects. Such considerations are particularly important if meditation is to be conceived as a means of therapeutic intervention. The therapeutic dimension of meditation also needs to be more closely integrated with existing work on the physiology of meditation (see Fischer 1971) and new work on the neurophysiology of meditation (see, for example, Newberg and d'Aquili 2001).

The fact that meditation regularly produces specific experiences is important. This reproducibility underlies the interpretation of meditation as a technology of self-cultivation and, in turn, the formation of communities devoted to meditation practice in religious and medical traditions throughout the world. An evolutionary interpretation of vivid experiences must take account of this fact.

Profound experiences

Of the vivid experiences discussed to this point, it is ultimacy experiences that are most important for people's existential self-interpretation and orientation in the world. Ultimacy experiences are defined just so that the existentially most significant experiences are registered. It is of special interest for understanding human spiritual formation, therefore, that a couple of subclasses exist within the class of ultimacy experiences: profound experiences and, within them, mystical experiences.

Theologians with a special concern for religious experience have long used metaphors to express the way experiences feel significant or profound for those who have them. Key metaphors of this type are depth, mystery, and horizon (used by Tillich 1951; 1957; 1963 and Rahner 1987) both influenced by Heidegger (1962). These metaphors have become sensitive phenomenological tools for describing profound experiences but the toolbox is incomplete. For example, attending to the spiritual insights of scientists in their work invites the introduction of another phenomenologically tuned metaphor, complexity. And the metaphor of scale enables us to distinguish the familiar mystical experience of oceanic calm from the experience of depth. These five characteristics of profound experiences can be associated with mental states as follows (see Wildman 2000).

- Depth (terror, joy, bliss, ...)
- Horizon (fascination, attraction, alienation, fear, disgust, hate, ...)
- Scale (awe, oceanic calm, vastness, emptiness, ...)
- Complexity (surprise, wonder, confusion, disorientation, irritation, ...)
- Mystery (ignorance, incomprehension, loss of control, ...)

These characteristics occur in various combinations in profound experiences, provoking different responses. For example, while depth invites surrender and scale induces worship, the other dimensions of profound experiences provoke interest in institution building, from different points of view: horizon for the sake of defence from the other, mystery for the sake of protection of the holy, and complexity for the sake of inquiry. Space does not permit further elaboration but this phenomenological toolbox is extremely useful for describing how human beings deal with their profound experiences. In short, profound experiences are the fundamental wellspring of inspiration for spirituality and religious expression in ritual and organization.

Mystical experiences

Another subclass of ultimacy experiences is also a subclass of profound experiences: mystical experiences. In fact, mystical experiences lie at the triple intersection of ultimacy, anomalous, and religious experiences. So mystical experiences can be understood as intense forms of profound experiences that are also anomalous and religiously relevant.

Traditionally, the word "mystical" is reserved for experiences that are cultivated or experiences that occur spontaneously in the context of an ongoing effort to cultivate spiritual vitality of mastery. Phenomenologically, however, experiences other than these may be indistinguishable from mystical experiences. This is a reminder that taking names at face value may mislead and that it is prudent both to seek phenomenological descriptions for the experiences in question and to make allowance for the complex motivations and social realities that underlie naming conventions.

Mystical experiences have been the most studied of all ultimacy experiences. Many distinctions have been invoked to account for the diversity of experience evident in mystics' self-reports. These reports span from nature mysticism to mysticism of supernatural beings such as angels and demons, and from mysticism related

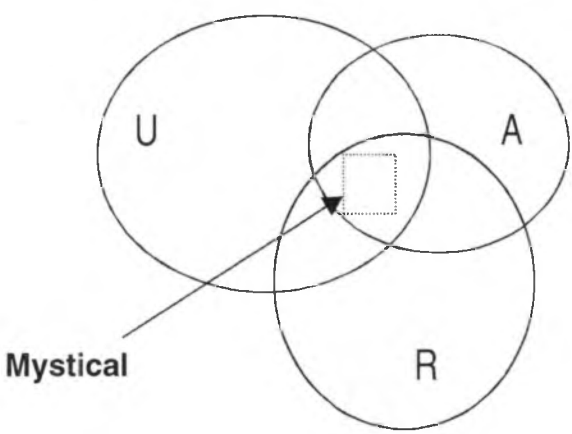

Figure 4. Mystical experiences lie at the intersection of three other classes: ultimacy experiences [U], anomalous experiences [A], and religious experiences [R].

to a personal divinity to mysticism that transcends all concrete imagery and names, so there is a lot to comprehend. Usually, some of this diversity is omitted, perhaps because mysticism is construed more narrowly, or perhaps to make the models of mysticism theologically more coherent.

Perhaps the most widespread distinction in use is the essentially theological contrast between kataphatic mysticism, which is characterized by concrete imagery and a personal relationship focus, and apophatic mysticism, which involves a refusal of imagery and construes divine union as absorption rather than intimate relationship. Whether the experiences of mystics divide as neatly as this distinction suggests is difficult to determine because the hermeneutical issues involved in interpreting mystics' self-reports are complex. At the very least, however, this distinction has proved useful as a rubric for interpreting the self-understanding of a couple of kinds of mystics.

The most infamous debate over mysticism has extended through most of the twentieth century. It concerns what can be inferred about mystical experience and reality itself based on apparent similarities and differences between mystics' self-reports across the chasms of culture and era. Constructivists hold that local contexts are the leading factor in mystics' accounts of their experiences, to the point that stable generalizations are extremely difficult to make (see Katz 1978). Opposed are those who defend the reality of a so-called "pure consciousness event" and who detect this event recurring in mystics' self-reports (see Forman 1990, 1999). At times, this debate seems to be conducted in the murky realm of unverifiable, unstable hypotheses, which is doubtless why it has persisted for so long. In our time, I suggest, the most productive questions about mysticism are the empirically tractable ones, such as the discovery of neural correlates for reliably reproducible mystical states of consciousness, and the elaboration of similarities and differences among mystical self-reports.

Most people do not have mystical experiences. Those who do tend to seek them out. The fact that such experiences are cultivated even while being so difficult to achieve is thought provoking and leads directly to questions about the value for people of such unusual experiences. Why go to such extraordinary lengths for mystical experiences? The answers appear to be three: the experiences feel good, they produce desirable practical effects, and they inspire compelling beliefs about reality. At least, that is how mystics seem to view matters. These are compelling enough reasons for some to pursue mystical experiences, perhaps, but evaluation of the associated epistemological claims to truth and the moral claims to beneficial effects needs to be carried on using means in addition to the positive self-assessments of mystics. Perhaps an evolutionary framework for interpreting mysticism can aid such evaluation.

Conclusion

The description of vivid experiences is now as fulsome as space allows here. Combining all of the types of experience mentioned to this point, the diagram illustrating relations of membership and overlap among classes is now as follows.

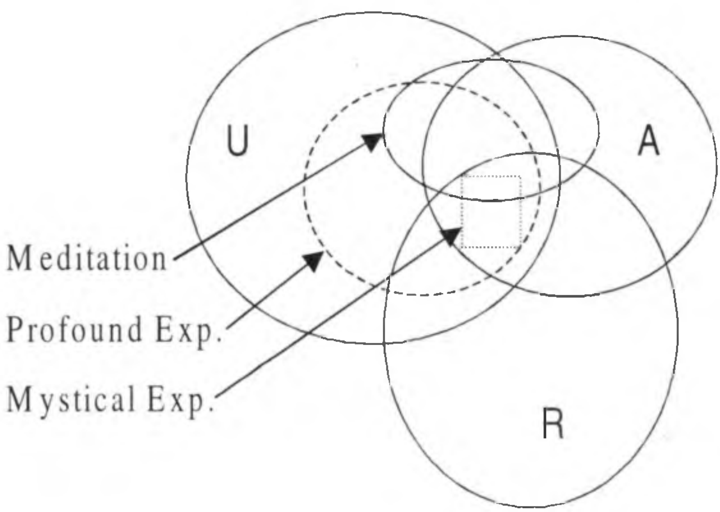

Figure 5. Relationships between religious [R] experiences, vivid experiences (where the latter class is constituted by ultimacy [U] and anomalous [A] experiences), meditation effects, and two subclasses of ultimacy experiences: profound experiences and mystical experiences.

This descriptive presentation of the diversity of vivid experiences suggests a number of conclusions. First, many people claim prosaic, humdrum experiential histories but typically this merely excludes mystical or other anomalous experiences, and perhaps the more extreme discrete ultimacy experiences. Many other experiences count as vivid and spiritually significant, however, and few people indeed are entirely bereft of vivid experiences so construed. Within tolerable limits of precision, therefore, and in anticipation of better survey data to confirm this, it is safe to conjecture that vivid experiences are normal and common, while the truly prosaic life is exceptionally rare and, correspondingly, difficult to comprehend.

A second conclusion bears on the need for neurological studies of religious experience. There has been some neurophysiological research on a few types of vivid experiences but most types remain neglected. The neuropsychological results to date are suggestive for a wider interpretation of vivid experiences, however, so there should be motivation to expand the reach and number of such studies. Such studies would be of two kinds. On the one hand, there is great value in "classical data" deriving from long-studied conditions such as temporal lobe epilepsy that produce colourful mental phenomena. Such data need to be enhanced and revisited to evaluate their relevance for interpretations of vivid experiences. On the other hand, and more recently, there have been studies that make use of various brain-scan technologies (Newberg and d'Aquili 2001). These studies suffer greatly from underfunding, which limits both sample sizes and the ability to perform digital summing and analysis of multiple scans, greatly hindering stable interpretation of the experiences being studied. Both types of research are important for reinforcing the phenomenological descriptions of vivid experiences and deepening knowledge of correlations between brain states and subjective reports.

A third conclusion bears directly on any attempt to give an evolutionary interpretation of vivid experiences. I think the evolutionary lens is the most salient for discerning the critical importance of vivid experiences in human social life but the actual description of such experiences is essential. The organized description of vivid experiences presented here should affect what counts as relevant and plausible in any evolutionary interpretation.

While a narrowly scientific theory of vivid experiences perhaps could rest content with marshalling the relevant data and placing it in an evolutionary context of interpretation, a comprehensive theory would have to venture more. For example, people make claims about the character of the world based on vivid experiences, claims that can be assessed – and ought to be when their moral implications are significant. Again, people's lives and their social environments appear to be regulated by the consistent occurrence of relatively mundane vivid experiences and occasionally dramatically transformed by unexpectedly potent ones. The way vivid experiences work to regulate and transform is a matter not just for the social sciences and psychology to describe. The relevant questions include the following: Are the sensory readings and cognitive information associated with vivid experiences valid? Under what conditions are they reliable? When should they be regarded with suspicion? These are truth questions, in one way, and questions about causation, in another. As such, they call for disciplines that are competent to handle issues of truth and causation, and in relation to the topic of vivid experiences the right discipline is a philosophically sensitive form of theology. The most important conclusion of this paper is that any such evaluative attempts must take account of the variety of types of vivid experiences in order to resist oversimplification and the distortion that results from it. Whatever else they may be, vivid experiences are ubiquitous, diverse, and highly significant for human personal and social life.

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From experiences to consciousness

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Abstract

We all have experiences of various kinds. What is experienced by one may not be experienced by another. Nonetheless, experiences per se are common to all – young or old, learned or ignorant, wise or otherwise, blind or deaf, and so on. And in the case of all of us, it is a matter of direct experience that we are conscious of such and such. We say, "I am conscious of the room", "I am conscious of the book", "I am conscious of my body", and so on down to "I am conscious of my thoughts". This naturally leads us to the conclusion that consciousness must be inseparably embedded in all our experiences.

The attempt here will be to set out from the above appraisal and take a guided tour culminating in getting a foothold on consciousness. It may be said en passant that something as commonplace as consciousness cannot be out of the purview of anybody's experience.

1. Introduction

The agenda in focus here is to inquire into consciousness leading to its understanding. The strategy is to proceed from the 'known' to the 'unknown'. It is pertinent at this stage of the discourse to query as to whether consciousness is something that we understand or something we have no clue about. Naïve and pedestrian as it may seem at first blush, the nontrivial pertinence of this question here will become evident on deeper consideration. In fact, the doubt itself needs to be first clarified before it may be cleared! After all, an individual having no idea whatsoever of a sphygmomanometer is, in principle, incapable of asserting, or for that matter, even negating, its existence.

In the early stages of the discussion on the nature of *Brahman* in the *Sutra Bhashya* (commentary on the *Brahma Sutras* (1.1.1) of Sage Sri Badarayana), Sri Shankara recognises the possibility of the seeker being saddled with a similar situation in respect of *Brahman*. To settle the matter, He launches into a debate as follows.

That *Brahman* is either understood or it is unknown. Had it been understood, it is futile to investigate into it! If it were unknown, it is impossible to even probe into it!

Evidently, the bottleneck lies in considering two extreme situations; in each of them, we reach a dead-end. A detailed analysis that follows the above question in the *Sutra Bhashya* leads to a conclusion which for our limited purpose here may be summarized as follows.

"One who is neither totally ignorant of it nor fully knowledgeable about it is the candidate fit for this study" (*Yoga Vasishtha, Vairagya Prakarana*, 1.2).

It may be objected to here that what has been said in so many words is tantamount to: "If it is known, then it is known; if it is not, then it is unknown". In the process of countering a similar charge Sri Vidyaranya (*Panchadasi* 1.12) cites an example by which the possibility of partial knowledge is demonstrated.

"Just as the voice of his son from among a chorus chanting is recognized by the father, ...". The father here is at a distance and his son, out of his sight, is one in a group of students chanting in chorus. The father is able to recognize the voice of his son; but due to the distance, he is unable to discern the details of the chanting. That is, 'he knows; yet does not know fully'. Neither knowledge nor ignorance is in full measure.

Let us consider a second example from mathematics, a branch of science widely recognized for its clinical precision set in a rational framework. Let f be a real-valued function on the reals and let $F=L(f)$ be its Laplace transform. The problem is to find the limit of $f(t)$ as t approaches infinity. The 'final value theorem' in the Laplace domain states that the limit of $sF(s)$ as s approaches zero is the same as the limit of $f(t)$ as t tends to infinity *when the latter limit exists*. Thus it is required to ensure *the existence* of the limit before it may be *evaluated* using the final value theorem. Else the results could be rubbish. Take $f(t)$ to be sin (at), for instance. $F(s) = L(f)$ is then $a/(s^2 + a^2)$. If we were to blindly apply the final value theorem to this F, the result would be zero, which is clearly inadmissible. This implies that there can exist a nontrivial case wherein we have convinced ourselves merely of the existence of the required limit and have yet to get to its value! As in the first instance, neither knowledge nor ignorance is in full measure.

The implication is that knowledge in part, and in association with ignorance regarding the detail, is a *sine qua non* for any investigation. Sri Shankara fashions such situations as follows (*Brahama Sutra Bhashya* 1.1.1): "All parlance pertaining to *pramana* (the means to valid knowledge) and *prameya* (the object of knowledge) is exclusively in the realm of ignorance". It may be noted here that the take-home message of the above statement is *not* that 'All parlance ... is in the realm of total ignorance'.

2. From experiences ....

We have, presently, set out to 'understand' consciousness. As we have seen from the foregoing, it would have been, even as a matter of principle, impossible (and meaningless!) to embark on this exercise had we been in total darkness regarding consciousness. What is it that we know, however halting and in small measure, about consciousness at an entry level? To seek an answer to this, where is it that our search should begin? In the backdrop of the discussion in the previous section, we proceed to probe into consciousness resorting to a known-to-the-unknown approach.

Those which are directly and indubitably known, and hence common, to all of us — young or old, schooled or unlettered, learned or ignorant, wise or otherwise, blind or deaf, and so on, i.e., without loss of generality — are our own individual and immediate experiences. Experiences may differ from individual to individual, though. Recognition of this fact naturally suggests that we may as well start our probe by looking into our experiences in some depth. Our experiences tell us that consciousness is 'somehow' linked with them. Had we not been conscious of our experiences, there would have been no way we could have come to know of our experiences. We articulate our experiences as

* I am conscious of the trees out there;
* I am conscious of the book;
* I am conscious of the chair;
* I am conscious of my body;
* I am conscious of my hands;
* I am conscious of my eyes;

and even so far as

* I am conscious of my thoughts.

Thus we see that consciousness is inseparably embedded in all our experiences. Something common to a collection of instances must be in the set of their intersection. A closer examination of the experiences listed above reveals that the objects which we are conscious of cannot exist in the intersection of the set of all experiences. For instance, 'the book' is not in the experience "I am conscious of my body" and 'my body' does not find a place in the experience "I am conscious of the book". When we are focused on our thoughts with our eyes shut, we may not comprehend any external object at all. The intersection of the set of all our experiences is consequently

* I am conscious.

3. ..... To consciousness

It may seem somewhat difficult to digest the conclusion at the end of the previous section. The following dialogue between an enlightened master and his seeking pupil (Sri Sankara's *Ekasloki*) will help clear the cloud.

Master : What is light for you?
Student : It is the sun during day; at night, the lamp, etc.
Master : May that be so. In seeing the sun, lamp, etc., tell me as to what serves you as your light?
Student : The eyes.
Master : When your eyes are shut, what (is it)?
Student : My intellect.
Master : In perceiving your intellect, what (is it)?
Student : There, it is I.
(It is significant to point out that till this stage of the dialogue, the master was addressing his ward in common second person. Now, however, on having seen that his student is enlightened himself, the master addresses him in respectful second person, *bhavaan*.)
Master : So, you are the ultimate Light.
(Now the student does not arrogate to himself the elevated position hinted at by his master. His words are poignant.)
Student: That I am, O Lord.

The ultimate light alluded to by the master here is nothing but consciousness. The student does not realize this subtlety at the outset and provides his answers taking only the gross meaning of 'light'. The master leads him tactfully through a sequence of progressively penetrating probing. The competent disciple, in his turn, picks up the cues from stage to stage and responds with sharpness and progressively deeper insights. The moral of the story, based on experience, is therefore "I *am consciousness*".

One may be tempted to argue that consciousness cannot be divested of an external object. The subjective experience of dream-free deep sleep may be cited to counter such a stance. Are we indeed conscious in dream-free deep sleep? Suppose not. Then our post-sleep recollection, "I slept peacefully; I was not aware of anything", must fall short of an explanation. After all, a recollection must suppose a prior experience. And as we have seen, there can be no experience shorn of consciousness. This message is forcefully driven home by Sri Vidyaranya (*Panchadasi* 10.11) with the aid of the following illustration.

In a stage play, a light illuminates, *sans* prejudice, the makeshift stage, the objects on it, the characters on stage, the audience, and so on. When after the play, the audience depart, the actors and actresses retreat and the stage is totally dismantled, the light continues to shine though it does not illuminate any object. The light not illuminating any object is not to be construed as the light being switched off! If any object presents itself, we say that the light illuminates it; else, it shines by itself, and that in fact is its true intrinsic nature.

Yet another significant and captivating illustration is brought out by Sri Shankara (*Manisha Panchakam* 4). On a day with thick dark clouds, we say that the sun is not seen as it is occluded by the clouds. Lo and behold! Here, the clouds, which we say are obstructing our vision of the sun, are themselves revealed only because of the illumination of that very sun! The simple matter of fact is that, clouds or no clouds, obstructing or otherwise, the sun shines by itself. That is its true intrinsic nature.

4. Conclusion

We set out to fathom consciousness. We saw that that presupposed some foothold on consciousness without which our probing is infeasible. That common minimum foothold, we discerned, was our experiences. A cursory look at our experiences suggested a 'working definition' for consciousness, namely, "that which is common to all our experiences". Through a sequence of ratiocinated steps supported by examples and illustrations, we arrived at the conclusion that

I AM CONSCIOUSNESS.

Consciousness by any other name - Some outstanding problems in the life of the mind

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Abstract

There has been much said about consciousness, but very often the right questions are not asked. In this paper, the author sets out to press certain "limit questions" that raise both matters of epistemological constraints in the inquiry and issues in metaphysical speculations about this thing called consciousness (and whether it names anything real at all?). Various candidates for a partial or (doubtfully) complete description of consciousness are entertained, before moving on to propose certain basic characteristics that would appear to be basic and in need of further explication. Drawing from critical phenomenology, these are identified as the surprising traits of intentionality, subjectivity (or deep self-awareness and the unconscious), and history of consciousness. On the metaphysical side, the paper concludes by arguing against faith in both the dualism of mind/spirit over matter, and reductionist materialism or physicalism, leaving open a qualia-based model of decentralized conscious states.

Is consciousness any of these things?:
(i) An event; (ii) a process; (iii) a substance; (iv) a phenomenal property or ; quality (*qualia*); (v) a function of some other event or process; (vi) an extension (of mind, of corporeality); (vii) momentary contentless mental movements; (viii) time-sequenced awareness contents; (ix) utterly contingent; (x) experiential apperception; (xi) an eliminative by-product.

Of course, these are not the exhaustive categories in terms of which consciousness has been described or analysed in accounts that abound in the various fields of investigation on the phenomenon apparently unique in at least the living human constitution. I do not have a particular theory to propound, but I wish to take this opportunity to register some of the questions and issues that, for me at least, remain outstanding or insufficiently addressed. What I set out to do in this paper is to underwrite certain *'limit-questions'*, or bounds of discourse, beyond which it would be fruitless to speculate; but 'limit-questions' may also point to possibilities by stretching the logic of the discourse and appealing to reasonable metaphysical propositions (the ontology of 'what it might be like'[1]) as critical demands coming from outside a discipline. I believe there is a good deal of high-fluting scholasticism matched only by extreme cynicism and positivism in the inquiry; and yet there are certain insights that need to be highlighted in such discussions as we are engaged in here at the symposium, but these may come from unexpected quarters. One of the questions that we have not dealt with but which gets a fair degree of attention these days in the literature is that of *intentionality*.[2] So I will begin with this observation before moving on to other more ontological and metaphysical questions.

I

All conscious experience appears to have the characteristic of being intentional, i.e., whenever we have some awareness that state of consciousness (even if it is without any specific form) *tends* towards or is *directed towards* some object or other (however obliquely).[3] No other part of our body or bodily state seems to possess this characteristic, unless consciousness is already involved even at a most primitive, subconscious level. For instance, the finger may pull itself away from the flame or the syringe as a stimulus of pain, but the finger does not in and of itself refer to the object of likely pain, or is in any sense *about* the stimulus of pain in the way in which awareness, cognition, feeling, memory, anxiety, fear and such other experiential states in such an occurrence are precisely *of* or *about* (the object) of pain. The pain when it occurs may itself become an internal object or noetic content of consciousness. But for consciousness, it seems, the body is not in a dis-position to direct itself (or be disposed) toward the world or anything outside.[4] In short, then, we experience consciousness not directly but in the course of an awareness that is *of* or *about* something; there is no such moment as 'pure' non-intending consciousness. Unless, of course, we mean by the latter some primitive, inchoate mental episode momentarily absent of content, nonetheless expectant of it (as in dreamy or drowsy states, or in a dash of anguished rage where the subject has lost sight of that to whom or which the anger is directed, whence some innocent bystander or the family pet cops the heat). Apart from certain strains of mysticism which are not necessarily based on empirically sustainable phenomenological data that is accessible across the spectrum, there is no good evidence to believe that consciousness is formless, contentless, without parts and in essence non-intentional and absolute (i.e. neither dialectical nor dynamic) as the doyen of Advaita Vedanta, Sankara had argued back in the 8th Century. Professor Mohanty has pointed out elegantly elsewhere, that Indian philosophers and mystic theosophies alike tend to conflate something not having form, or contents, or parts, or without a locus etc., with not being intentional.[5] Even the distinction between something being an act or being a state, and being without form or without parts, or bereft of location and non-referential re-identification ('ego'), can be critical in such matters, as the debate between the *Nyaya*, the *Mimamsa*, and Buddhist on the structure of consciousness (or conscious-*ing* moment from the Buddhist perspective) have attested to. But we cannot go into this intricate debate here, suffice it to note that a thorough critique of faith in 'pure' consciousness (or the presumed stark opposition between '*asmad*' and '*yusmat*' – self as consciousness and the other – on the flawed analogy of light to darkness[6]), leads to the unavoidable conclusion on the basic intentional character of consciousness. This is not to argue for the 'essence' of consciousness, for to admit to any *essence* would be to suggest already that there is such an existent as consciousness; when in fact, following the wisdom of the Buddhist philosophers, the phenomenologists, and reports from modern science, we are better off 'bracketing out' (*epoche*) all ontological existential presuppositions. Because, the argument goes, consciousness may well turn out in the end to be a no more than a convenient naming term for what is basically a process, an event, a property (or balloon of properties), a momentary series of awareness (phenomenal) states that arise and disappear with each apprehension of an object or more likely the *concept* of the object. Furthermore, these discrete mental states are bindingly held together by another unifying and slightly more enduring mental state, individuated or, as it were, pegged down to a virtual-spatial locus (roughly around or within the body). This binding qualia acts as the 'owner' of the intentional series, which we call the 'ego' (the egological qualia), or what manifests itself in its self-reference as 'I', the 'I-sense' (*ahampratyaya),* or (more theoretically) as the transcendental subjectivity (in neo-Kantian terms, where 'transcendental' is a phenomenological and not a metaphysical ideal for an experiencing subject or *person*).[7]

The foregoing analysis thus far, then, has made a strong case for intentionality within any discourse of consciousness. This has been one of the great discoveries attributed widely to Husserlian phenomenology, although Ramanuja (the 12th century Indian philosopher) was also insistent upon this trait, albeit more on metaphysical grounds than from any studied empirical or phenomenological consideration, but all the richer for it within the Vedantic discourse[8]. This fact about consciousness has huge ramifications for any systematic study thereof, one of which is that it should prove theoretically difficult to isolate consciousness as a substance (in a vat for example, or in supposedly deep meditate state), that is not at the same time in relation to some other thing or things – and it is hard to see how a thing could be in relation to itself, as is often implied in the Vedanta (Advaitic) utterances about the self-luminosity of *atman* as *sui generis* consciousness (*cit*). I fail to see what certain experiments such as the arrestive ECG and probes into the neural chemistry or anatomy of the brain can yield when these seem scantly attentive to the dimension of intentionality, not as a side-product, but as a correlate part of what constitutes (or is constitutive of) consciousness. It is not unlike the situation where an etymologist thinks he can pronounce on the meaning of a sentence as a speech-act simply by discerning the root denotation of each word in the sentence in its formal structure. Like *meaning*, that can vary with each utterance or occurrence of the same sentence (depending on the context, norms of interpretation, disposition of the audience etc.), consciousness too appears to have this peculiar subjective dimension which cannot be easily, reductively, extricated or suspended for want of a 'clean' analytic or scientific account. But this does not necessarily affect eliminative accounts which are also reductive to a degree. But before saying something more on the heuristic significance of such accounts, I wish to say something about another model I have in mind, which I call the 'ideality' of consciousness, in terms of which certain hard-headed assumptions that have been around so long can be eliminated.

By 'ideality', I mean to underscore several points at once. In the most general terms, ideality can be taken to mean 'just the very idea of' or paradigm of controlling ideas (as perhaps when we think of 'ideology' in the Hegelian sense); but in more specialized terms, it would suggest something like a capacity for formal abstraction, a geometry or architectonic if you like, which lends itself to conceptual or discursive analysis. Ideality covers certain specific and in many ways inexplicable characteristics of consciousness alongside intentionality. These are capacities of higher mental order, much besides sensations, reactions, and similar light-weight empirical measure of the presence or 'facticity' of consciousness (to avoid talk of 'essences'). And these, mind you, still cry out for explanation or adequate integration within all accounts of consciousness. Let me list a few of these elements:

Subjectivity (self-conscious apperception)
The capacity for *a priori* concepts
Categories of understanding
Moral intuitions
Historical sense (individually and collectively)
Aesthetic experiences
Compassion
Time and space fore-grounds
Language
Logic and reason
Extension or universalization

These capacities, tendencies, or dispositions do not just happen to us and they are not as easily reducible to psychological traits as more simple-minded psychologistic or positivistic accounts would have it: just my sense that there is an extended temporal space and several sites or locations outside of the extremities of my individual body is not (as far as I can tell) experienced by, for example, inanimate things, such as the table I am sitting at and the computer I am writing on (or even by the deceased body that I dreamt of last night in its blissful self-folding sleep of oblivion to my concerns about its proper ritual disposal). Notice that I am also, unlike the table, able to describe my behaviour and make decisions about what to write (if the inspiration moves me!). In other words, I am a *subject*, who has a range of experiences which are episodically or periodically brought under an 'I', often described as the unity or apperception of all the experiences connected mereologically in a series. How can we explain this sense of awe at being a drop in the vast panorama of phenomenon coupled with being self-conscious?.

II

Subjectivity

This is a major category heading the list under 'Ideality' and presents a major challenge to all accounts of consciousness, especially naturalist, reductive, and eliminative ones. But is this subjectivity an act, an event, a property, or is it nailed, so to speak, solidly onto a substance of some kind? One of the enduring virtues of the Cartesian model – despite its dualistic excess on which I will comment shortly – is that by focusing on the mental, the 'ghost inside', it kept this challenge in the forefront and has continued to rear its cinematic head to critique unbending naturalist accounts. Many traditions have wondered who is the 'I' that sees and hears, that listens and speaks, that thinks and writes, and even *thinks* about thinking? But then scholastic tendencies in these traditions have tended to run far off the immediate questions only to bring back, as it were bigger ghosts and mysteries from afar to explain this small mystery – such as God, *Brahman*, universal *Atman*, spirit-self, *unio mystico*. More precisely, in Descartes' case in European thought or echoing the case of *Nyaya* in Indian thought, a mental non-material substance (incorporeal mind or spiritual self) that is separate and independent of the corporeal body (physical matter, biological nervous system and brain), that makes possible this self-consciousness of an extended being *(res extensa)* amidst all the furniture of the universe. Ontological dualism, however, has not got us very far, and if anything – going by current wisdom in Philosophy – has rather got in the way of clear thinking in respect of this inquiry. The problem has not so much been in what we have been led to believe on the *mind* (or the broadly spiritual) side of the equation but in respect of the tacit intuition about the material substance. As David Ray Griffin has pointed out (rephrased by George Shields, (1998)[9]) that the Cartesian formula of *res extensa* as representing the essence of matter has impacted on both the materialist and the dualist traditions alike: "(S)ince consciousness has been regarded as the opposite of extended matter, those who presuppose Cartesian matter are then logically forced into two divergent paths, each rife with difficulty and paradox: either completely reduce consciousness to extended matter (or eliminate consciousness entirely) or ontologically separate it from the material domain. On the first option, we end up with a most implausible denial of the reality of consciousness and its qualia, and, on the second, we give up naturalism and thus introduce notions of occult agency (among other perplexities)."

Now, Kisor Chakrabarti's (1999) attempt – here closely following the *Nyaya* ontology – to shift the burden of extension (*vibhu*) from the material substance to the non-material substance called *atma* (self) does not get us out of this paradox, as it leads to reducing consciousness in the other direction (the purely spiritual, the 'occult agency'), without providing a satisfactory answer to the major question of how can substances of entirely different nature or kind be said to interact at all?[10] Well, perhaps we ought to recognize this unique suggestion coming from the *Nyaya* for what it is worth: namely, that, unlike in Cartesian dualism where it is the material substance (the body and its sense-organs) that has extension, in the *Nyaya*, it is the essence of the self, the non-material substance, to have *vibhu* or (literally 'extensional pervasion') that makes possible this extension.[11] But how exactly this inversion of the source of extension helps solve problems in dualism is not clear.[12] There is a same old causal impasse here as in the Cartesian (or any other) model of mind–body dualism *qua* realist ontology (as distinct from aspectual or discourse dualisms). The analogy of my thought moving the pen (or to a post-modernist, the act of writing re-inscribing ideas in the head) will not work in the context of accounting for how the mental or spiritual substance, which has none of the properties of matter (and cannot even be said to occupy space for that matter or spirit), could move the physical (or vice versa), and not just whisk right through the physical base (body, brain, pineal point) as low-frequency radio waves do without necessarily breaking into sound or noise at every point. We are left with an unworkable epiphenomenalism.

Moreover, ascribing states of consciousness to the disembodied self (*atma*) as a *property* (*guna*) or *qualia* – which is really the heart of the *Nyaya* account of consciousness - presents the further difficulty of separately establishing the existence of the *atma*, which is an even more formidable challenge than establishing a non-materialistic Cartesian mind. It is interesting though that the *Nyaya* 'mind' (*manas*) is more akin to the Aristotelian *communis sensus* (the 'common sense') than it is to the Cartesian mind, as it is described virtually as the sixth sense-organ and yet distinct from the body and its basic sense-organs. However, locating the mind as a cognitive-affective *hermes* or conduit in some nebulous space between the given material substance (constituting the body and its sense-organs) and a supposed spiritual substance does not resolve the problem of a more plausible explanation of just how it is that two entirely and essentially different kinds of substance can work through a medium that does not share the properties (fully or even partially) of one side of the divide. Just the same problems arise for other Indian accounts: in respect of the 'inner sense' *antahkarana* in Vedanta, 'intelligence', *manas–citta* in *Samkya-Yoga*, and in *Mimamsa* with its own variant concept of the 'mind–function', *manapratyaya*, although not a supplemental sense-organ. There is something missing here in all these accounts; and what is missing is not some *thing* but an explanation of the transparency of *atma* (spiritual self-substratum) to the body qua mind and vice versa. It is often said that at death the *atma*, like the electricity in a table lamp, departs from the body, and cripples or renders dysfunctional the mind, like the globe of varying voltage and amps, and there is no possibility of consciousness states thereafter . But what is this evidence of? The absence of evidence to the contrary does not amount to evidence of absence.

III

It seems that we need to free ourselves of the erstwhile polarity of 'inside' and 'outside', i.e., of trying to locate consciousness within the mortal frame (whether in the cinema of the 'Cartesian theatre', the supposedly non-physical mind), *or,* in some single spot within the body, such as the brain, much less in a single spot within the brain (the 'Centre of Narrative Gravity'). Our mental life, and if the intentionality that I spoke of earlier is anything to go by, is located neither outside in the world, nor inside our body. Perhaps in the new language that we are desperately in quest of we may have to speak of consciousness as that which is both constituted by and constitutive of the body (or brain) and the mind (as the meaning-act). This sure does sound circular, but it is not viciously so; it is defensible. Because, what we are trying to do is to avoid both the horns of the Cartesian-implied dilemma that we pointed to a moment ago: (i) the mind (alone) is responsible for consciousness; (ii) the natural world is itself generative of consciousness. I am tempted to say, consciousness begins with (i), and matures with (ii), and yet – when we take in the historical dimension or long-term persistence of consciousness as of time (which is how I would re-write Heidegger's much clichéd 'Being and Time') – consciousness curiously also constitutes (i) and (ii).

To develop this point a bit further, by historical consciousness I mean the collective repository or archeology of the inner-time consciousness across the board picking up on discrete human experiences. There is, as it were, a cumulative growth of consciousness states, layers upon layers, like fossils, now perhaps inert but once upon a time every bit consciously felt and owned (or 'pre-loved') by some living agency. The agents may be' dead' or mute but the discrete train of traces or subtle effects, as it were, are brought forward as many artifacts, testimonies, records, achievements, merits and sins, values and aspirations – indeed, the outer-time consciousness or *history* in that more Hegelian sense – from generation to generation, epoch to epoch, and so on. How dare we leave consciousness out of the movement and trajectory of history, human and other sentient history (unless, we have moved through life like stars and galaxies governed by unself-conscious hidden laws of nature)! For, the very sense of history is the collective self-consciousness and reflection upon the folding layers of qualias, such as are attached to whole groups', races', or communities 'I's (or 'we's), replicating in many ways the individual's narratives and life-stories writ large (as when we speak of civilizations, the preserve of cultures, transcendental self-identity of enclosed communities etc.).

This back-logged consciousness also *creates* us in a manner of speaking; meaning that each individual (body-mind complex) inherits or imbibes fragments (in Hindustani there is a universalizing poetic image of '*chand ka tukra*', 'bits of the moon') of the collectively conscious subjectivity or transcendental qualia (again, in a contingently historical rather than pre-assigned ontological sense). It is this that enables (or em-powers) many a capacity, and identifies us as distinct individuals belonging to distinct communities, not least of which are speech-language or *lingua franca*, discourse, self-story or social identity, moral values, religion, aspirations, and so on. And we pass these on, somewhat transformed, evolved or regressed, often without self-consciousness (*authorial imprimatur*) to the next generation, *ad infinitum*. We should not lose sight of this unique dimension of transparency (as trans-*parenting)* of consciousness, which I have called constitutive - although some philosophers will still argue that it is merely correlative.[13] Nevertheless, like history, the next moment is never the same because it is 'interpreted' or formed and fused through the antecedent moments. This was the genius also of the Buddhist theory of consciousness in its recognition of the branching effect, the mereological spread over finite time of a self-narrating, self-referring, stream of conscious-*ing* moments bound together (the 'binding' effect) in a loosely unified field, we like to call 'self' (not as an irreducible substance here), whose present self-awareness and knowledge of the world are supervenient upon properties and relations leftover from all the past experiences (conscious-*ing* states), and whose future is likewise determined by or is a mere trajectory of the vanishing present. Beneath all this noise so to speak, and beyond also, is nothing but emptiness – meaning, no-self, no-soul, no-mind, no-God, no-*Brahman*, no-Absolute, just nothingness. (There are, of course, subtleties and differences within Buddhist schools, such as *Yogacara, Sautrantika* and *Madhyamika*, that we need not go into here.)

Coming back to the point about the historicality of consciousness and its cumulative effect on phenomenal experiences in every next moment; however this in itself might not be, as it clearly need not, essential to consciousness, for if there were just one person (a *purusha*) in the whole universe who lived only temporarily without progeny (*aprajapati*), we would not necessarily want to deny consciousness to the *Mahapurusha*. The difference nevertheless will be in the qualia of consciousness, the properties that is, which will be one of degree rather than of kind, just in the way your or my consciousness has refracted through many previous (time-sequenced) and different prisms (spatially) of conscious-*ing* moments. Suffice it however to show that consciousness is *something*, it is profoundly enigmatic but a sure remainder in human experiences. This would suggest an irreducible core within consciousness or at least in the explanations and definitions of consciousness. Now this has been a moot issue and the subject of much debate in recent works in philosophy and psychology on consciousness. But reductionism is alive and well in several quarters, some more ruthlessly eliminative than others. For example, Daniel Dennett (1991) does not believe that irreducibility in respect of the arresting mystery of subjectivity is such a big deal: that is to say, the reference to the subjective, to intentionality, can be carved off, and these too can be reduced to ordinary biological, *physical* features of the brain (qua Searle (1992) and Churchland (1981)), *and* exhaustively redefined in third-person (ordinary thing-language) descriptions and criteria (e.g., our experience of heat is redefined in terms of kinetic energy that increases mean temperature).[14] Such a redefinition eliminates any reference to the subjective appearances, the way heat or colour appears to individuals.[15]

There are some philosophers, such as Thomas Nagel,[16] Roger Penrose[17] and David Chalmers[18] more recently, who have resisted ironing out the perspectivism of persons into the smooth objectivity of the world of physics, much less in terms of unbending hard-wired materialism. They urge that even if consciousness is not mystery, it is still unexpected from an objective approach to *what it is like* inwardly to be in a conscious state and to have conscious (or unconscious) experiences which we may never be able to pass on, again, to the table or the computer that are in some ways the only 'witnesses' to these ruminations in the early hours of each morning (while the resident dogs seem to have a better sense of my angst). Given these characteristics, consciousness is at least '*surprising*', as

Chalmers puts it.[19] And so these philosophers believe that there is at least an epistemological irreducibility of mental processes to brain states that calls into question all attempts at one-sided elimination. Thus Nagel has argued that '(t)he subjectivity of consciousness is an irreducible feature of reality – without which we couldn't do physics or anything else – and it must occupy as fundamental a place in any credible world view as matter, energy, space, time, and numbers'.[20] Any 'correct theory of the relation between mind and body would radically transform our overall conception of the world and would require a new understanding of the phenomena now thought of as physical. Even though the manifestations of mind evident to us are local – they depend on our brains and similar organic structures – the general basis of this aspect of reality is not local, but must be presumed to inhere in the general constituents of the universe and the laws that govern them.'[21] Nagel's epistemic non-reducibility (with a remainder) reinforces the point I have been trying to stress here about the involvement of the larger picture, so to speak, of the world as a constitutive element in the emergence of consciousness, neither inside in the brain nor wholly outside in the heavens: but in the matrix that holds them together in an organic whole. Again, I agree with Nagel that the same entity can have causally emergent physical and mental properties; this is called by Nagel, and others, the 'dual-aspect theory'; I prefer to call it, *non-dual naturalist emergentism,* in which the necessity of an absolute ontological substratum to consciousness is eliminated. However, this position does not argue for a wholesale elimination of mental concepts in the explanation (for the 'mentalese' has a central role to play in terms of phenomenal properties that are supervenient upon physical occurrences, but they could also be dependent upon other inter-looping phenomenal properties or qualia). Nor does the non-eliminative view of our mental world imply that we succumb to some version of ontological transcendentalism or the 'mystical' within subjectivity and intentionality!

Such a position, which echoes recent developments in Process Para-Philosophy,[22] retains intact a common sense commitment to non-reductionist naturalism, while at the same time assuming a broad 'radically empiricist' notion of the data a theory ought to accommodate, including the capacity for non-sensory ('extra-sensory') perception, by virtue of admitting a role for *Nyaya*'s notion of *mensa extensa*, the mind as having its own extension (in cohorts with *res extensa* within an organized division of labour). This overcomes the difficulties of accounting for the emergence of consciousness and its properties from purely extensional matter on the one hand, and pristinely extensional psyche on the other. The same topic can have both these correlative qualias or aspects. Still, I confess, a further argument is needed to explain how these can be *constitutive* or *productive* of consciousness. We are burdened, indeed haunted, by the same sort of problem that arises in attempting to make links from observing behaviour and properties of neurons and synaptic responses to stimuli inserted and observed from without and to subjective states and intentionality experienced within; and vice versa. I do not have an answer to this (as yet).

Conclusion

To bring this discussion to a close, let me highlight again some salient issues and characteristics of consciousness that have been uncovered in order that the discussion moves forward rather than backward in the multi-disciplinary inquiry that we are all engaged in. Here are 10 significant points (with two supplements) I have argued for in this short analysis.

1. *Consciousness* is the name for the preeminent principle of awareness in every day experience that is responsible for making an occurrent self-consciously (or self-awareingly) an experience: it is what illuminates an experience – we may call this the conscious mind;
2. Consciousness has content but no particular form; it takes the form or contours of the occurrent experiences which the awareness shadows or witnesses, albeit not as an entity distinct from sensations, feelings, cognitions and other mental states as mapped in phenomenological analysis;
3. Awareness may be submerged or suspended as in unselfconscious processes, dreams and deep sleep states – or the unconscious;
4. There is (either way) an irreducible core of subjectivity and intentionality that makes the conscious mind more than all sensations, bodily ascriptions, experiences, including the "I-sense" and moral knowledge;

5. It is thus more than the physiological-neural and synaptic-receptor etc. activities inside the brain or sense-organs (*manas* included);
6. The processes and brain mechanisms observed or chartered from outside (or yogically, i.e. mystical-meditative introspection) yield at best *correlates* and not what is constitutive of consciousness in all its complexity;
7. Basically, consciousness is constituted by and constitutive of the world (recurrently birthing) within a historical and social-cultural process; this is the horizon of the transcendental subjectivity into which the individuated subjectivity is fused; in other words,
8. The 'Narrative Gravity' extends beyond the individual 'owner' to the larger cumulative historical dimension that constitutes the world and interactively the qualias of all consciousness (i.e. differentially spaced branching streams of conscious-*ings* each of which creates its own contingent 'I-feeling');
9. It follows from 4 and 8 above that consciousness is not a substance (materialistic or spiritual and non-corporeal) but a phenomenal property qualia (or intertwined clusters of qualias) and there is no such thing as 'pure' or 'absolute consciousness' in the metaphysical sense (it could be transcendental in the phenomenological sense, as in the 'inner core structuring noema');
10. We need principles of phenomenological supervenience in lieu of unidirectional causal language (thus, e.g. mental event *M* is supervenient on physical event *P* which is observed from outside as P*, *ceteris paribus*), mereological apperception (identity is generated from within the branching and binding series), and a more inclusive ontology of non-dual naturalism (aspectual or property dualism within 'natural' philosophy) to re-define and refine our understanding of consciousness
11. This would help eradicate outmoded discourses of mind–body dualism and epiphenomenalism (Cartesian and Indian), false identifications (*upadi, adhyasa*) of consciousness with Self, Soul, Spirit, God, *Brahman*, Absolute, *Nirvana*- or *Svarga-bhokta* (each of whose existence remains in doubt);
12. By such a test, we will have put the Grand Narrative of the Mind to rest, and given the life of the mind a chance.

Notes

1. In this context one might consider Thomas Nagel's famous paper on 'What is it like to be a Bat?' *Philosophical Review* 1974, 435–50. Here Nagel argues how current reductionist theories are inadequate in providing any new information about the mind/body relationship.
2. John Searle (1992), *The Rediscovery of the Mind* (Mass. MIT Press, Cambridge), Searle argues that intentional facts cannot be constituted by neurophysiological facts, pp. 156–158; J N Mohanty (1972) *The Concept of Intentionality* (St Louis: Warren H Green); (see also next note).
3. Mohanty J N, 'Consciousness and Knowledge', in his (1992) *Reason and Tradition in Indian Thought An Essay on the Nature of Indian Philosophical Thinking* (Oxford: Clarendon Press), pp. 26–53, p. 28; pp. 43–46. I am indebted to this essay as to many enlightening discussions with Professor Mohanty.
4. Although perhaps in the comatose state of a brain-dead individual, or in the analogues to deep sleep, parts of the body continue to interact with each other through the complicated nervous system and organic functions that keep going as long as there is life force in the body.
5. Ibid. pp. 28–30
6. See P. Bilimoria, 'On Sankara's Attempted Reconciliation of "You" and "I (*Yusmadasmatsamnvaya)s*" in ,J N Mohanty and P Bilimoria (eds) (1997), *Relativism, Suffering and Beyond Essays in Memory of Bimal Matilal* (Oxford University Press, Delhi) pp. 252–276.
7. I have précised a long discussion in the tradition, although shortened in Mohanty's account (*op cit).*
8. *Sribhasya*, Adhyasa I Pada 1, section on Perception (*pratyaksa). The Vedanta Sutras of Sri Ramanuja*. (Translated by Georg Thibaut, Vol I, p. 52)
9. George W Shields, review of David Ray Griffin (1998), *Unsnarling the World-Knot: Consciousness, Freedom, and the Mind-Body Problem*. (Berkeley: University of California Press), in *Sophia* vol 40 no 2. December 2001, pp. 67–72, p. 67
10. Kisor Kumar Chakrabarti (1999) *Classical Indian Philosophy of Mind: The Nyaya Dualist Tradition* (State University of New York Press, Albany), pp. 210–211
11. I have discussed this view in detail in another paper (unpublished), 'Extra-sensorial liaisons of 4D Yogins: enigma extolled by Nyaya; impeachable to Mimamsas', a view best expounded in Visvantha's

Bhasa-Pariccheda. The mystical disembodied (or twin) self extended to other, even distant, egological bases is rendered as *vibhuti*, and may claim to itself yogic awareness of others' mental states, notwithstanding problems of individuation, confusion of ego-identities, and zealous expropriations.

12. See Patrick Foster's review of Kisor Chakrabarti in *Sophia*, vol. 40 no. 2 December 2001, pp. 73–75
13. Shields (*op cit)* mentions William Seager and Jaegwon Kim in a related contestation over *correlative* versus *constitutive* implications.
14. Daniel Dennett (1991), *Consciousness Explained*. (Little, Brown, and Company, Boston), P. Churchland (1981) 'Eliminative materialism and the prepositional attitude;. *Journal of Philosophy* **78** **(2):** 67 Boston: 90.
15. However, Searle, who is still a physicalist in these matters, criticizes Dennett for denying subjectivity as the central feature of consciousness (1992, p. 57). A good of these debates are to be found in Willem B. Drees (1997: *Religion, science and naturalism* (Cambridge University Press, Cambridge), pp. 187, Boston: 190.
16. Thomas Nagel (1986) *The View from Nowhere* (Oxford University Press)
17. Roger Penrose (1994), *Shadows of the Mind*. (Oxford University Press, Oxford, New York)
18. David J Chalmers (1996), *The Conscious Mind in Search of a Fundamental Theory* (Oxford University Press, New York).
19. Chalmers is drawing on some famous expressions made famous by Nagel, Lewis, and others, p. 5, and onwards.
20. 1986, pp. 7ff
21. Ibid p. 8
22. As noted from Shields' review of Giffin's work.

Beside the 'intentor' and the 'integrator': Looking at two 'faces' of consciousness

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Abstract

Understanding is always of something which is 'other' than us, that which we are not acquainted with. We intend to know the 'other'. We understand the 'other' by means of images, ideas, words and metaphors. In the process of understanding we also try to integrate the knowledge we get, to a larger system of our world-view, which in turn influences, consciously and unconsciously, our ways of responding to situations.

In study of mind and consciousness the basic duality involved in understanding takes an interesting turn, that of integrating the understanding of the experiencer with experience itself. Experience itself is a factor in the process of intending to understand it. If definition and knowledge are to be objective, potential of predictability and repeatability, can study of human mind and consciousness be included under classical ways of understanding? Can we define consciousness based on pre-experiential understanding of it? Can the experience be studied with the experiencer having minimal or no role?

Conversely, can the self/experiencer be understood with experience having minimal or no role? In short, will the definition of consciousness be exhaustive of its complexity?

I propose that these questions are as difficult or as easy as asking 'Can I see my face?'. I can see my face as much as it is represented. But none of the representations can replace my original face. What we 'see' is only the reported. The being of the reported cannot be confused with the being of the original. Whether they are two distinct duals is of course a metaphysical theme for discussion. However, I think, the most interesting issue is that though the reported and that which is reported about can not be reduced to one, 'the reported' and 'that which is reported about' can influence each other. I understand and define myself based on my experiences. At the same time, my experience depends upon the notion I have of myself. I intend to know. I also integrate that which I know. And this mysterious power of consciousness to intend as well as to integrate is the puzzle we are all trying to solve!

1. Introduction

Be it of the physical, mental or social world, understanding is always of something which is *other* than us, that which we are not acquainted with. We intend to know the *other*. We understand the *other* by means of images, ideas, words and metaphors. All of these tools are involved in the building of institutions and organized knowledge systems. In the process of understanding we also try to integrate the knowledge we get, to a larger system of our world-view, which in turn influences, consciously and unconsciously, our ways of responding to situations.

In the study of mind and consciousness the basic duality involved in understanding takes an interesting turn, that of integrating the understanding of the experiencer with experience itself. The experiencer itself becomes a factor in the process of intending to understand the experience.

If 'definition' and 'knowledge' are to be objective, with the potential for 'predictability' and 'repeatability', can we include the study of human mind and consciousness under classical ways of understanding? Can we define consciousness based on pre-experiential understanding of it? Can the experience be studied with the experiencer having minimal or no role? Conversely, can the self/experiencer be understood with experience having minimal or no role? In short will the definition of consciousness be exhaustive of its complexity?

I propose that these questions are as difficult or easy as asking 'Can I see my face?'. I can see my face as much as it is represented. But none of the representations can replace my original face. What we 'see' is only the reported. The being of the reported cannot be confused with the being of the original. Whether they are two distinct duals is of course a metaphysical theme for discussion. However, I think, the most interesting issue is that though 'the reported' and 'that which is reported about' cannot be reduced to one, 'the reported' and 'that which is reported about' can influence each other. I understand and define myself based on my experiences. At the same time, my experience depends upon the notion that I have of myself.

I intend to know.
I also integrate that which I know.

And it is this mysterious power of consciousness, both to intend as well as to integrate the puzzle, that we are all trying to solve!

2. Methods and approaches

2.1 *'Name-ing' and 'Form-ing' the unknown*

A common feature of many of the approaches to the study of 'consciousness' is the distinctness in the method of defining the problem. The study of 'consciousness' is initiated by two parameters such as the 'name' and 'form' of consciousness. In other words 'the what' and 'the where' of consciousness (Menon 1999) mark the starting point to address the complex issues involved of the unknown. The definition for 'consciousness' would restrict the specific areas for investigation and also categorise them on the basis of related functions whether cognitive, physiological or even trans-mental. The classification of different approaches to consciousness studies could be based on this point itself. And, without this classification, there is not only the possibility of the absence of conceptual exchange between methods but also semantic confusion. This would also mean that 'the perspective' is as important as the problem at large for the interdisciplinary discussions on a complex phenomenon like consciousness. If the perspective itself is clearly laid down by means of the categories and concepts used, the 'mystery' and 'anonymity' generated during the discussions about 'consciousness' could be avoided to a larger extent.

A major clash between discussions being how the subjective and/or objective (functional) nature of consciousness is accounted, an initial clarity and specificity in terms of the conceptual framework and extent of the applications of the method would be helpful as well as foundational in constructing theories and developing interdisciplinary exchanges.

2.2 *Localisation of conscious experiences*

To elaborate further on this contention, a widespread 'attitude' towards consciousness, namely the 'given-ness of the problem of consciousness', could be looked into. A taken-for-granted assumption that 'consciousness' is something static and sedentary 'sitting' *somewhere* to be understood has led to a major part of the research towards the localization of the conscious experience/s. Though the 'unknowability' of 'consciousness' as a complex phenomenon is conceded, it (the 'unknown') has also encouraged the classical way of knowing which is by means of segregation and performance. Distinct performances of 'consciousness' are taken and these are labeled as 'conscious experiences' and their origin, function and localized area (neurophysical and neurochemical) identified as the problems to be solved. The understanding of 'consciousness' is essentially the understanding of neuronal functions, cognitive or sensory-motor. The major trend beholden by this trend is the 'building block approach' (Searle 2000) which explains the conscious field as consisting of a series of building blocks each being a conscious experience. The knowledge about any one conscious experience would contribute to the understanding of other kinds of conscious experiences. The mystery of consciousness would finally be solved by the understanding of the interconnections between the causal mechanisms of different conscious experiences. Questions about continuity, uniqueness and nonphysical attributes of consciousness, by this approach become auxiliary or even redundant.

The building of consciousness from fewer characteristics to more number of characteristics is certainly an approach that would favour the Darwinian evolutionary advantage. This approach would also be able to forsake the need for a specific working definition of consciousness. Eventually the method (instrument, design, measurement etc.) for investigation becomes the crux of the study. The means to understand becomes the subject for analysis and focus. But 'what' is to be understood, in the process, is either not defined, or ontologically reduced and pushed into an epistemological oblivion.

3. Is consciousness unknown like any *other* unknown?

3.1 *A neighbour unnoticed and the 'puzzle of consciousness'*

Obviously it is the 'why' of 'consciousness' that has made it so interesting for us to know more about it. Why should discrete neuronal functions and neurochemical reactions 'generate' a unified feeling of having physical sensations such as pain, or even mental dispositions such as sorrow, happiness etc.? Why should quantitative phenomenon have qualitative co-relates? These two questions form the basis of the 'puzzle of consciousness' distinguished as the 'easy' and 'hard' problem of consciousness (Chalmers 1995). The 'unknowablity' of consciousness, which is centred around the 'hard' problem of consciousness, is not just about the subjective and qualitative nature of consciousness but also about the prior distinction between subject and object that precedes any theory formation or metaphysical discussion.

The distinction between the subject and object, that is, something which is near to me/part of me and something which is far away from/other than me, is fundamental to human thinking and experience (See *Dṛg-Dṛśya Viveka* of Adi Śankaraçarya) whether physical, mental or socio-cultural. The mystery about consciousness is the mystery about the gap between two distinct 'entities' namely the objective and the subjective. Can one be reduced to the other; or can the existence of one be caused by the other: explaining one in terms of the other seems to be also the way to solve the 'disturbing' duality.

3.2 *The changing and the abiding*

The discussion on the 'hard problem' of consciousness has generated a consensus on identifying the 'puzzle of consciousness' as involving a qualitative duality. Whether this duality is apparent or real is the intractable question eluding neurobiologists and philosophers. If ontological nature is taken as the defining and demarcating factor, the duality involved in consciousness could be seen as ontological too. The neurophysiological function and the sensory-motor response caused/triggered by an external stimulus are two distinct reals from a physical point of view of the brain/ consciousness. From a personalistic/non-physical point of view the picture is different. It is ME having an experience of pain; whether I am cognizant of the neuronal functions or not is not a deciding factor on which MY EXPERIENCE is dependent. I may or may not be having the knowledge about the neuronal functions responsible for my specific conscious experiences. But for sure, I have the knowledge of/am aware of distinct conscious experiences relating to and abiding in ME. The neuronal reactions and the sensory-motor responses are also not the significant signs of 'my conscious experience'; but it is the unified 'identity feeling' of 'me having such an experience' which is the significant sign of my conscious experience. Even if we look at the duality involved from this perspective it is that which is initiated by the identity of 'me' (I AM having an experience) and 'mine' (MY EXPERIENCE).

The duality problem of consciousness is of two kinds: one is of the 'easy' and 'hard' problem; and the other is within the hard problem. The duality within the 'hard problem' is a phenomenological puzzle and raises a 'harder problem' (Menon 2001a). The duality of the 'easy' and 'hard' problem is a neurobiological problem.

There are three distinct 'features' known of 'consciousness'. At every instance of physical pain (physical-conscious experience), mental pain (non-physical-conscious experience) or any (conscious) experience there is a 'gestalt' meaning brought out by a union of three units such as,

(i) experience (e.g. pain),
(ii) experiencer (e.g. me <u>in</u> pain)
(iii) I-ness (me <u>having</u> pain)

The first two: 'experience of pain' and 'me in pain' are ontologically of a transient nature. Just as the 'experience of pain' I can have many other distinct experiences. Correspondingly the 'experiencer' also changes.

The third unit that is of a meta-experiential nature ('me HAVING such an experience') is changeless, since it accrues to a continuing and abiding 'I-ness'. It is this unit that integrates both the distinct conscious experience/s and the conscious experiencer/s and presents a meaningful continuity.

3.3 *The other-ness and near-ness of the unknown*

Experiences are mostly characterized by their 'distance' and broadly divided as objective and subjective. We can have a range of experiences, a certain type pertaining to outside objects, and a certain type pertaining to inside objects. When my toe hits a stone, the pain I feel is 'inside', but the stone, which has triggered the pain, is an object outside, which has its own distinct physical properties. The experience of pain is nearer to me than the experience of the existence of the stone. 'Is the perception of the stone nearer to me and belonging to the same class of the pain?' is another question to be looked into. At this juncture of our discussion, what is attempted is to see the broader classification of that which is outside the subject and that which is inside the subject.

Whether it is the existence of the stone, or the pain, both are given meaning, by relating them to a personal identity.

(i) [I see that] the stone exists,
(ii) I feel pain.

The feeling of pain is nearer [to me] than the existence of the stone. At the same time the pain as well as the stone are recognized as other than me. There is something unknown about both the pain as well as the stone. The stone as well as the pain are also 'felt' as other than me.

Is consciousness 'unknown' like the 'other' unknowns? This question once again focuses on the 'harder problem' of consciousness. The stone (object which has physical properties) or the pain (object which has mental properties) is experienced as other than me, changing and having meaning when related to an experiencer. They are unknown because they are OTHER than me.

Consciousness is not totally unknown, since it is possible to know about it through the distinct experiences and also through the distinct experiencers. What is unknown and mysterious about consciousness is threefold:

i) How is a meaningful continuity of ME HAVING different and distinct experiences produced?

ii) Why is a meaningful continuity of ME HAVING different and distinct experiences produced?

iii) Where is the meaningful continuity of ME HAVING different and distinct experiences produced?

The unknown-ness of consciousness is about the 'harder problem' of consciousness, the distinct and unique I-ness performing two functions differing by their ontology: There is an intentional 'outward' movement of consciousness; there is also an integral 'inward' movement of consciousness.

4. Two faces of consciousness

4.1. *How does consciousness 'look like'?*

Like causality, attributing a name and limit to a form are also ways of the human mind to know the 'unknown'. It is also interesting that our minds (and institutions of knowledge creation) use history as a tool (may be because we essentially deal with relative time: past, present and future) to understand and classify new objects of knowledge, and therefore comparison is as important as uniqueness. To know something new, we first compare it with classified and validated knowledge (by the accepted tests, measurements etc.) and then allocate them under a category. Therefore the 'new' is always relative to the 'old'. In other words, the 'unknown' is relative to the 'known'. It is this basic structure of duality embedded in our thinking that helps us to know, to relate and to have meaningful interactions and institutions.

In consciousness studies, we look for measurable physical correlates of qualitative non-physical conscious experiences. The contention is that discrete conscious experiences could be localized and identified by their neural correlates. Whether the neural correlates are also the neural causes of conscious experiences is an issue debated within this camp. This method also helps to trace the evolutionary path of consciousness starting from its primordial beginnings (in terms of functions).

How much of a conscious experience can be identified and localized by its neural correlate is an important question. The discussion on this question brings forth the quantitative and qualitative distinctions vivid in a conscious experience. "Does the brain need to be the centre of focus for understanding consciousness?" might also emerge as a question to be looked into. At the same time, unless we identify cortical areas and limits to neuronal functions, a matching of cognitive abilities and degrees of consciousness cannot be possible. Matching brain functions and degrees of consciousness is a major step towards understanding the complexity of not only human behaviour and intelligence but also life as a whole. But then, how far can we reach by such a ladder of linear and hierarchical steps? Will we be able to find all the missing links? Will we be able to understand the qualitative jumps made and the vast differences between kinds of consciousness (such as: waking, dreaming, deep sleep; conscious, unconscious, subconscious; attitude, personality trait, identity)?

4.2 *Ways to knowledge and ways to transformation*

There seem to be two kinds of pursuits: The first kind is that which attempts to generate, classify and categorize knowledge for building institutions and understanding various levels of complexities in human behaviour. The second kind is that which does not follow a structured database, but which attempts to transform existing patterns of thinking and experience. The distinction between ways to knowledge creation and ways to transformation is well spelt out in the area of consciousness studies. Therefore, understanding consciousness in terms of degrees of intelligence and thereby degrees of self-awareness (based on cognitive and social functions) is as important as practices and philosophies that focus on the transformation of states of mind and experiences. Neural mechanisms and even their artificial simulations to cause specific experiences are indeed significant and need to be understood. Their understanding is considered significant since it leads to the removal of myths created about the ethereal continuity of consciousness. Reducing conscious experiences to their neural mechanisms, causes and cortical areas, according to this camp, is tantamount to reducing something (self) mistaken as qualitative to something quantitative.

This reductionism is good enough to obtain focal understanding about consciousness, and based on this, to obtain better classification of intelligence ranging from humans to other animals to machines. But is the problem fully grasped and accounted for by that attempt? If we look a bit closer, the answer is 'No'. The problem of consciousness is not just about having different kinds of conscious experiences and their explanation in terms of neural causes and correlates. Had this been the case, reductionism would have solved the mystery underlying the phenomenon.

The problem of consciousness is less about conscious experiences and more about the conscious experiencer. Based on the brain, we might be able to map the history of life and the evolution of human intelligence. Unfortunately, however this mapping is not sufficient to understand the principal nature of consciousness, namely self-orientation (Menon 1999). The problem of self is not even the problem of degrees of self-awareness (which is accounted for by cognitive abilities and social intelligence) but is the problem of self in and by itself. Ways to understand neural mechanisms underlying conscious experiences and ways to transform states of mind and experiences are distinct by method as well as by their ultimate goals. The goal of the first is scientific knowledge about life and intelligence and the second is spiritual inquiry.

The distinctions between these methods and goals also bring forth two levels of complexity in consciousness, of the 'I' and of the 'experience'.

4.3 *The 'who am I' question*

Since it is not in accordance with the usual norms of scientific thinking, the question relating to the nature of consciousness pertains to its phenomenological functions (neural and cognitive) and physico-chemistry which can be specified and quantified, and not to its ontology. The ontology of consciousness necessarily involves qualitative factors and understanding, which would then emphasize not the many-ness of conscious experiences but the uniqueness of the conscious experiencer or what is easily available to us as our 'I-ness'. The 'who am I' question (see *Saddarsanam* of Sri Ramana Maharishi, 1970) could open new avenues to the understanding of consciousness, and herald a different approach (from locating conscious experiences) to spiritual enquiry and transforming states of mind.

4.4 *The one face and two looks*

If the question about 'I-ness' is significant for understanding consciousness, what is the meaning of neurobiological and other locus-specific approaches to consciousness? Are they opposed to self-approaches or even redundant? We can say that the answer is negative. The two approaches, though distinct by their very nature and method, are equally meaningful. We might even consider that the complexity of consciousness would see some light of unraveling only in the corridors where the two approaches would meet and be complementary to each other.

The complexity of consciousness is such that it is simple in the context of the experiencer, but intricate when the experience is analysed. Therefore it is likely that the first person approaches would contribute to the growth and transformation of the human self, and the third person approaches to the generation and application of knowledge about human intelligence and life as a whole. In both the cases, we should remember that the complexity about consciousness lies not in its nature but in understanding its two distinct and different expressions of the 'experiencer' and the 'experience'. The 'Face' is simple. The two 'Looks' are complex and difficult to understand.

4.5 *Intention, integration and the irreducible I-ness*

It is difficult to understand the two varied expressions of consciousness because they are different in terms of their production, function and evolution. Much of the discussion in the circles of philosophy and science is centred on the intentional mode of consciousness (Varela 1999) and its production (or qualitative nature). For some reason it is forgotten that many a time human lives are guided by the habitual (social and psychological) ways of responding to situations and unintentional consequences of human actions (see *Brahmasutra Adhyasa Bhashya* of Adi Sankaracharya, 1996). The intentional act and thinking and the non-intentional act and thinking, both have meaning, when we look at the human mind, since they are co-coordinated, structured (Menon 2001b) and given continuity by their belonging to an 'I-ness'. This 'I-ness' is irreducible.

Intentional and non-intentional acts and thinking could as well come under the purview of philosophical and neurobiological analysis. But the 'irreducible 'I-ness' is transcendental to even a meta-level of understanding and is purely experiential and self-oriented.

Our conscious experiences could be the product of our intentional or non-intentional acts and thinking. Analytical knowledge about them also is the product of the intentional mode of consciousness. What is often missed in attempts to understand consciousness is the categorization of the 'irreducibility' of consciousness in terms of 'I-ness'. Reductionism can work only at the level of intentionality. The irreducibility of 'I-ness' could be appreciated better if we introduce the 'integral' mode of consciousness (see *Bhagavad Gita Bhasya, Ch.13* of Adi Sankaraçarya). We not only (intend to) know and experience, we also integrate that which is known and experienced to a larger self. What is beside both the intending and the integrating is (yours and mine)'I-ness'.

4.6 *Self-exploration and the unavoidable mystery about consciousness*

The mystery about consciousness is the mystery about its 'belonging' to a self. This mystery is unavoidable to the extent we try to understand the integral mode of consciousness and the simple given-ness of your 'I-ness' and mine. We can understand consciousness as far as it is represented and reported. It would be like saying that the story is complete at its introduction, if we conclude that the problem of consciousness is answered by its representations. Representations cannot replace the original. And therefore the reported cannot be confused with the original. However intricate and interesting the reported is, it would be unwise to think that the original has nothing more to it than its representations.

Understanding consciousness is continuous self-exploration. Knowledge about consciousness does not work in a linear and causal fashion. Self-knowledge is transcendental. Therefore understanding consciousness would be also by exploring the many possibilities of the human self and mind, than just the convenient addressing of it as a figment of imagination. What is interesting and worthy of exploration is to look at what is beside both the intending and the integrating mode of consciousness. Focusing on the duality (intentional and integral mode) of consciousness might result in epistemological circularities until and unless we look at what is 'beside' both the modes, which is the 'I-ness'. To see the 'wave' is to see the 'sea'. To see the 'sea' is to see the 'wave'. To see what is beside both is to become one with the non-dual.

5. Conclusion

What was attempted in this discussion was to look at whether the duality involved in the understanding of consciousness is basic. Intentional and integral modes of consciousness can be better explained and the epistemological circularity involved in duality-approaches can be avoided if we include a third factor of 'I-ness' which is nonlinear, alocal and acausal, and hence metaphorically described as 'beside' in this paper. The mystery about consciousness is that it is self-oriented. Breakthroughs in consciousness research could happen if we encourage self-exploration and spiritual enquiry also along with third person approaches.

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Section 3

Consciousness and rebirth in classical Yoga

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Abstract

The tradition of Adhyātma or Classical Yoga is based on pre-Buddhistic verbal foundations viz., Early Upanishads, Yoga-Sutras and Bhagavad Gita. It deals inter-alia with the evolution of consciousness in Homo sapiens and the crucial role of yogic practices in accelerating the movement towards attainment of Prajñāna. i.e., universal consciousness. In this context one has to come to grip with the age-old concept of an evolving Antaḥ-Karaṇa (internal instrument of cognition and consciousness) and the possibility of its purification, refinement and eventual perfection through sustained yogic practices, particularly meditation, that may well need more than a life time on this earth. Thus Punarjanma (rebirth) finds its appropriate place in Classical Yoga, assuring continuity in evolution of consciousness from one life to another.

Modern Science can adopt a new and pragmatic approach to the theme of human consciousness in the light of not only ancient yogic wisdom, but also recent findings of Neuro-surgery and Neuro-physiology.

1. Introduction

The beginnings of the Yoga tradition are definitely shrouded in the mists of antiquity, but it is now universally recognized that Yoga constitutes one of India's oldest and most important scientific-spiritual legacies to the human family. There is enough evidence to show that Yoga was conceived and developed, studied and researched, practised and perfected, experimented upon and expanded in scope uninterruptedly, primarily on the vast Indian Subcontinent, since the dawn of human history. Today millions of eager and enthusiastic seekers, from practically all countries of the world, are responding positively to the call of Yoga and reaping diverse benefits in terms of enhancement of the quality of life, particularly physical and mental health, through regular yogic practices. Numerous rigorous scientific studies of the last few decades, in India as well as elsewhere, have also established beyond doubt the therapeutic value of many yogic exercises, apart from their enormous contribution to positive health and increased sense of well-being of the practitioners constituting men, women, boys, girls and people of all ages.

Gautama Buddha (563-483 BC) is perhaps the first important historical figure of the Yoga tradition, whose date can be fixed, whose life can be sketched and whose teachings on the problems of human existence can be ascertained, with some measure of certainty. It is reasonably obvious, however, that the meditative practices associated with advanced stages of the yogic discipline were well established in India *long before* the Buddha was born.

The excavation of seals portraying deities in time-honoured meditative postures in the sites of Mohenjodaro and Harappa of the Mature Indus Valley Period (3000-2000 BC) strongly suggests that the Yoga traditions are not only over four millennia old, but was in fact given special recognition in Indian society well before the Vedic period beginning around 1500 BC. Considering that any movement takes its own time to germinate and grow, and that many, many generations of development are the *sine quo non* for the wide acceptance of any concept or practice, today's votaries of Yoga in all parts of the globe may be fully justified in considering themselves the inheritors of a vibrant and glorious tradition that goes back to at least 5000 years of human history.

2. Adhyatma yoga (Classical Yoga)

Not surprisingly, the present global scenario related to this ancient and dynamic tradition of Yoga is a vast, complex and often confusing one, many of its ramifications and manifestations as dealt with in numerous texts, treatises and manuals causing great bewilderment in students of its theoretical and applied aspects. Derived from the Sanskrit root "*yuj*", meaning to unite, Yoga was generally understood from the beginning as a *state of union* of pairs like

1. Individual Consciousness and Universal Consciousness;
2. *Ātman* (the individual self) and *Brahman* (the Supreme, All pervading Self);
3. The human and the Divine; and
4. Man and God,

where the second entity is invariably conceded as beyond the reach of the human intellect. Down the ages the word Yoga came to be used not only to refer to the afore-stated goal or objective, but also to describe the several paths that can lead to this transcendental state of union. Thus the yoga literature deals with special pathways to Yoga like *Jñāna Yoga* (Path of Discriminative knowledge), *Bhakti Yoga* (Path of Dedicated Love and Adoration), *Karma Yoga* (Path of Unselfish Action), *Dhyāna Yoga* (Path of Spiritual Meditation), *Kuṇḍalini Yoga* (Path of Awakening *Kundalini,* the Evolutive Potence), *Laya Yoga* (Path of Total Absorption) etc., each supposed to suit a particular temperament at a particular stage of spiritual evolution.

Adhyātma or Classical Yoga is concerned with *Ātman,* the Individual Self or the Person in Depth and its union with *Brahman,* the Cosmic or Divine or Universal Self. It derives its strength and significance from the three ancient philosophical systems of *Sāṁkhya, Yoga* and *Vedānta.* The *verbal* foundation of this unique *Science,* of Man in Depth and *Spirituality* of Self-Unfoldment rests, surely and securely, on the triune bed-rock of the *Early Upanishads,* the *Yoga Sutras* and the *Bhagavad-Gita.* Whatever the suggested dates for the extant editions of these texts, the sanctity of spiritual traditions and the evidence of inherent thought content stamp these three important and precious Sanskrit texts unmistakably as pre-Buddhistic.

Sāṁkhya and *Yoga,* the two closely related *darśanas* (systems of philosophy built on intuitive or experiential knowledge), are generally accepted in the Indian spiritual tradition as the earliest in the long line of codified systems of transcendental thought and practice. These two massive structures of the intellect raised on the foundation of spiritual experiences of individual researchers are attributed to Kapila and Hiraṇyagarbha respectively in ancient Sanskrit texts of the Vedic tradition. These two sages and seers seem to be pre-historic personages who deified at some period well before the advent of Gautama Buddha on the Indian spiritual scene. Incidentally, the *Bhagavad-Gītā,* which forms part of the long *Mahābhārata* epic and is generally considered to have been composed by *Vyāsa* before 500 BC, refers to the *Sāṁkhya-Yoga* tradition as *purātana,* meaning age-old or ancient, and also as *uttaman rahasyam* (well-guarded secret knowledge) (*Gita,* IV.3). Sri Krishna also says *(Gita,* III.3) the following almost at the beginning of his famous dialogue with, Arjuna:

"*Loke-'smin dvividhā Niṣṭhā purā proktā Mayā-'Nagha, Jñānayogena Sāṁkhyānāṁ, Karmayogena Yogināṁ.*
In days of yore a two-fold spiritual discipline was taught by me in this world, O Arjuna, the path of knowledge for votaries of *Sāṁkhyā* and the path of works for practitioners of *Yoga*". Thus the internal evidence of many ancient Sanskrit classics also confirms that Yoga constitutes a very old tradition indeed, considered 'ancient' well before 500 BC.

The *Upanishads* constitute the last portions of the Vedic revelation and, as generally acclaimed by scholars, represent a very bright chapter in the history of the human spirit. Any one who reads them in the original Sanskrit is caught up and carried away by the elevation, earnestness, profundity and compelling fascination of the pregnant, often poetic, utterances through which they unravel the mysterious and sacred relationship between the human soul (*Ātman*) and the Supreme Reality (*Brahman*).

Although one hears of 108 Upanishads, most of them composed in the first millenium or even later, and some of them sectarian in character, by common consent twelve of them viz., *Īś a, Kena, Kaṭha, Kauśitaki, Praśna, Muṇḍaka, Māṇḍūkya, Taittirīya, Aitareya, Chāndogya, Bṛhad-Āraṇyaka* and *Śvetā-śvatara,* are labelled as the Early *Upanishads* and were apparently composed between 1000 and 800 BC. These contain the hard core of *Vaidika-Darśana* or the Vedantic philosophy and have dominated Indian thought and action for the last three millennia.

On the other hand, the *Bhagavad-Gītā,* the Song, of the Lord or the Song Celestial, often referred to as the thirteenth major *Upanishad,* is a compact work of 700 verses (*ślokas*) divided into 18 Chapters. It has long been hailed as the best known and most widely read spiritual classic of India. Described in the text itself as *Yoga-Śāstra* (Treatise on Yoga Practice), the *Gita,* as it is popularly referred to, enjoys maximum popularity among yoga practitioners having some acquaintance with Sanskrit.

Hailed as the first systematic and scholarly treatise on Yoga theory and practice, the *Yoga-Sūtras* consist of just 196 short statements or aphorisms (*Sūtras*), divided into four sections (*pādas)* entitled *Samādhi* (Unitive Experience), *Sādhanā* (Spiritual Practice), *Vibhūti* (Para-normal Attainments) and *Kaivalya* (Final Liberation). According to tradition, this work was composed by Sage Patanjali, who is supposed to have lived around 300 BC. The composition of *Sūtras* in any discipline presupposes in India the existence of large reservoirs of knowledge accumulated over centuries and the necessity at same point of time to condense each important concept or idea therein in *just a few words* for convenient transmission in the then prevalent oral tradition. The last century has witnessed a steady increase in interest in this ancient treatise embodying India's timeless wisdom on Yoga.

The expression *Adhyātma Yoga* (Classical Yoga) goes back to one of the very early Upanishads viz., *Katha,* that deals with Yoga in some detail. In an inspiring dialogue between a great teacher referred to as Yama, the God of Death, and a brilliant young disciple called Nachiketas, we have in this *Upanishad* some incisive questions dealt with, related to *Adhyātma Vidyā* (Science pertaining to the *Ātman*) and *Yoga Vidhi* (Rules of Yoga Practice). Thus *Adhyātma Yoga* emerges here (*Katha,* I.2.12) as the Yoga of Self-Knowledge or Science-cum-Spirituality of Man in Depth.

Significantly, in the tenth chapter of the *Gita,* while dealing with special divine manifestations like Himalaya among mountains, Ganga among rivers, Kapila among sages, *Auṁ* among syllables and the Holy Peepal among trees, Sri Krishna says:

"*Adhyātma - Vidyā Vidyānām* (Aham).
Among Science or sectors of knowledge, I illumine in particular *Adhyātma Vidyā* (Science and Spirituality of Man in Depth)." (X.32)

3. Prajnanam (Consciousness)

As can be ascertained from the basic texts of *Adhyātma Yoga,* the Indian sages and seers were aware from the very beginning of the vastness, complexity and transcendental nature of the field of Consciousness. It is not therefore surprising that different expressions were used in these early texts to refer to this most elusive and yet inescapable of all phenomena. Starting with *Prajñānam, Prajñā* and *Jñānam,* we come across words like *Chit, Chitta, Chetanā, Chetas, Chiti* etc., the actual meanings having subtle nuances related to the actual theme under discussion and the context in which a word is used.

The early Upanishads present us already with an impressive, detailed, convincing and profound vision of the Supreme Reality or Truth, starting with the defintion and description of *Brahman,* the All-Pervading Consciousness, without begining and without end. Beyond the reach of words, this Reality can, however, be DIRECTLY EXPERIENCED by the seeker of Truth, as claimed unequivocally by the *Rishis,* the spiritually advanced sages and seers of Ancient India. The word *Brahman* is derived from the Sanskrit root '*Bṛh*' meaning to grow, to burst forth and suggests gushing forth, bubbling over, ceaseless growth, continuous activity, in short, a LIMITLESS DYNAMIC EXISTENCE.

Among the numerous statements and descriptions in Vedic texts unveiling the mystery of *Brahman,* the following four *Mahā - Vākyas* or Seminal Utterances have a hallowed place:

1. *Sarvam Khalv-idam Brahma*
   All this is verily Brahman
   (*CHĀNDOGYA UPANIṢAD,* III.14.1)
2. *Prajñām Brahma*
   Brahman is pure Consciousness
   (*AITAREYA UPANISAD,* III.1.3)
3. *Ayam-Ātmā Brahma*
   The individual Self is Brahman
   (*MAṆḌŪKYA UPANIṢAD,*2)
4. *Aham Brahmā-'smi*
   I am Brahman.
   (*BṚHAD-ĀRAṆYAKA UPANIṢAD,* I.4.10)

Some institutions and schools of thought consider the following well-known Vedantic assertion as a *Mahā-Vākya:*

TAT TWAM ASI ---- That Thou Art.
(CHĀNDOGYA UPANIṢAD, VI.8.7)
However, the word *Brahman* is missing from this statement and the same *Upanishad* gets quoted again, thus questioning the special status of this undoubtedly pregnant and oft-quoted sentence.

Expressed in the neuter gender, *Brahman* is beyond the range of our mind and speech. All things manifest in the universe exist in space and time and are subject to ceaseless change under the inexorable law of causation, but *Brahman* is changeless, eternal, infinite, ever-free and beyond the reach of the senses. *Brahman* is the very essence of *Sat* (Existence), *Chit* (Consciousness) and *Ānanda* (Bliss). *Brahman* is the source and support of every object in creation and is *both* the efficient and material cause of the universe. The *Infinite* becomes finite in infinite ways in creation.

Another related basic concept in *Adhyātma Yoga,* is *Ātman,* the individual Soul or Self. Derived from the Sanskrit root *"an",* to breathe, and hence referred to as the breath of life, *Ātman* is the invisible and undying element of the human personality. Any individual being consists of the *Sthūla Śarīre* (gross body) made up of things material and the *Sūkṣma Śarira* (Subtle or fine body) composed of the functions of the mind, intellect and will, the so-called *Āntaḥ-Karaṇa* (the Internal Instrument of Cognition and Consciousness). The fine body builds up the gross body and keeps it going, but it is not active by itself or on it own. It is actually animated and made to work by the *Ātman,* the true Self or Soul, the substantive part of any living being. The *Ātman* is the source of all life, activity and consciousness. Warmed up into life by its touch, the fine body animates the gross one, just as the moon illumined by the Sun lights up the Earth.

The identity of *Brahman* and *Ātman,* the Cosmic Self and the Individual Self, is the most important and the most basic assertion of the Upanishads. The realization of this identity, this merger or union of *Ātman* and *Brahman,* is the supreme objective, the *summum bonum,* of human existence and looms large, bright and resplendent in the spiritual vision behind *Adhyātma Yoga.* Let us savour of some glimpses of incandescent eloquence in this regard from two great Upanishads:

"*Adṛṣtam, avyavahāryam, agrāhyam, alakṣaṇam, acintyam, avyapadeśyam, ekātma-pratyata-sāram, prapañcopaśamam, śāntam, śivam, advaitam, caturtham, manyante, sa Ātma, sa vijñeyah.* It is unseen, incomunicable, unseizable, featureless, unthinkable, unnameable, the essense of Self-Knowledge, into which all phenomena dissolve, the peaceful, the benign, the non-dual, it is considered the fourth state of consciousness, it is *Ātman* and has to be experienced".

(*MĀṆḌŪKYA UPANIṢAD,* 7)
"*Ātmā va are draṣṭavyaḥ, śrotavyo, mantavyo,*
nididhyāsitavyaḥ – Ātmam khalv-are dṛṣṭe,
śrute, mate vijñāte, idaṁ sarvaṁ viditam.

Ātman is to be actually perceived, my dear, it has to be heard, to be reflected on and to be meditated upon. When verily my dear, the *Ātman* is actually seen, having been heard, reflected on and experienced, then all this is known".

(*BṚHAD-ĀRAṆYAKA UPANIṢAD,* IV.5.6)

4. Punarjanma (Rebirth)

From its earliest days the Indian spiritual tradition has dealt with *Punarjanma* (Rebirth) and *Samsāra* (Cycle of births and deaths of the human being) in a matter-of-fact way. There has been no doubt expressed and no explanation offered in relation to this doctrine. It has been a self-evident axiom and has always been coupled with *Karma*, the important and complex law of cause and effect in the moral sphere. These two concepts have been accepted by all Indian religious traditions viz., the Hindu,. the Buddhist, the Jain and the Sikh, and have been actively and enthusiastically propagated in the West during the last century by the theosophical and anthroposophical movements launched respectively by the Russian, Madam Blavatsky, and the German, Rudolf Steiner. According to statistics floated by the media from time to time, a good number of Jews, Christians and Muslims have started believing in these concepts in recent decades.

Why has one to be born again and again on this earth? The Indian answer to this question is clear and unambiguous. Man can attain perfection or realize the Spirit or Divinity within, only when the mind and intellect are sufficiently evolved and cultivated, and become fully mature, obviously healthy and spotlessly pure. This process understandably takes a long time and cannot possibly be completed in one life time. Many, perhaps innumerable, births are needed for this purpose, the actual number of lives depending on the sincerity and intensity of the efforts consciously put in by the concerned person to attain maturity, purity and perfection. The *Sthūla Śarīra* (gross body), referred to earlier, is what meets death and gets discarded. The *Sūkshma Śarīra* (subtle body) animated by the *Ātman* (Soul or Self) works the gross body as long as it effectively can and then leaves it to build a fresh body.

As shown below, the basic texts of *Adhyātma Yoga* follow this ancient tradition and deal with rebirth with clarity and precision and as needing no further comment or explanation on what they say. As is to be expected, in this regard the concerned verses in the *Gita* are indeed the most informative and also the most beautiful to recite:

1. "*Sasyam-iva Martyaḥ pacyate, Sasyam-iva jāyate punacḥ.*
   A mortal ripens and withers like corn, and like corn is born again".
   (*KAṬHA UPANIṢAD,* I.1.6)

2. "*Ayam Ātmā idaṁ Śarīraṁ nihatya, Avidyām gamayitvā anyaṁ, navataraṁ, kalyāṇataraṁ Rūpaṁ kurute.*
   The *Ātman,* having thrown away this body and dispelled its ignorance (according to the Law of *karma*), makes unto Himself another, newer and move beautiful shape".
   (*BṚHAD-ĀRAṆYAKA UPANIṢAD,* IV.4.4)

3. "*Sati mūle, tad-Vipāko Jāty-'Āyur-Bhogāḥ.*
   So long as the root cause (generation of merit and demerit through the Law of Karma) exists, it will bear fruits like rebirth, long or short life and experience of pleasure and pain".
   (*YOGA-SŪTRAS,* II.13)

4. "*Samskāra-Sākṣātkaraṇāt, Pūrva-Jāti-Jñānam.*
   Though *Samyama* (controlled concentration and meditation) on the latent impressions in the sub-conscious, the Yogi attains knowledge of his previous lives".
   (*YOGA-SŪTRAS,* III.18)

5. "*Dehino-'smin yathā Dehe, Kaumāraṁ, Yauvanaṁ, Jarā, Tathā Dehāntara-prāptiḥ, Dhīras-tatra na muhyati.*
As the soul or the self passes in this body through childhood, youth and old age, even so is it taking on of another body. The sage is not perplexed on this account".
(*GĪTĀ*, II.13)

6. "*Vāsāmsi jīrṇāni yathā vihāya, navāni gṛhṇāti Naro'parani Tathā Śarīrāni vihāya jīrṇany-'anyāti samyāti navāni Dehi.*
Just as a person casts off worn-out garments and puts on new ones, even so does the embodied Soul or Self cast off worn-out bodies and take on others that are new".
(*GĪTĀ*, II.22)

7. "*Prāpya puṇyakṛtām Lokān, uṣitvā śāśvatīh Samāḥ, Śucīnām śrīmatāṁ Gehe, Yogabhraṣṭo-'bhijāyate.*
Having attianed to the world of the virtuous and dwelt there for many years, the Yogi still short of his objective is born again in the house of such as are pure and prosperous".
(*GĪTĀ*, VI. 41)

8. "*Tatra taṁ Buddhi-Saṁyogaṁ labhate paurva-dehikam Yatate ca tato bhūyaḥ, Samsiddhan, Kurunandana.*
There the Yogi regains the intellectual impressions and connections developed in the previous life and strives again from that starting point for perfection, O Arjuna".
(*GĪTĀ*, VI.43)

9. "*Prayatnād-yatamānastu, Yogi saṁśuddha-kilbhiṣaḥ, Aneka-janma-saṁsiddhaḥ tato yāti parām Gatim.*
Striving assiduously, cleansed of all blemishes, perfecting himself through many lives, the Yogi then attains to the highest goal".
(*GĪTĀ*, VI.45)

5. Antahkaranam (The inner instruments)

From the point of view of Modern Science, the concept of *Antaḥkaraṇa,* the Inner Instrument of Cognition and Consciousness, in Classical Yoga is perhaps the most important, deserving of careful study from the experimental angle. As is to be expected, *Sāṁkhya* and *Yoga* philosophies are already seized of the important role of *Antaḥkaraṇa* as the interface between Matter and Spirit, the Human and the Divine, as also the lower and higher Selves in an individual. The following quotations from *Sāṁkhya-Yoga-Kośah,* a compendium of philosophical terms in these two ancient *darśanas* put together by Acharya K N Tripathi of the Banaras Hindu University, Varanasi, in 1974, bring out the basic characteristics of this complex inner instrument:

1. *Buddhir-Ahaṁkaro Mans-ceti Trayam-Antaḥkaraṇam.* The Inner Instrument is made up of three viz., *Manas* (Instinct), *Buddhi* (Intellect) and *Ahamkār* (Ego, I-ness, Will).

2. *Pañca Jñānendriyāṇi, pañca Karmendriyāṇi ceti Bāhyakaraṇam.*
   The five senses of Knowledge and the five senses of Action constitute the Outer Instrument.

3. *Cittam - Antaḥkaraṇam. Chitta* (the Mental Being?) is (a synonym) for the Inner Instrument.
4. *Kṣiptam-Mūḍham-Vikṣiptam-Ekāgram-Niruddham-iti pañca Cittasya Bhūmayaḥ.*

Chitta can exist in five states viz., confused/wandering foolish/ forgetful, occasionally steady/steadying, one pointed and restrained.

In the light of the above, the famous definition of the State of Yoga in *Yoga-Sūtras* is easy to comprehend, viz.,

"Yogas-Citta-Vṛtti-Nirodhaḥ.
Yoga is the state of *Nirodha* (restraint) of all *Vrittis* (fluctuations) in the *Chitta* (Inner Instrument)."
(YOGA-SŪTRAS, I.2)

The Gita follows the *Sāṁkhya-Yoga* line and describes *Prakriti* (Nature) as made up of eight entities viz.,

"Bhūmir-Āpo-'Nalo Vāyuḥ Khani Mano Buddhir-'eva ca, Ahanikāra itī-'yam Me, bhinnā Prakṛtir-'aṣṭadhā. Earth, Water, Fire, Air, Ether (Space?), Instinct, Intellect and Ego - this is the eight-fold division of My nature."
(*GĪTĀ,* VII.4)

Here the first five constitute the field of the Outer Instrument, while the last three make up the Inner Instrument, that deals with the inputs from the Outer Instrument.

Incidnetally, the expression *Antaḥkaraṇa* occurs frequently in Sanskrit literature and is widely in use today in most Indian languages. To give an interesting example, in Kalidasa's most famous drama, the hero, king Dushyanta, justifies his attraction to the heroine, Shakuntala, as it has the approval of his *Antaḥkaraṇa:*

"Satām hi sandehapadeṣu Vastusu,
Pramāṇām-Antaḥkaraṇa-pravṛttayah.
The doubts that perplex the good get resolved by the directions from the Inner Instrument." (*Abhijñāna-Śākuntalam,* 1.20)

6. Buddhi (The intellect)

Of all three constituents of the *Antaḥkaraṇa,* the human intellect endowed with the capacity to know, to think, to analyse, to reason, to reflect, to ponder and to meditate has been assigned the highest place in the Classical Yoga tradition, particularly because of the crucial role it has to play in probing and grasping the unseen *Ātman*. The clarion call of the *Gita* is:

"*Buddhau Śaraṇam-anviccha.*

Take refuge in the intellect."(II.49)

"*Buddhi-nāśāt praṇaśyati.*

With the loss of intellect, (Man) is ruined."(II.63)

The *Gita* is also clear that the *Buddhi* is fully involved in the final and full realization of the Self or the Divine:

"*Śruti-vipratipannā te yada sthāsyati niścalā,*
Samādhav-acalā Buddhiḥ, tadā Yogam-avāpsyasi.
When thy intellect, confused by wearing conflicting statements, will rest, steady and undistracted, in total absorption (in the Self), then wilt thou attain to thy State of Yoga."(II.53)
"*Sukham-ātyantikam yat-tad-Buddhigāhyam-atīndriyam.*
The supreme joy of union with the Self can be graspd by the intellect, but not by the senses." (VI.21)

The *Kaṭha Upaniṣad,* generally assigned a date much earlier than the Gita, also accords a high place to the human intellect, not the average one, but the highly evolved, carefully cultivated, extremely sharp and spotlessly pure intellect, which can comprehend and grasp the Higher Self:

"*Eṣa Sarveṣu Bhūteṣu Gūḍhātma na prakāśate;*
Dṛśyate tv-agryayā Buddhyā Sūkṣmayā Sūkṣmadarśibhih.
He is the secret Self in all existences, but is invisible. Yet is He "seen" by the seers of the Subtle, through their subtle and sharp intellects." (I.3.12)

It is in the same inspiring *Upanishad* that we come across the beautiful and off-cited metaphor of the chariot, that helps us to distinguish clearly between the roles of the different constituents of the Inner and Outer Instruments of Man:

"*Ātmānaṁ Rathinam viddhi, Śarīraṁ Ratham-eva tu,*
Buddhim tu Sārathim viddhi, Manaḥ Pragraham-eve ca;
Indriyāṇi Hayān-āhur-Viṣayāms-teṣu Gocarān,
Ātmendriya-mano-yuktam, Bhoktety-āhur-Manīṣinah.
Know the body for a chariot, and the Self for its Master; know the intellect for the charioteer and the mind for the reins only. The senses they speak of as the horses of the chariot and the senses as the paths in which they move. The wise call him the true enjoyed, who has his mind and senses Yoked to the Self (by the intellect)." (I.3. 3 and 4).

7. Involution and evolution

Evolution is a concept now quite familiar to the educated, but Involution is not a word that has been very much in use, at least not until Sri Aurobindo (1872-1950) started writing about creation or cosmic manifestation as the consequence of a *double movement* of Involution and Evolution. Actually, Involution as a process of self-limitation or a densification, by which *Brahman* or the Universal Consciousness-Force veils itself by stages into a dense, cosmic in conscience in Matter, is already hinted at in the Upanishads themselves. In its *Brahmānada Valli* and *Bhṛgu Valli,* the *Taittirīya Upanisad* deals with the so-called veils or covers or sheaths hiding the Supreme Consciousness and the possibility of evolving to the state of *Brahmānanda* (the *Ānanda* or Bliss of realising *Brahman)* by gradual and progressive shedding of these veils and the movement or passage through a series of ascending planes of the Consciousness-Force. Starting with *Anna* (Matter), the uncovering process leads first to *Prāṇa* (Life), then to *Manas* (Instinctive-cum-Intellectual Mind) and eventually to *Vijñāna* (Intellectual-cum-Intuitive Mind), which is yet to become the common possession of mankind. For above the present normal human consciousness and experience is the state of *Ānanda* (Bliss of *Brahman),* which represents the goal of *Adhyātma Yoga,* as also of Integral Yoga of Sri Aurobindo.

To sum up, the process of *Involution* and *Evolution* is going on *all the time;* it has had not beginning and will have no end. Creation is a spontaneous emanation from *Brahman,* as the *Upaniṣads* instruct us with apt metaphors:

"*Tad-etat Satyam: Yathā sudīptāt Pāvakāt, Visphuliṅgāḥ sahasraśaḥ prabhavanti sarūpāḥ, Tathā-'kṣarāt Vividhāḥ, Saumya, Bhāvāḥ, Prajāyante, tatra caīvāpi yanti.*
This is the Truth: As from a blazing five thousands of fiery sparks leap out, even so, my dear, a multitude of beings issue forth from the Imperishable (*Brahman*) and return thither too."
(*MUṆḌAKA UPANIṢAD,* II.1.1)

"*Yathorṇa-nābhiḥ sṛjate gṛhṇate ca, Yathā Prithivyām Oṣadayas-Sambhavanti, Yathā Sataḥ Puruṣāt Keśa-lomāni, Tathā-kṣarāt sambhavatīha Viśvam.*
As the spider brings forth and also draws in its thread, as herbs sprout on the face of the earth, as the hairs grow on the head and body of a living person, so from the imperishable (*Brahman*) emerges here the Universe".
(MUṆḌUKA UPANIṢAD, I.1.7)

In this ceaseless process of Involution and Evolution, the human being represents with his intellect a peak in the evolutionary process, capable of cooperating with Nature in contributing to and expediting the onward movement to the acme of evolution viz., merger of his Higher Self (*Ātman)* with the Universal Self (*Brahman.*) *Adhyātma Yoga* lays down the paths to perfection, but the *Yogi* has a long and arduous journey to perform, even while keeping the means and ends clearly in view. To quote the *Gita* on the last step (meditation) and the final goal,

"*Yuñjann-evam sadā-'tmānaṁ, Yogi vigata-kalmaṣaḥ, Sukhena Brahma-saṁsparśam, atyantaṁ Sukham-aśnute.*
Uniting his mental being (Lower Self) constantly with the Supreme Consciousness (Higher Self) i.e., practising meditation

constantly, the Yogi gets rid of all imperfections and enjoys the Infinite Bliss of contact with *Brahman.*" (VI.28)

8. "Footprints" of the Ātman

The recent almost explosive revival of scientific interest in the fascinating and complex field of Consciousness has brought *Adhyātma Yoga* and Modern Science together, bridging in that process a gulf of over 3000 years. As *Yoga* and Science now rub shoulders, as it were, at National and International Conferences, it is essential to appreciate that the basic texts of *Adhyātma Yoga* involve terms and concepts that were current in an ancient society and are hence far from easy to comprehend *today.* Even when explained in modern idiom and in the English language, there are difficulties in coming to grip with basic concepts like those of *Brahman* and *Ātman,* which seem to transcend all available paradigms in modern science.

It is surprising and significant that an Upanishad could anticipate such a difficulty and also suggest a possible way of overcoming it:

"*Atmetyevopāsīta, atra hy-'ete sarve Ekaṁ bhavanti*
....Tat Etat padanīyam, asya sarvasya yat ayam.
Ātma, anena hi etat Sarvam veda, yathā ha vai
padena anuvindet, evam... ...

Research should concentrate on *Ātman* alone, since all these several aspects are united in It ...... The *Ātman* has to be sought after, because one known all things throught It, just as one searches and finds out an animal through its *footprints....*" (BṚHAD-ĀRAṆYAKA UPANIṢAD, 1.4.7)

"FOOTPRINTS" – that has to be the watchword now for scientists. The *Antaḥkarṇa* is obviously the main field for the location of the *Ātman's* footprints.

To start with, one can think of the vast invisible and inaudible spectrum of electromagnetic radiation and how one has come to "know" it through its "footprints" on the instruments tracking this radiation. The problem is perhaps more complex here with the very vast spectrum of planes or states of consiousness already divided into dozens of unconscious, sub-conscious, subliminally conscious, normally conscious and super-conscious states. However, as the old adage has it, "where there is a will, there is a way."

Science, religion and spirituality*

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Abstract

Today's world needs all the three disciplines of knowledge and wisdom. Imperfect and partial knowledge has resulted in competition and conflict, bringing misery to mankind.

Science: Science is any organized body of knowledge based on facts and principles gained by systematic study. Scientific method and attitude are important. They must be used for the benefit of mankind. Though technology and pure science have made our lives more comfortable, they have also made our life miserable because of the attitude of the people involved in them. If the scientists reform themselves into better human beings, the benefits of science and technology can be used for the upliftment of the whole of mankind.

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Religion: Faith in the existence of God or a superhuman, controlling power and intellect behind the universe. Religion of dogmas and formal observance is not religion at all in the true sense of the term. Fanaticism and regimentation are other factors, which have suppressed freedom of thought and action. Intolerance and hatred of religions other than one's own is a byproduct of this. True religion lies in spirituality. All the great religions of the world, when understood properly and practiced sincerely have led to the same kind of mystical experience.

Spirituality: Spirituality is an expression of the spiritual dimensions inside us, which comes after attaining the highest state of mystical experience. Though the expression and terminology of mystical experiences of the various saints and sages of the world appear to be different from one another, the content of their experience is the same. Spiritualism should not be confused with spirituality.

The basic aim of all arts and sciences, all fields of knowledge, is to give us true happiness. This can be got only by true spiritual experience. If science and religion can cooperate properly, humankind can easily attain this final goal of life.

Introduction

Today's world has come to the threshold of an explosion in science and technology. During the last five decades or so they have advanced at such a terrific pace that all the progress of the previous five millennia put together pales into insignificance. This explosion is threatening to develop into a veritable volcano as has already been amply proved by the two world wars, the third, perhaps, peeping around the corner.

Curiously enough, there has been an explosion in the field of religion too, if the plethora of new cults and sects, along with the revival and reform movements of the old religions is any cue to the same. Bizarre as it may look, it is yet a fact that religion – or rather, religious leaders – are trying to 'prove' the facts of religion via the ways of science. Whether this wooing of science by religion has succeeded in coaxing the former to accord respectability to the latter or not, is a moot point. However, it is an undeniable fact that instead of religion providing a meaningful direction to science, it has put itself in the unenviable position of defending itself!

To be sure, the world needs science. To be sure, again, the world needs religion also. Hence, for the sure progress of mankind, both science and religion must cooperate and coordinate their efforts.

Is this ever possible? Is it ever conceivable to bring together light and darkness and hope to produce a charming mystic twilight? Yes, if it is first conceded that they are complementary disciplines and not contradictory. It is not only possible but highly desirable, and not only highly desirable but also extremely urgent. It is the partial and imperfect understanding of each by the respective votaries that has resulted in unhealthy competition and self-destructive conflict, bringing mankind to the brink of the precipice of total annihilation.

Science and scientific attitude

Derived from the root 'scire' (to know), 'science' signifies knowledge and enlightenment as opposed to nescience, ignorance and superstition. In a more restricted and technical sense, it stands for any organized body of knowledge based on observable facts and gained by a systematic study. It is no doubt a pursuit of truth, concerning itself mainly with the world outside and trying to understand what it is and how it works. Of course, in this adventure after truth, it is often confronted with the eternal question, 'why?' for which it often fails to get a satisfactory answer.

Science goes about this business by collecting information about observable facts through experiments and observations, classifying them in some known order and drawing inferences through logic and reasoning based on them. Tentative conclusions called 'hypotheses', are drawn and further experiments conducted to confirm the same. Once these hypotheses are proved beyond all doubt through controlled and repeatable experiments, they are enunciated as 'theories'. However, while forming the judgement by the personality factors of the scientist, this is rightly termed the 'scientific attitude'. Only that person endowed with such an attitude is a true scientist. He is ever ready to change his theories when new facts and deeper investigations lead to different conclusions. This is how science has grown enormously and gained respect.

Applied science and technology

These discoveries of science, both basic and secondary, have led to the creation of, and to fantastic developments in, another field, that of applied science and technology. Energies of nature have been harnessed and converted beyond all recognition, to subserve human ends. Modern man is so deeply involved in the products of science that it is almost impossible for him to live without them.

Where the scientists have erred

Not withstanding all the blessings that science has wrought for mankind, it is a stark fact that it has also brought the world to the brink of total annihilation. Of course, we may concede that it is not science but scientists that are responsible for the predicament. Where exactly have they gone wrong? They have concentrated all along on the external world, the 'without', forgetting and neglecting the internal world, the 'within'. Hence they have obtained only a partial, and consequently an imperfect, view of the world. The story of the six blind men 'knowing' the elephant is an illustration very much to the point. This total lack of study of the world within has resulted in a lopsided development of the human personality. To be sure, a beautiful face needs a beautiful nose, which must be of the right proportion and set in the right place. Neither its total absence nor its all-encompassing presence, nor its displacement from its allotted place (suppose an ear and the nose exchange places, how will it look?) will contribute to the beauty of the face! Even so has the human psyche been warped as a result of the relentless pursuit of the external world. This has resulted in the total neglect of values and encouraged a sensate culture. To satisfy the insatiable hunger for material enjoyment, natural sources of wealth and energy are being depleted at a terrific rate. The two world wars have, in no small measure, been a consequence of this greed. Gadget-civilization is adversely affecting the normal biological and psychological capacities of man. The writing on the wall is very clear. If we refuse to read it, our civilization can be destroyed by the 'barbarians from inside'.

What scientists can do, to reform themselves and transform society

If this should not happen – none, including the scientists, will ever wish it to happen – scientists should change their basic outlook. Pursuit of truth, the whole truth, should be their sole aim, and the benefits that accrue from their toils should be extended to the *whole of mankind*. This means that the scientists should refuse to be the handmaids of their greedy employers or selfish political and governmental leaders. Otherwise all the fruits of their efforts could be misused and even abused for destructive purposes.

But, in a highly commercialized society like ours, where Mammon has already driven out God, is it ever possible? Any scientist who dares to do it, will either be put behind the bars or have to face starvation. Even if these do not happen, he will not be able to muster enough support – financial and otherwise – to start his own institution for research work.

This is a serious impediment. There are two possible ways of overcoming it. First, the saner sections of our society including a few philanthropists should volunteer to back up such scientists. Second, the scientists themselves should work for a few years only and save up for their future projects.

Nothing is impossible in life. Where there is will, there is a way. Once the scientists reform themselves and pursue science in this spirit, they can transform society. In this adventure, religion can be a very helpful companion to inspire and guide.

Religion: what it is and what it is not

Almost from the beginning of its existence, mankind has believed in the existence of God or a superhuman controlling Power, a power often pictured as a person or a personality, entitled to reverence and worship. It is this belief that gradually gave rise to the building of separate places of worship for Him, as also the evolution of various kinds of rituals of worship.

At the higher levels, religion has stressed the mystic experience of God – this, in fact, is the quintessence of religion – as the *summum bonum* of life, and has prescribed self-purification and self-discipline as the necessary means of achieving it. The result has been a galaxy of beings called saints, sages and seers.

However, the path of self-purification and self-discipline is difficult and invariably involves self-effacement also. The generality of mankind finds it easier to follow formal external rituals and observances than lead such interior life aimed at total transformation of the personality. This naturally resulted in formal religion replacing religious experience, dogmas getting the better of inner convictions and the development of an organized church with its concomitant evils of fanaticism, regimentation and a 'holier than thou' attitude. Intolerance and hatred of religions other than one's own was also an important byproduct of this neglect of true religion.

Rejuvenation of religion

The only way of rejuvenating religion is to emancipate it from the clutches of soulless formalism and redirect it towards the mystic experience of the inner Truth. This inevitably entails the stressing of self-purification and self-discipline. The details of such methods of purification and discipline could, however, vary from person to person.

While trying to describe ineffable, religious mystics all over the world, have left us quite a voluminous literature. A careful study of this reveals to us that the content of such experience is always the same, though their descriptions, and, even methods of discipline leading to them, vary considerably. From this we can conclude that 'Religion' (as realization of Truth, as mystic experience of God) is always ONE. If this is conceded, then we have to accept that all the 'religions' of the world are simply the various paths of discipline ultimately leading to that mystic experience, even as the various radii of a circle leads to one and the same centre.

Spirituality, the fulfilment of religion

The practice of religious discipline, if pursued relentlessly and with devoted faith, has got to lead to the direct experience of God, the all-pervading, all-knowing spirit. Once this spirit, the noncorporeal essence of all corporeal beings, nay, even of the insentient nature, is realized, then, that experience blossoms forth in every thought, word and action, as universal love and sympathy. It is truly universal since it is based on the direct perception of the fundamental unity behind the whole creation. At the subjective level, it results in perfect inner poise unaffected by the vicissitudes of life and an experience of unalloyed joy in the inner being. This is 'spirituality', the fulfilment and the acme of religion.

It is strange, but true, that man seems to have a special knack for misunderstanding and even messing up things. It is perhaps due to this that spirituality has often been mistaken for miracles, and magical rites, sorcery and spiritualism. This has naturally induced unregenerate people into seeking to fulfil their vile and vulgar desires, even by harming others, through such ignoble means. Of course, charlatans have quickly seized such opportunities to masquerade as 'spiritual' men and wrought immense harm to gullible people.

Synthesis, the need of the hour

By now it is clear that each one of these disciplines of science, religion and spirituality, is an honest attempt at discovering the truth and that all these disciplines are potentially capable of being used for the greatest good of the greatest number. It should be possible to synthesize them intelligently so that the three disciplines will get mutually strengthened and not hindered.

While jealously guarding the 'scientific attitude' and fearlessly devoting itself to the pursuit of the truth 'without', science should cultivate a positive respect towards religion as an equally valid discipline working in a parallel field, a field concerning the 'within'. It should be tempered by the value-system of religion so that a scientist will never forget that others also are human beings like him, with similar desires and aspirations. This in turn should inspire him to mobilize his discoveries for the good of humankind.

Religion on its part should shed its antipathy towards and suspicion of science. It should ruthlessly adopt the scientific attitude in its investigation into the 'within', so that all superstitions can be decrusted from its body. By emphasizing always the need for spiritual experience of the inner truth through self-purification, religion should aim at transforming people from the level of brutes to the level of gods. It should vigorously propagate and impart the value-system to the scientists, so as to give them a new dimension in their pursuit of knowledge.

Whether we are scientists investigating the 'without' or scientists delving into the 'within', we are all pilgrims on the path of human progress. We must cooperate and help one another so as to reach our journey's end and share the joy of fulfilment.

Kashmiri Sufism, Islam and Hinduism

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Abstract

South Asian Islam finds its best expression in Kashmir's Rishi-Sufi order and its precious gift known in the valley and beyond as Kashmiriyat, of which the Kashmiri people are justly proud. The defining features of Kashmiri Sufism are a belief in both the transcendence and immanence of God, respect for other religions, belief in reincarnation, emphasis on following the right path (very similar to the eight-fold path taught by Lord Buddha), developing the mind's potential through meditation and absorption, using primarily a technique called paas-e-anfaas (watching the breath, a form of pranayama), belief in miracles performed by the Sufi saint and his capacity to intercede with God on behalf of his followers, love of idols of gods and goddesses and contempt for the Mullah, the priest who teaches a ritualistic version of Islam.

The evolution of Kashmiri Sufism has been possible because of a peaceful interaction between Islam and Hinduism in the South Asian region over 14 centuries, in which both religions have discovered a

spiritual symbiosis. But it needs to be emphasised, particularly in view of the current Islamic fundamentalist propaganda, that though it has remained open to influence from other religions and philosophies, the essential character of Kashmiri Sufism remains Islamic.

Introduction

Born in the sandy dunes and hills of Arabian Desert 14 centuries ago, Islam has spread throughout the world. It now claims almost two billion followers. Wherever it has gone, it has acquired a local colour, while retaining its basic belief systems. Islam itself has encouraged this process. The Holy Quran exhorts its followers to believe in all the prophets of God, by whatever names they may now be known, who preceded Prophet Mohammad (peace be upon him!).

In Islamic traditions the number of such seers, who brought messages from God, is put at 1,24,000, though only 25 names could be mentioned in the Quran. Thus while expressing belief in the oneness of God and the prophethood of Mohammad, a Muslim simultaneously expresses belief in all the previous messengers of God as well. It is natural that the Muslims have not felt obliged to distance themselves totally from their previous beliefs and practices even after conversion to Islam, at least to the extent these did not contravene their new Islamic beliefs. Indian Islam, therefore, naturally has its own indigenous flavour. And it finds its best expression in the Sufi way of life in the Kashmir valley.

Kashmiri Islam is renowned for its broadmindedness and its deep commitment to tolerance of all streams of thought. It is known to be firmly anchored in the Indian soil. Where from does this deep commitment to a composite Hindu–Muslim culture, to what we Indians call secularism, which is basically respect for all religions, emanate? Why is *Kashmiriyat* so important to the Kashmiri Muslim? I think the answer lies in the eclectic and syncretic nature of their spiritual beliefs. It is the impact of Sufi and Rishi visions of Islam that have helped him synthesise the message of Prophet Mohammad with the teachings of earlier prophets of Islam that constitute the core beliefs of Hinduism, Buddhism and Jainism.

Peaceful spread of Islam in Kashmir

Perhaps the most important factor that contributed to Kashmiri Sufism is the history of a peaceful spread of Islam in this region. Definite historical facts that would account for the extraordinarily large number of conversions that took place in Kashmir are not available, as Sir Thomas Arnold points out[1] with regret in his highly regarded book, *Preaching of Islam*. But whatever scanty information is available leads us to attribute this surprising phenomenon to a long and continuous missionary movement carried out by Sufi saints, *pirs, faqirs, dervishes* and *ulema*. The Islamic missionary entered the valley at a time when, in the words of W R Lawrence (*The Valley of Kashmir*), it "was a country of drunkards and gamblers." Such an atmosphere is very much suited for the spread of a new philosophy or religion.

In the introduction to his English translation of *Rajatarangini*, another authority on Kashmir, Dr M A Stein maintains that Islam made its way into the valley not by forcible conquest but by gradual conversion, for which the influx of foreign adventurers from the south and central Asia had prepared the ground. Bulbul Shah, also known as Sharf-ud-Deen Syed Abdur Rahman Turkistani, was one such adventurer, a mystic, who acquired the first notable success in the spread of Islam in the form of the conversion of Ranchan Shah who became the first Muslim ruler of Kashmir and assumed the name Sultan Sadr-ud-Deen.

Bulbul Shah died in 1327 A.D. He was a Syed from Turkistan. Another Syed who wielded an extraordinary influence on the spread of Islam in the valley of Kashmir was Shah Hamadan. Born in 1314 A.D. at Hamadan in Persia, the great Syed became interested in *Tasauwwuf* (mysticism) and learnt its first principles from his maternal uncle Syed Ala-ud-Deen. He became a disciple of great Sufi saints Sheikh Abul Barkat Taqi-ud-Deen and after his death Sheikh Sharif-ud-Deen Mahmud Muzdaqani. His teachers advised him to complete his education by extensive travels in the world. Shah Hamadan followed this advice and visited several countries. In his 21-year long journey he came in contact with several Sufis and mystics from various parts of the world. As he returned to his native place, Timur started the persecution of Syeds. This forced him to leave for Kashmir. Seven hundred Syeds are said to have accompanied him to Kashmir in the reign of Sultan Shahab-ud-Deen in 1372 A.D.

The migration of so many Syeds along with the great mystic Shah Hamadan proved to be a decisive factor in the conversion of the great mass of Kashmiris to Islam. That the majority of the people embraced the new religion also gave a mystical colour to Kashmiri Islam. These mystic divines established hermitages all over the country, which served as centres for the propagation of their beliefs.

The present *ziarat* (shrine) of Shah Hamadan is said to have been erected on a spot that he used as a retreat on the Vitasta. This is where he used to discuss religion and philosophy with the Hindu divines and *sanyasis* and test their so-called supernatural powers. In two well-known incidents, the sanyasis embraced Islam along with all their followers following the test of their powers. These discussions and trials followed by conversions of a large number of Hindu divines greatly encouraged the process of the spread of Islam. It has also left an indelible impression on the Kashmiri mind, as many of the points raised and discussed here have become part of the local folklore.

Another wave of Syeds came from Turkistan in 1396 A.D. along with the 22-year old son of Shah Hamadan, Mir Mohammad. Three hundred Syeds came this time in the reign of Sultan Sikandar. The Sultan's Prime Minister was a brahmin named Malik Siya Butt. Impressed with a dialogue with Mir Mohammad, Siya Butt converted to Islam along with his family and many followers and assumed the name Malik Saif-ud-Deen. He married his daughter re-named Bibi Barea to Mir Mohammad. Syed Mir Mohammad's influence resulted in the prohibition of distillation and sale of wine. Gambling and Sati (the Hindu practice of wives being burnt on the pyre of their dead husbands) were also forbidden. He passed away in 1354 A.D. and was buried near his father in Khatlan.

The advent of such a large number of eminent Syeds who were seeking refuge from the persecution of Timur left a great impression on the valley. As G M D Sufi writes in his valuable contribution, *Islamic Culture in Kashmir*, "Deeply imbued with the Sufism of the age and country from which they emigrated, these Syeds and their followers seem to have stimulated the tendency to mysticism for which Buddhism and Vedantism had already paved the way. Perhaps also shocked at the tyranny and self-assertion of Timur, they may have sought refuge in the regions of abstract thought as a solace for the worldly repression under which they laboured".

Rishi-Sufi order

The most important influence on the Kashmiri Muslims, in terms of their *Kashmiriyat*, is that of the *Rishi* order of Sufis. While the Sufi orders like the *Suhrawardi*, *Kubravi*, *Naqshbandi* and *Qadri*, arrived in Kashmir from Persia, Central Asia, and Central and North India, the *Rishi* order evolved in the Valley itself in the beginning of the 15th century.

The Kashmir valley was already permeated with the traditions of Hindu asceticism and Buddhist renunciation. As an authority on Kashmiri Sufism, Prof Abdul Qaiyum Rafiqi explains[2], the term *Rishi* itself is clearly a derivation from Sanskrit traditions. Important chroniclers of this period, Abul Fazal, for instance, or Emperor Jahangir, reveal a close resemblance between the life-styles of the Sufis and the Hindu Rishis as well as Buddhist and Jain monks.

Nand Rishi Sheikhul-Alam Sheikh Nooruddin is the forerunner of the Rishi order of Sufis. Having wielded tremendous influence on the Kashmiri society, Sheikh Nooruddin is considered the national saint of Kashmir. His *ziarat* (shrine) at *Charar-e-Sharif* is visited by thousands till this day and is the main target of Fundamentalist Islam's ire. His sayings show that he believed that God is both immanent and transcendent. God is everywhere, not confined to one place or another. According to Sheikhul Alam, all the branches of knowledge are nothing but the commentary upon the proclamation of faith, "There is no God but Allah". If one truly seeks God, he says, everything but Allah becomes worthless. One, who recognises himself, recognises God: "When I was able to recognise my own self, I was able to recognise God; both loss and gain became identical to me and the distinction between life and death disappeared."[3]

He once told his mother: "God was and is and shall be for ever; He is independent of all other creatures; He lacks nothing."[4] Further he says:

"There is one God,
But with a hundred names.
There is not a single blade of grass,
Which does not worship Him." [5]

"First I became certain that there is no God but Allah,
Then I made myself (acquainted) Divine revelations.
First I forgot myself and yearned after God,
Then I reached la-makan." [6]

With such deep commitment to spiritual growth and the Islamic philosophy of Divine Unity as expressed in the philosophy of *Wahdat-ul-Wujud*, which is uniquely similar to the Hindu philosophy of non-duality (*Advaita*), it is not at all surprising that the Rishis consistently preached complete harmony among different religions and peace and understanding among their followers.

This was not always easy. Sheikhul Alam Sheikh Nooruddin, for instance, faced restrictions during the reign of Suha Bhatt who had started persecuting non-Muslims in his new-found Islamic zeal after conversion to the new faith.

Aware of the tension created between Hindus and Muslims during the reign of Sultan Sikandar, Sheikh Nooruddin wrote:

"We belong to the same parents.
Then why this difference?
Let Hindus and Muslims (together)
Worship God alone." [7]

"We came to this world like partners.
We should have shared our joys
and sorrows together." [8]

Nand Rishi Sheikh Nooruddin's message was not confined to Hindus and Muslims alone. It speaks to all mankind. That is why his sayings and his verses have acquired the character of proverbs and are routinely referred to by Kashmiris of all hues in their daily life. Another reason for the popularity of his verses and that of many other Rishis may be the fact that they expressed their thoughts in the simple language used by the common folk. The message given by Kashmiri Rishis or even Sufis of previous orders, who had arrived from Central Asia, is always the same - divine unity of All That Is.

In fact it is the Sufis of previous orders who had prepared the ground for the emergence of Rishis with their powerful message of religious synthesis. One poem is of special relevance. This is from the verses of Sarfi, a Sufi of the *Kubravi* Order.

> *"O, Sarfi!*
> *What benefit are you going to gain from the pilgrimage?*
> *If Kaaba, temple and tavern are not identical with you.*
> *O, Sarfi!*
> *As on every side a ray has*
> *Fallen from His face to light the night,*
> *Impossible it is for you to say that Somnath*
> *Has not the Kaaba's light".*

It is also noteworthy that many a Sufi and Rishi, have had no hesitation in expressing their love of idols of gods and goddesses. In fact they consider idol-worship as part of the phenomenon of mystical love. Sheikh Yaqub, a Sufi of the *Kubravi* order, for instance, proudly calls himself a *kafir* of *Ishq* (Divine Love) and yearns to burn himself in the fire of love. He challenges the *ulema* (scholars) who find fault with the love of idols, to tell him if anything else is more meritorious in the world than the crime of loving idols. He asserts repeatedly that his faith is the love of idols.

The same convergence of Hindu–Muslim thought is discernible in Kashmiri mysticism on the question of reincarnation. While few Muslims in other parts of the sub-continent believe in reincarnation in the context of the philosophy of Karma, it is not unusual to find many believers in this theory among Kashmiri Muslims. Kashmiri Islam is much indebted to the Persian influence in this regard. Verses like the following from the *Masnawi* by Hazrat Jalaluddin Rumi, are common knowledge in Kashmir:

"I died as mineral and became a plant,
I died as plant and rose to animal,
I died as animal and I was Man.
Why should I fear?
When was I less by dying?
Yet Once more I shall die as Man,
To soar with angels blest,
But even from angelhood I must pass on...." [9]

Sufism involves the improvement of man's relationship with man as well as man's relationship with Allah. Those who believe in *Wahdut-ul-wujud* also believe that the only real existence is Allah who is therefore *Wajib-ul-wujud*. All other beings are shadows, phantoms of our creation as the poet Meer Taqi Meer says:

Ye tawahhum ka karkhana hai,
Yan wohi hai jo aitebaar kiya.

This universe is nothing but delusion (Maya),
Nothing exists except what we assume.

This idea is similar to the philosophy of Vedanta – 'There is only one Brahma and none else exists'. The most distinguished exponent of *Wahdat-ul-Wujud* was Shaikh Mohiuddin Ibn Arabi, the author of *Futuhat-e-Makkiya* and *Fusus al Hikam*. Some Sufis like Mansur al-Hallaj, Qazi-ul-Qazzat Hamadani, and Masud Bak were martyred for propagating the philosophy of Unity of Existence, yet the idea remained a pillar of Sufi belief, especially among the Sufis of India, where the philosophy of *Vedanta* gave it a firm foundation.

For the Sufi, God is both transcendent and immanent. The concepts of transcendence and immanence (*bhedabheda*) in Indian philosophy too assert both identity and difference between the world and finite individuals, on the one hand, and Brahman, on the other. The world and finite individuals are real and yet both different and not different from the Brahman. Brahman is viewed as both the material and the efficient cause of the world. Though Brahman as cause is different from Brahman as effect, the two are identical inasmuch as the effect dissolves into the cause, as the waves return into the sea. As waves are both different from and identical with the sea, so are the world and the finite individuals in relation to Brahman. The finite selves are parts of Brahman, as sparks of fire are parts of fire.[10]

The relationship between the broad-minded Sufis and the conservative *Ulema* has never been cordial in most Muslim societies. But whereas the Sufis were on the margins of society in several other places, in Kashmir, as in other parts of India, they were the dominant influence. This is what makes Kashmir different from Muslim societies in other parts of the world. This made it possible for the Sufi in Kashmir to rebuke the preacher rather than being the target of abuse as in other places.

One essential feature of Kashmiri Sufism is a faith in miracles performed by the Sufi saints and their ability to intercede with God on behalf of their followers, a power that was restricted in Islam to Prophet Mohammad alone, that too to be exercised on the Day of Judgement alone and not in matters of solving mundane day-to-day problems. Fundamentalists make much of it to prove that Sufism is far from Islam, as it seems to encourage pre-Islamic superstitions, though Islam wants to make people rational and the Prophet himself did not depend on miracles to convey his message to the people or to impress upon them his closeness to God as prophets had done before him.

This makes it imperative that we try to understand the Sufi view of the place and function of miracles in their scheme of things. "Miracles," said Naqshband[11], "have a function, and that function operates whether they are understood or not. They have a true (objective) function. Hence, miracles will in some people produce confusion, in others scepticism, in others fear, in others excitement, and so on. It is the function of the miracle to provoke reactions and supply nutriment; nutriment in this case which varies with the personality acted upon. In all cases the miracle is an instrument of both influence and assessment of the people acted upon."

A point of convergence between Kashmiri mysticism and the general *Vedanta* philosophy is the belief that performance of duties together with knowledge of *Brahman* leads to liberation. In religious life, like many Vedantists, Kashmiri Sufis are an advocate of *bhakti*, but *bhakti* is not a mere feeling of love or affection for God, but rather is *dhyāna*, or meditation, directed towards the transcendent Brahman who is not exhausted in his manifestations. As Dara Shikoh[12] pointed out:

Dost thou wish to enter the circle of men of illumination?
Then cease talking and be in the "state";
By professing the unity of god, thou canst not become a monotheist
As the tongue cannot taste sugar by only uttering its name.

Even the meditative technique that Kashmiri Sufis use is closer to the Indian tradition. By and large they use variations of *paas-e-anfaas*[13] (watching the breath). This is similar to various techniques of *pranayama* widely practised in India's *Hath-Yoga* traditions. These meditative techniques were being practised initially by the *Shaivite yogis* of Kashmir before the advent of Islam. The Sufis have added the repetition of the word Allah or Allahoo or huwwa to their meditative technique.

Islam and Hinduism - spiritual symbiosis

In order to fully appreciate the depth of the Kashmiri Sufis' commitment to both Islamic and pre-Islamic Buddhist and Vedantic ideas, it is necessary to study the perspective in which their interaction with the two great religions took place. Islam and Hinduism have lived together in this land for almost fourteen centuries – the first thirteen as very good neighbours. 'Love thy neighbour, for he is yourself', said the Vedas. The Holy Quran agreed. It is this spiritual symbiosis that kept the followers of the two religions in near-perfect harmony for such a long time.

Islam's encounter with other religions was quite violent. The history of crusades launched by Christian powers is well known. It was Hinduism alone that provided Islam with a fertile ground for natural growth. Even the Central Asian bandits who invaded and looted India could not disturb the growing ties. A number of Sufi saints spent their lifetime in India, spreading Islam's message of peace. Prophet Mohammad, too, is believed to have felt attraction for India. Allama Iqbal put it in these unforgettable words:

> *Meer-e-Arab ko aai thandi hawa jahan se;*
> *Mera watan wohi hai, mera watan wohi hai.*

(From where the Prophet received a cool breeze; that is my land, that is my land).

Beginning with the term they employed to describe themselves, Dharma and Deen (both meaning ways of life), and an emphatic assertion of the Oneness of God (*Ekam Sat*: *La Ilaha Illallah)*, Islam and Hinduism share the vision of a moral order prevailing in the universe. Both *dharmas* inform us of cosmic agencies keeping an account of all our deeds for which we will be made accountable. Both talk about life after death.

While their perception of humanity's intellectual level is understandably different, both Islamic and Hindu scriptures accord the highest value to intelligence, reason, *buddhi*. The Holy Quran's repeated emphasis on reason and education is well-known. No wonder the advent of Islam heralded a period of great intellectual and scientific achievements that was also instrumental in propelling the Europeans from the Dark Ages to Enlightenment. The use of reason is regarded as one of the ten principles of Hindu Dharma as well. The greatest prayer in the Vedas asks inspiration for intelligence. Even the Gayatri mantra calls for 'an unerring guidance to our intellects.' In Yogavasistha, the redoubtable sage Vasistha exhorts Sri Ram Chandra to "discard irrationality even if it comes from the creator himself"[14]. No wonder our ancient Hindu ancestors had led the world in nearly all disciplines of scientific and artistic endeavour for several millennia.

Hinduism has been likened to a vast sponge, absorbing all that it can. As an ancient Deen it has to do that in order to stay modern. (The Vedas claim to predate Creation. This is confirmed by the Bible: 'In the beginning was the word'[15]. Hinduism has gracefully accepted a modified version of Islamic laws of divorce and property rights to women. Indian Constitution, largely prepared by Hindus, is based on the Hindu-Muslim ideal of equal respect for all religions. It gracefully accepts the Islamic ideal of human and gender equality. Similarly Islam teaches us to practice Ijtihad, that is accepting new ideas in order to keep up with changing times.[16]

Islam also enjoins upon its followers to respect and learn from all the previous prophets. The Holy Quran, for instance, does not go into a detailed discussion of the Oneness of God. It does not teach techniques of meditation and concentration on God, though these are vital elements of prayer. There is no need. The Hindu scriptures, our *Adi-granth,* had done that much earlier. They tackle the question of the unity of God from all possible angles and teach such a variety of techniques of meditation that the world is flocking to India to learn them. Our philosophies are complimentary, not contradictory. In any case the richness of Hindu philosophy and its openness to all competing ideas themselves ensure that it treats all new ideas as complimentary rather than contradictory. The spiritual symbiosis is an obvious fact. We only need to study and reflect with an open mind.

Kashmiri Sufism is primarily Islamic in spirit

According to Reverend Stanton, the orthodox Muslim divines, following the Quran, taught from the first that the nature of man was utterly unlike that of God, and hence the idea of a divine incarnation was, and is, abhorrent to Islam. Yet there have always been Moslem seekers after a Way by which man could attain real communion with God. They taught that by meditation, mystical rites and asceticism, following the example of illuminated teachers, it was possible for the believer to have direct touch with Allah, such as the mere observance of the law of religion could not give.

Kashmiri Sufism and indeed Sufism in general are under attack today from a political and fundamentalist version of Islam that considers them a deviation from Islam.

Much is made of the Kashmiri Sufi's belief in reincarnation, for instance. That reincarnation is a Hindu belief is well-known. But it is not known that the *Quran* refers as *Kafir* (non-believer) any one who does not believe in the possibility of rebirth. Most notable in this context are the verses of the great mystic, Hazrat Jalal-ud-Deen Rumi, quoted earlier, describing the process of evolution through reincarnation - from mineral and plant to animal and man and then to angelhood and beyond.[17]

Another great mystic Mansur al-Hallaj, famous for his formulation, *Anal Haq* (I am The Truth: *Aham Brahmo Asmi*) had written:

"Like the herbage I have sprung up many a time on the banks of flowing rivers. For a hundred thousand years I have lived and worked in every sort of body."[18]

The *Quran* itself seems quite clear: "And you were dead, and He brought you back to life. And He shall cause you to die, and shall bring you back to life, and in the end shall gather you unto Himself."[19]

The words 'you were dead' can only mean that they had lived before becoming dead. And the words "in the end shall gather you unto Himself" could very well mean the attainment of *moksha* rather than what is usually interpreted as an eternal life in Heaven or Hell.

Some other verses from the Quran are also relevant:

As the rains turn the dry earth into green thereby yielding fruits, similarly God brings the dead into life so that thou mayest learn.[20]

And He sent down rains from above in proper quantity and He brings back to life the dead earth, similarly ye shall be reborn.[21]

A Pakistani scholar Dr M H Abdi remarks that "commentator Ayashi on the authority of Imam Baqer says that the ultimate referred to in the foregoing verse really mean Rajat (reincarnation), or going up and down, and ...that Rajat means rebirth in this world of great Holy Beings as well as of well-known kafirs before Qiyamat (resurrection) ...Kafir means the perverse." In this context Abdi again quotes from the Quran: The Kafirs "have sworn by the strongest oath that one who dies shall not be reborn. Surely they will be reborn and this law is perfect but people who do not possess wisdom do not comprehend it."[22]

"Commentator Qummi quoting Imam Jafer, the well-known authority in the Islamic world, says that (this) means rebirth to be undergone before entering the Heaven world."[23]

In a series of articles, "Reincarnation – Islamic Conceptions," Dr Abdi, expresses some interesting thoughts on how rebirth gradually lost popularity in Islam:

"The position adopted by the successive luminaries who followed (Mohammed) was to affirm the belief in reincarnation but not to propagate it as a teaching for the masses. The attitude was due to psychological reasons. (This is what seems to have happened in

Christianity as well.) The emphasis in Islamic teachings has throughout been on the purity of action.

"Another factor to remember is that the defensive wars, which have been described as Jihad or holy wars, which the Muslims fought in the early days and the wars of conquests (therefore not holy) which the Muslims fought in later days...gave a different shift to Islamic teachings. Philosophical, mystical and ethical teachings received an impetus in the first phase but they had subdued existence in the later phase. During this phase the republican character of the State was changed into monarchy and the supremacy no more belonged to the saints and philosophers.

"A subject like reincarnation demands a subtle mental attitude. It entails understanding of the higher planes of consciousness, the laws of cause and effect and the working of the laws of evolution. The monarchs had no interest in such subjects. Like so many other teachings, reincarnation was confined to the study and attention of the outer and inner students of Sufism...(However,) there is no danger for a Muslim being called a heretic if he believes and expresses himself in favour of reincarnation."[24]

Many Muslims look at the concept of rebirth in the context of resurrection on the Day of Judgement alone. But it needs to be remembered that the concept of Day is derived from the concept of Time and our concept of Time is an entirely earthly concept. As the Holy Quran is the word of God, the concept of Time contained therein must be a Divine concept. The Divine, let us remember is eternal, Timeless. For all we know, we may already be going through the Day of Judgement.

Scholars like Reynold A Nicholson have studied the subject of Islamic mysticism in depth. His conclusion is clearly that there is a basis for Sufism in orthodox Islam itself. Mohammedan orthodoxy in its present shape owes much to Ghazali, and Ghazali himself was a Sufi.[25]

Nicholson says: His (Prophet Mohammad's) deeper instinct craved a direct revelation from God to the soul. There are no contradictions in the logic of feeling. Mohammed, who had in him something of the mystic, felt God both as far and near, both as transcendent and immanent. In the latter respect, Allah is the light of the heavens and the earth, a Being who works in the world and in the soul of man.

"If My servant ask thee about Me, lo, I am near"[26]*;*
"We (God) are nearer to him than his own neck-vein"[27]*);*
"And in the earth are signs to those of real faith, and in yourselves. What! Do ye not see?"[28]

It was a long time ere they saw. The Moslem consciousness, haunted by terrible visions of the wrath to come, slowly and painfully awoke to the significance of those liberating ideas.

"The verses which I have quoted do not stand alone, and however unfavourable to mysticism the Koran as a whole may be, I cannot assent to the view that it supplies no basis for a mystical interpretation of Islam. This was worked out in detail by the Sufis, who dealt with the Koran in very much the same way as Philo treated the Pentateuch. But they would not have succeeded so thoroughly in bringing over the mass of religious Moslems to their side, unless the champions of orthodoxy had set about constructing a system of scholastic philosophy that reduced the divine nature to a purely formal, changeless, and absolute unity, a bare will devoid of all affections and emotions, a tremendous and incalculable power with which no human creature could have any communion or personal intercourse whatsoever. That is the God of Mohammedan theology. That was the alternative to Sufism. Therefore, "all thinking, religious Moslems are mystics," as Professor D B Macdonald, one of our best authorities on the subject, has remarked. And he adds: "All, too, are pantheists, but some do not know it."[29]

Nicholson goes on to study the similarities and differences in Sufi, Buddhist and Hindu thoughts. The Sufis learned the use of rosaries from Buddhist monks, and, without entering into details, it may be safely asserted that the method of Sufism, so far as it is one of ethical self-culture, ascetic meditation, and intellectual abstraction, owes a good deal to Buddhism. But the features, which the two systems have in common, only accentuate the fundamental difference between them. In spirit they are poles apart. The Buddhist moralizes himself; the Sufi becomes moral only through knowing and loving God.

Nicholson concludes that mysticism has its origins within Islam itself, no matter how much it may have gained from its interactions from Christianity, Neo-Platonism, Gnosticism, Buddhism and Hinduism. The receptivity of Islam to foreign ideas has been recognized by every unbiased inquirer, and the history of Sufism is only a single instance of the general rule...Even if Islam had been miraculously shut off from contact with foreign religions and philosophies, some form of mysticism would have arisen within it, for the seeds were already there.

How, it may be asked, could a religion founded on the simple and austere monotheism of Mohammed tolerate these new doctrines, much less make terms with them? It would seem impossible to reconcile the transcendent personality of Allah with an immanent Reality which is the very life and soul of the universe. Yet Islam has accepted Sufism. The Sufis, instead of being excommunicated, are securely established in the Mohammedan church, and the *Legend of the Moslem Saints* records the wildest excesses of oriental pantheism.

Conclusion

Kashmiri Sufism represents the best fruit of centuries of interaction between ancient Indian traditions and Islam. It is a synthesis of various religious traditions that has evolved over the centuries. But this could not have been possible without a spiritual symbiosis that exists between Islam and pre-Islamic religions, philosophies and traditions. Kashmiri Sufism is under attack now from fundamentalist Islam that calls Sufism a deviation from Islam. A continued peaceful co-existence of the Hindu and Muslim communities in South Asia is essential for the further evolution of Kashmiri Sufism. This demands that we rediscover the spiritual symbiosis between Islam and pre-Islamic traditions. It also needs to be remembered that though Kashmiri Sufism has evolved through an interaction with pre-Islamic ideas, in essence it remains primarily an Islamic movement.

Above all, we must remember that Prophet Mohammed has himself affirmed that the Holy Quran has an esoteric foundation: It was "sent in seven dialects; and in every one of its sentences there is an external and an internal meaning...I received from the messenger of God two kinds of knowledge: One of these I taught...(but) if I had taught them the other it would have broken their throats."[30]

Notes

1. Prof Abdul Qaiyum Rafiqi, Sufism in Kashmir, p. 134
2. Prof Abdul Qaiyum Rafiqi, Sufism in Kashmir
3. Dawud Mishkati, Asraru'l-Abrar, ff.67b-68a
4. Baba Nasib, Rishi-Nama, f.140a
5. Nur-Nama, p. 39, Poem 6
6. Nur-Nama, p. 154, Poem 123
7. Nur-Nama, p. 42, Poem 12
8. Nur-Nama, p. 91, Poem 96, see also ibid., p. 156, Poem 217
9. Masnavi Jalaluddin Rumi, Sufiism: The Essence of Rumis's Masnevi, p. 171
10. Encyclopaedia Britannica
11. Journal of the Royal Asiatic Society of Bengal. Vol. **5\1**, p. 168\56. Hasrat, Dara Shikoh, pp. 260–68
12. Dara Shikuh, Husana: ul-Arifin, p. 16 (From Dara Shikoh in Journal of the Royal Asiatic Society of Bengal, Vol. 5; no.t.p. 168)
13. Rafiqi, Sufism in Kashmir, p. 204
14. B N Banerjee, Hindu Culture, Custom and Ceremony, p. 110
15. John, **1**: 1-4
16. Maulana Muhammad Ali, The Religion of Islam (S Chand and Co. Ltd., Ramnagar, New Delhi-110055, p. 96)
17. Masnavi Jalaluddin Rumi, Sufism: The Essence of Rumi's Masnevi, p. 171
18. Mansur al-Hallaj
19. The Holy Quran, Sura 2:28
20. The Holy Quran, Chapter 8- Sura Iraf- MeccanVerses 6-6-13
21. The Holy Quran, Chapter 25- *Sura Zakhraf- MeccanVerses* 5-10-6
22. The Holy Quran, Chapter 14- Sura Nahel-Verses 4-0-10
23. Theosophy in Pakistan, October-December 1964; January-March 1965
24. Theosophy in Pakistan, October-December 1965
25. Reynold A Nicholson, Sufis: The Mystics of Islam – as quoted in *Understanding Mysticism*, Chapter 11
26. The Holy Quran, 2.182
27. The Holy Quran, 50.15
28. The Holy Quran, 50.20-21
29. Reynold A Nicholson, Sufis: The Mystics of Islam – as quoted in *Understanding Mysticism*, Chapter 11
30. The Sayings of Mohammed, Quoted in Reincarnation and Islam, pp. 4–5

Towards an integral epistemology of consciousness: A radical proposal based on Sri Aurobindo's work

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Abstract

Sri Aurobindo distinguishes several types of knowledge ranging from the sense-based knowledge that we have of the physical world outside ourselves, to the direct awareness that we have of our own existence. Other types of knowledge, in between these two, inform us about our inner states and processes, thoughts and feelings. Science, with the help of technology, has perfected and extended our sense-based, "objective" knowledge to such an extent that we tend to consider this as the only valid source of information. Other types of knowledge are commonly considered "subjective", private and unreliable. This paper argues that this is an impoverishing and perhaps even dangerous development. The "subjective" types of knowledge are essential for a comprehensive understanding of ourselves as well as the world. It is these that give meaning and value to our individual and collective existence. Before they can become an integral part of science, however, they need to be honed to a similar level of perfection and reliability as the exact sciences have already achieved in the outer, "objective" type of knowledge. It is *suggested that the Indian systems of yoga could provide the philosophical basis as well as the practical techniques and methodologies to do this. Some of the core elements of these approaches are discussed as well as the far-reaching consequences of a wider acceptance and pursuit of such a perfected form of subjective knowledge.*

Introduction

What is it to know something? How can we know anything at all?

Within the normal routine of science these fundamental questions are seldom raised. Each scientific discipline has its own framework within which more immediately practical questions are selected, answers searched for and, in due time, generally found. As long as we remain within the boundaries of our discipline, the deep questions do not really arise. They do come up, however, when we get involved in interdisciplinary work. Then we get confronted with the significant differences in the approach to knowledge and its acquisition that exist between the different scientific disciplines. The issue comes up still more trenchantly when we try to study a subject that simply does not fit within the parameters of our particular discipline. Consciousness is one such subject that challenges the most basic assumptions of the disciplines that are at present trying to tackle it.

When consciousness was studied in the 19th century there was plenty of confusion, no doubt, but no essential, epistemological difficulty, for it was approached mainly from within the confines of a metaphysical and clinical psychology in which subjective, introspective forms of enquiry were still accepted as a legitimate source of knowledge. When psychology in the early years of the 20th century, attempted to become an objective science, like physics, it redefined itself as behaviorism, and the subject of consciousness disappeared more or less completely from scientific enquiry (Guzaldere 1995). Only at the very end of the 20th century, did consciousness force itself again on the scientific agenda. This time around, however, it was taken up by an objective psychology, "evidence-based" medicine, and hard sciences like neurophysiology, computer science and physics. And here the epistemological difficulties arose.

There can be no doubt that the objective sciences have made tremendous progress during recent times regarding the functional and physical correlates of consciousness, but it is hard to believe that this will make us much wiser about consciousness itself. If it is confirmed, for example, that our human consciousness is not located in any one specific centre of the human brain but that it goes together with 40Hz electromagnetic waves that move from the front to the back over the frontal lobes, then this is extremely interesting in its own right, but it is not very clear how much this adds to what we know about consciousness itself (as distinct from its material correlates). That the essence of consciousness escapes scientific study as presently understood is perhaps not so surprising. Modern science has put all its energy into arriving at knowledge that is objective and independent of the observer, and consciousness might quite well be quintessentially subjective.

From where then do we get knowledge about consciousness itself? An answer might be found in the fact that modern science is not the only systematic effort to arrive at knowledge that humanity has made so far. There are in fact many other knowledge systems, but for our purpose the most promising is that of the spiritual traditions of India, which have specialized for thousands of years in the exploration of the inner worlds and on the acquisition of valid and reliable knowledge of consciousness. That the Indic traditions could play a major role in the further development of consciousness studies is widely acknowledged (Baruss and Moore 1998). What is less clearly seen, is that this contribution consists of a unique combination of two elements: on the one hand a highly sophisticated theoretical framework for the study of consciousness and on the other a welter of practical techniques to change consciousness. How crucial this latter ability to modify consciousness could be for the effective study of consciousness has as yet hardly been recognized. This is surprising given the immense role physical technology has played in the advancement of the physical sciences: technology has not only provided the apparatus needed for more detailed observations, but has also been the spur for further theoretical work and the final test for the practical applicability of theoretical advances. Similar roles have been played by Yoga in the development of the Indic theories of consciousness. An effective "technology of consciousness" is absolutely critical for the development of more powerful and reliable methods to arrive at subjective knowledge.

Integrating Eastern and Western knowledge systems is however not easy. It is still comparatively simple, for example, to study the physiological effects of meditation techniques from within science. Such decontextualised phenomena do not conflict with the standard scientific paradigm and have been extensively studied in literally thousands of scientific research projects.[1] However, the more subtle aspects of the Indian understanding of consciousness cannot be fully grasped without challenging the materialistic, reductionist premises that are, according to many, still the bedrock of modern science.[2] Such not physically reducible aspects of reality cannot be fully understood without adopting at least some essential elements of the Vedic, or Buddhist, ontology, which are incompatible with a materialistic view of reality. If one studies the materialist and the spiritual systems dispassionately, it becomes clear that the results of Yoga cannot be explained losslessly by the materialistic worldview, while, as we will see later, it is comparatively easy to fit the entire scientific enterprise within one or two specific niches of the more comprehensive Indian ontology. But before we can work this out, we must have a look at what the two different traditions actually mean by knowledge, consciousness and reality.

What is meant by knowledge?

The words "knowledge" and "consciousness" are used in many different ways by different people, so before proceeding I will try to clarify how I will use these terms. I do not think it is possible, or for that matter, very useful, to give exhaustive definitions of either. These concepts are too complex and comprehensive for such an attempt. So the following is meant only as a first indication of the direction in which we will move. For our limited purpose it is sufficient to observe that the knowledge aimed at by science is not of the same type as the knowledge aimed at by the Vedic tradition. Scientific knowledge consists of explicit statements about things and processes and the relationships between them. One of the most generic descriptions of a valid statement of scientific knowledge is probably "If you do action *a*, under conditions *c*, you will get result *r*" (Velmans 2001). This pragmatic formula holds even for much of yogic knowledge, but it does not hold for all of it: it presumes, for example, the existence of an independent agent, which does not apply to the higher ranges of mystical experience. There are other differences as well. In the Vedantic worldview, where truth is not seen primarily as a property of sentences, but as something inherent in the observer as well as the observed, the knowledge aimed at does not consist of independently existing, external descriptions of such truth. The aim rather consists of the very act of seeing, realising or even becoming that truth. In ordinary science explicit statements about reality are complete in themselves; in Yoga statements about reality are rarely more than hints or aids, meant to arrive at a direct perception of a deeper truth, which itself remains concealed behind the outer formula. As Forman (1990, p.41) says with respect to "Pure Consciousness Events", "linguistic systems are afloat, not pinned down to the terms in which the mystic undergoes the event". While scientific knowledge can indicate avenues for outer action, Vedic knowledge indicates rather a different way to be and experience. Even the role of reason is not the same in both systems. In the early Vedic and Upanishadic tradition rational thinking is not used as a means to arrive at truth, but rather as a means to express as faithfully as possible a truth already seen or lived on a "higher" level of consciousness, so that the expression, by the quality of the consciousness inherent in it, can help others to experience that truth directly for themselves.[3]

Within the context of Yoga, Sri Aurobindo describes Vedic knowledge as follows:

> *[T]he knowledge we have to arrive at is not truth of the intellect; it is not right belief, right opinions, right information about oneself and things, that is only the surface mind's idea of knowledge. To arrive at some mental conception about God and ourselves and the world is an object good for the intellect but not large enough for the Spirit; it will not make us the conscious sons of Infinity. Ancient Indian thought meant by knowledge a consciousness which possesses the highest Truth in a direct perception and in self-experience; to become, to be the Highest that we know is the sign that we really have the knowledge.*
>
> *...For the individual to arrive at the divine universality and supreme infinity, live in it, possess it, to be, know, feel and express that one in all his being, consciousness, energy, delight of being is what the ancient seers of the Veda meant by the Knowledge;* (Sri Aurobindo, 1972a, pp. 686–87)

It may be clear that this Vedic concept of knowledge is something entirely different from the scientific concept of knowledge. Of course the ancients were aware of the more mundane type of knowledge, but they were less exclusively interested in it than modern science. *Avidya*, or "ignorance", as they called it somewhat disdainfully, denotes all knowledge that is not knowledge of the Absolute and the word is specifically used for knowledge of the world, in other words, for science. According to Sri Aurobindo's interpretation of the *Isha Upanishad*, both *vidya* (Knowledge of the One) and *avidya* (knowledge of the multiplicity) are needed for a complete understanding of reality:

> *Into a blind darkness they enter who follow after the Ignorance, they as if into a greater darkness who devote themselves to the Knowledge alone*
>
> *… He who knows That as both in one, the Knowledge and the Ignorance, by the Ignorance crosses beyond death and by the Knowledge enjoys Immortality.*
> (Sri Aurobindo's translation, 1996, pp. 21–22)

In the acquisition of the Vedic type of Knowledge four clearly demarcated stages are distinguished, of which only the first is a part of ordinary science: information, experience, realization and transformation. These four stages of understanding are most typically used to describe different levels of understanding the ultimate reality, but they also occur in other types of knowledge. Information can be gained by listening to others, by reading or by conducting objective experiments. It is the level of knowledge that science deals with. Unless it is related to something emotionally loaded, information generally does not directly affect a person. Only through the second stage of direct experience, knowledge becomes really one's own. Still, experience does not yet make any deep change to whom one is in one's essence. It is still something one *has* and is still separate from who one thinks one *is*. Direct personal involvement comes with the third step: realisation. Realisation involves a true reversal of consciousness. After realisation, there is no coming back. It changes who you feel you are. But even then, even though one has changed one's basic position and outlook on reality, one's nature remains still largely what it was. The whole nature changes only during the last stage, through the process of transformation. Experience and realisation can come by themselves, or after much effort, but they are things that happen at once. One can afterwards remember the exact date and time. Transformation however is a gradual and laborious process.

Before we can explore how the Vedic, inner knowledge relates to scientific knowledge, we have to have a look at what consciousness is, for human knowledge is typically a combination of information with consciousness, or at least potential consciousness. Recent years have seen an enormous interest in information, largely spawned by the communications industry with its need to store and transfer information electronically. We will not get into this information aspect but focus rather on the aspect of consciousness.

What is consciousness? What is reality?

In most scientific literature, consciousness is equated with the ordinary mental awareness of one's surrounding and one's internal movements. Sri Aurobindo uses the word "consciousness", in line with the Vedic tradition, in a much wider sense, for something that is pervasive throughout existence. As such it can take many forms. In man consciousness manifests most typically as mind, but in pure inorganic matter, for example, it manifests as not more than an obscure habit of form and movement. Consciousness in Sri Aurobindo's terminology is thus a much wider concept than mind. It exists in many grades or types that together form a hierarchy ranging from matter to the pure spirit, with the mind somewhere in the middle.

Sri Aurobindo formulates his view of this wider range of consciousness as follows:

> *Consciousness is usually identified with mind, but mental consciousness is only the human range which no more exhausts all the possible ranges of consciousness than human sight exhausts all the gradations of colour or human hearing all the gradations of sound – for there is much above or below that is to man invisible and inaudible. So there are ranges of consciousness above and below the human range, with which the normal human [consciousness] has no contact and they seem to it unconscious...* (Sri Aurobindo, 1972b, p. 234)

This extended use of the term may in first instance be confusing for those who are used to the way the term is used in most of western scientific literature. Consciousness and mind are there often equated and in psychology mind is even used as a wider concept than consciousness (for example when a distinction is made between conscious and unconscious mental processes). Such a restricted conceptualization of consciousness makes of consciousness a freak phenomenon that suddenly appears at a certain level of physical complexity and that as such defies explanation. Much of the confusion that presently reigns in the field of consciousness studies seems to be due to an unworkable delineation of both matter and consciousness. Chalmers' "hard problem" (Chalmers 1995) for example, is hard only because it contains implicit assumptions about the relationship between matter and consciousness that are quite unwarranted.[4]

If we take consciousness in line with the Vedic tradition as all-pervasive and existing not only within individuals, but also, independently, on a cosmic scale, then the individual consciousnesses can be seen as instances, portions or representatives of these different types of cosmic consciousness. The gradedness of consciousness and its cosmicity taken together have led to a conception of reality as a complex scheme involving interpenetrating but experientially distinct worlds, each consisting of a different type of consciousness and being.

Sri Aurobindo sees these different worlds as different *relations* between conscious existence as observer and the same conscious existence as the observed. Human mentality, that is our mental awareness of the physical world, is just one type of consciousness somewhere in the middle of a long scale. At the upper limit of the scale there is the consciousness the Divine has of himself. At the bottom end of the hierarchy we have the completely involved consciousness of inorganic matter. In the latter, self-oblivion is almost complete with the elemental particles of physics moving about in a seemingly inconscient, but still lawful organisation: "the force acting automatically and with an apparent blindness as in a trance, but still with the inevitability and power of truth of the Infinite" (Sri Aurobindo, 1972a, p. 344). The grades of conscious existence in between the two extremes of Spirit and Matter have been described in many ways. Sri Aurobindo uses generally the Vedic "sevenfold chord of being": *Sat, Chit, Ananda,* Supramental, Mental, Vital and Physical, with several subdivisions within each of these seven major planes.

> *We mean [by planes of consciousness, planes of existence] a general settled poise or world of relations between Purusha and Prakriti, between the Soul and Nature. For anything that we can call world is and can be nothing else than the working out of a general relation which a universal existence has created or established between itself, or let us say its eternal fact or potentiality and the powers of its becoming. That existence in its relations with and its experience of the becoming is what we call soul or Purusha*[5]*, individual soul in the individual, universal soul in the cosmos; the principle and the powers of the becoming are what we call Nature or Prakriti* (Aurobindo 1972c, p. 429).

In this view there exists neither a purely objective world "out there", nor a purely subjective experience "in here". Reality consists of the different *relationships* between consciousness-existence as observer and the *same* consciousness-existence as observed. Conscious existence is all there is at any level. When consciousness-existence identifies itself with the ordinary physical mind, it experiences a separation between itself as subject and itself as object and senses itself as a separate subject in the midst of what appears to it as an "objectively", independently existing matter. There can be no doubt that this is the most common experience of reality amongst humans, but otherwise it is not privileged in any manner. Matter as we see it and our ordinary mental consciousness are not real primitives, but rather intermediate points on a long continuum of conscious-existence, which ranges from what appears to us as inconscient matter to what appears to us as superconscient spirit. Of course in our ordinary mental awareness we do not *see* reality like this, we see the world as existing independently "out there", and we experience our own consciousness as existing "inside" and as looking out at that "objective reality". This is quite sufficient for most practical purposes, but will not do as a full description of reality. It grants much too concrete a sense of reality to the world *as we see it*. It should be clear that not only acknowledged subjective phenomena like colour and hardness but even supposedly objective phenomena like space and time are constructs of our mental level of consciousness. *All* our descriptions of reality, whether stemming from a naïve common sense or from the most sophisticated mathematical models of science, can, in principle, never be more than the outcome of the interaction between our observing conscious existence with whatever ineffable conscious existence presents itself to it as object. Even the very distinction between subject and object exists only on the intermediate levels: at the bottom consciousness is totally involved in its own separate existence, at the top it is all encompassing.

These different worlds of *Veda* and *Vedanta* are not closed systems that are completely sufficient within themselves. But it is not correct to speak of interactions between essentially different types of substances or forces either (e.g. of interactions between mind and matter). The different worlds are interwoven in a different manner, based on an underlying identity. In terms of the observing self, *Vedanta* holds that there is actually only one observing Self (the *paramatman*). The many selves of the *Sankhyas* only appear separate and different from each other by a process of self-variation and "exclusive concentration" that takes place in portions of the original Self that in essence remains One. Similarly, as the *Sankhyas* acknowledge, there is only one objective reality, which is ineffable, or, in the more descriptive Sanskrit phrase, *anantaguna*, "of infinite quality". So there is actually only one world of which we are portions and see aspects. When our individual consciousness expands and begins to merge with the cosmic consciousness, we begin to realise that there is only one conscious existence that separates itself, for the joy of manifestation, into an infinite number of relations between itself as observing consciousness and itself as observed Nature. At any given time, the only thing we can know about the reality is the interaction between the centre, and thus the type, of consciousness we identify with and this ineffable Nature. The scientific, objective relationship is just one amongst many such relationships.

Four types of knowledge

On the basis of this broad philosophical conceptualisation of knowledge, consciousness and reality, we can now attempt to build a more pragmatic bridge between scientific and Vedic knowledge. Though the scientific and the Vedic ways of knowing seem so different as to be incompatible, they may actually be complimentary and prove to be equally needed for arriving at a complete picture of ourselves and of the world in which we live. While scientific knowledge has proven to be extremely effective within the limited range of the mental understanding of the physical world, the Vedic type of Knowledge has provided a comprehensive map of the whole field. Just like science has spawned a technology to explore the material level of reality in an objective way, the Vedic tradition has developed yoga as an effective technology to explore the inner and higher levels of reality in a subjective way. It does this largely by enabling the observer to change the type and centre of his or her consciousness. This is not relevant only for those interested in metaphysics and spiritual growth; what happens on the higher and lower levels of consciousness has an enormous influence on our ordinary waking state, and their study is thus of the utmost importance for humanity.

The systematic study of consciousness will have to begin, however, on the level of the ordinary waking mind. Even in our ordinary waking state, there is not only one type of knowledge, but several. In one place, Sri Aurobindo distinguishes four different types of knowledge that are routinely used in the ordinary waking state. Together they form a gradient between the external knowledge that Science works with and the inner knowledge that according to the Vedic tradition is the essence of all other forms of knowledge. The four types of knowledge are called as follows:

(1) Knowledge by indirect separative contact (= scientific knowledge of the outer reality)
(2) Knowledge by direct separative contact (= objective introspection of inner processes)
(3) Knowledge by direct intimate contact (= experiential knowledge of inner processes)
(4) Knowledge by identity (= Vedic knowledge)

The first type of knowledge, *knowledge by indirect separative contact*, consists of explicit, objective information about what we see as the external world. Sri Aurobindo describes it as *indirect* because it is mediated by the external sense organs, and as *separative* because it goes together with a sense of clear separation between the self, who is the knower, and the object, which is the known.

This type of knowledge has been developed and expanded impressively by the physical sciences over the last couple of centuries and is perhaps too well-known to need further comment.

The last type, *knowledge by identity,* is the very different type of knowledge that we have of our own existence. For this type of knowledge the senses are not required as it is knowledge that arises "from inside out." It is the knowledge we have of ourselves simply because we are. There is no difference here between subject and object and, in a way, not even a process: knowing and being are one. In our ordinary waking consciousness, knowledge by identity is hardly developed and almost point-like in character: it is undifferentiated and has no other content than the bare fact of its own existence. But according to the Vedic tradition, it is possible, through extensive spiritual practice, to develop this type of knowing further and then there is no theoretical limit to its scope. It is through this type of knowledge that the individual is considered capable of realising his or her identity with the Cosmic or the Transcendent Divine. It is also this type of knowledge that the *Upanishad* speaks about when it says: "When That is known, all is known." The logic behind this amazingly bold statement is that knowledge by identity is in essence the knowledge of the Self, and as all individual Selves are ultimately one, it is considered possible to have an intimate self-knowledge of other selves. This claim is in principle open for experimental testing, but it may be clear that it requires a rather radical change in many aspects of one's cognitive functioning to make knowledge by identity operational to a substantial degree. It should not be surprising, however, if smaller manifestations of the basic principle would be found to be fairly common, for example, in occurrences of telepathic communication.[6] As interest in consciousness studies increases and our insight into the processes and techniques of change in consciousness deepens, one can expect more and more interesting work in this direction.

In between these two extremes there are two more types of knowledge, both used for our internal states and processes. The first is knowledge about internal, psychological and physiological states and processes obtained by looking "objectively" at what is happening inside oneself. If one focuses on one's physical state, one could say for example, "My hands feel cold." The cold sensation is then felt as pertaining to a part of myself, even though I'm neither fully identified with the cold sensation nor with the hands. The same separation between the inner observer and the inner observed can be experienced with feelings or thoughts. I can say for example, "I like this approach to Epistemology," or "I think that he is right." In this type of knowledge there is a small gap between the observer and the inner process that is being observed. This type of knowledge is thus called knowledge by separative direct contact, *separative* because there is this sense of distance between the knower and the known, *direct* because the outer senses are not required. This type of knowledge was, under the name of "introspection", used extensively in Psychology till the second decade of the twentieth century when it was discarded in favour of a purely external study of behaviour. In a later section we will discuss some of the difficulties with introspection and the solutions Indian psychology has found for them.

In the third type of knowledge, one identifies with some inner psychological state or process. One is conscious, but one does not *observe* what is going on inside because one is fully involved in what one is doing. This type of identification is experienced, for example, when one is fully engulfed in a feeling, say a feeling of happiness. If one expresses what one feels in such a state of engrossing happiness, one does not say anymore explicitly and self-referentially, "Today I'm really happy," which would imply a certain distance, but one's happiness shows implicitly in the manner in which one expresses oneself, e.g. "What a beautiful day it is today!". Similarly, when one is completely engrossed in one's own thinking one can express what one is thinking, but the expression does not involve a reflexive reference to the fact that one is thinking. One could say, for example, "You are right". Even in this case there must be some implicit awareness that one is thinking this, but one is not aware of it by looking at one's own thinking process from the outside. One is aware of it from within the thinking itself, or perhaps one should say, by *being* the thought. This third type is thus called knowledge by intimate direct contact, intimate because the observer is united with the observed, and direct because there are no intermediary sense organs involved. Knowledge by intimate direct contact is hardly used in the development of science but, under the name of "experiential knowledge", it is an essential element of all forms of "learning by doing" and the training of skills. It is also used extensively in psychotherapy, whether psychodynamic, cognitive behavioral, or humanistic/transpersonal. It can be trained to extraordinary levels of intensity and refinement by spiritual practice and it plays an important role in most mystical traditions.

Though it is useful to distinguish these four types of knowledge conceptually, in daily life they often go together, in quick succession or even simultaneously. The most fascinating aspect of this is, that the last, the knowledge by identity, is always present in the other three, be it often as a hidden, implicit presence. This is clear for the middle two: one simply *knows* that the hand one feels as cold is "one's own", one *knows* that it is oneself who is happy. But knowledge by identity is there in a diminished form even if our sense-based knowledge of the outside world: one recognises what one sees *as part of one's world*. This may look like a rather minimal level of identification, but the suffering caused by its absence in some of the most serious and "unlivable" forms of schizophrenia, makes clear how essential this basic sense of belonging is for a healthy existence.[7] There is another form in which knowledge by identity presents itself within our knowledge of the outside world, and that is all we know about the structure of the world that we cannot derive from the raw data our senses provide. There are certain basic knowledge structures that are needed to make sense of what comes from the senses. The fundamental rules of logic and mathematics are some interesting examples of such innate or intuitive knowledge, but it occurs also in the less formalized knowledge individuals have of their surrounding. Sri Aurobindo holds that a lot of this "built-in," instinctive knowledge is required to make anything at all out of the extremely incomplete and imperfect information that our sense-organs provide. The necessity or otherwise of this type of pre-experiential knowledge has been discussed for centuries, but it appears the tide is slowly turning again in its favour. For example, Sir Karl Popper (1994, p.15) has given some of the most convincing arguments against a *tabula rasa* image of the newborn child and recent psychological research seems to provide experimental evidence corroborating the idea that we do have extensive innate knowledge about the structure of the world. How such innate knowledge relates to intuitive knowledge remains however a complex issue. In Sri Aurobindo's description of the manifold reality, logic and mathematics both belong to the pure mental plane and not to the physical plane, and they are derived from knowledge by identity rather than from knowledge by separative indirect contact.

The honing of subjective knowledge

As a whole, science has concentrated almost exclusively on the acquisition of sense-based knowledge of the outer world. This is understandable in terms of the historical division of territories between science and religion at the time of Descartes. It can also be explained as a universal human trait: the windows of the senses look outwards, as the *Upanishads* say, and that is where we are inclined to look for truth in the first place. But there are also a number of pragmatic reasons that have maintained this strong external focus. The main one is the lack of reliability of untrained introspection and other forms of subjective knowledge. All human perception is prone to error, but perceptions of inner states are particularly inconsistent and unreliable. There are many reasons for this. One of them is that human beings are aware of only a tiny fraction of what is going on inside. We have access only to the surface and miss out on the forces and processes that take place below, behind and above the surface, and these surface appearances can be misleading. As Freud discovered in the early twentieth century and the Indian tradition in a completely different (and much more comprehensive) fashion several millennia earlier, it is from these deeper (and higher) layers of consciousness that our outer nature is determined. As long as one does not open the deeper recesses of one's nature to the inner sight, it is not possible to achieve a reliable form of introspection. A second distorting factor is that we have an interest in the outcomes. In introspection one typically looks with one part of oneself at another part of oneself. It is extremely difficult to watch oneself objectively without any bias, fear or expectation. The mind has its preferences, the vital nature its desires and needs, the body its physical limitations. All these interfere with "clean" observation. This is of course true for external observations as well, but the outer reality does not so easily change because of one's moods or desires. The inner states, on the other hand, change easily under such influences and even due to the observing process itself. Taking all this together it is quite understandable that introspection was discarded in the beginning of the twentieth century as too unreliable a source of information for scientific use.

But none of these problems with introspection is irremediable. Each one of them can by systematic effort be eliminated. The different paths of Yoga have in fact all developed techniques that are supposed to achieve exactly this. They all aim to arrive at a direct perception and finally a merger of one's individual consciousness and being with the consciousness and being of the Divine. To make this possible, a considerable purification of one's inner instrument, or *antahkarana* is essential. The different yogic traditions thus all have their methods to improve the range, the "resolution" and the reliability of inner perception. These techniques can be grouped into those that aim at greater concentration, at freedom from the sense-mind leading to an ability to penetrate the deeper and higher layers of consciousness, and at freedom from partial identifications, that is from the body, from the vital drives and emotions, from one's thoughts and finally from the ego-sense. These techniques are within their tradition considered to lead to a free consciousness, capable of watching the movements of *Prakriti*, nature, as a completely independent witness, making it possible to observe inner events not only with a greater precision but also with a perfect "objectivity" and thus reliability. The inner disciplines of Yoga can thus play exactly the same role for a science of the inner realities as modern technology is playing for the material sciences.

Conclusion: Can we have a reliable science of consciousness as a subjective reality?

If we presume that the essential nature, the *svadharma*, of science is to look for truth, then there should be every reason for science to expand its field and take up the methods of Yoga to achieve reliable and detailed knowledge of the inner realities. This is, however, an entirely new territory for science. Modern science is a child of the European Enlightenment[8] and systematic methods to train consciousness have, at least in recent times, not been part of the mainstream western tradition.[9] Besides new methodologies, it would involve new attitudes towards personal involvement and, perhaps most difficult of all, the acceptance of Indic ontologies, which are more comprehensive than the materialistic and idealistic philosophies with which the West is familiar. It will even involve new scientific hierarchies, based less on intellectual acumen and vital assertiveness, and more on inner wisdom.

Given the political and economical dominance of the West at present, one can expect considerable resistance to this acceptance of Eastern techniques, philosophies and attitudes. There are, however, precedents of cultural influence moving in the opposite direction of political conquest. In classical Rome, for example, Greek art and science were widely, and we would now say rightly, valued above their Roman counterparts: after Athens had been defeated militarily and politically, slaves from Greece were used extensively as teachers for the Roman elite. Eugene Taylor predicts, on the basis of a detailed study of the history of spirituality in the United States, that a similar cultural counter stream will take place in the coming years. He sees that as a result of a "cross-cultural exchange of ideas between East and West unprecedented in the history of Western thought" there will be a "historical change in the very context in which reality is defined" (Taylor 1999, p. 290).

One can only hope that Taylor's prediction will come true. At present spiritual development is left entirely to the subculture and remains outside the compass of science. As a result, mainstream society is in a state that has much in common with multiple personality disorder. Public life – the media, government, business, and education – is entirely governed by the materialist and reductionist ideas of the physical sciences. Private life, after five and in the weekends, follows often a completely different set of values and truths. Like all such internal divisions this split leaves both sides diminished. Science is providing more and more power without the wisdom to use it. Religion and spirituality abound in uncritically accepted creeds and dogmas, and miss the best that the progressive intellect of humanity could have given them. If science and spirituality can come together we can expect an unprecedented collective progress in the inner realm, and it is hard to deny that this is sorely needed. All really serious problems facing humanity at the present stage are not material in nature but are psychological. Imagine the joy and fulfillment if the ancient yogic techniques for attaining inner peace, freedom and wisdom could again become an organic part of our collective life and could be developed further for the benefit of all present and future generations!

Notes

1. An excellent example is the work of Benson on the "Relaxation Response". A good overview of this type of work can·be found in Murphy and Donovan (1997).
2. Interestingly there are very few philosophers of science who advocate a strong reductionistic, materialistic worldview. (Daniel C Dennett is probably the most outspoken representative of this group.) I do not think there can be much doubt, however, that most scientific literature, at least in the "hard sciences", is written as if this is the "given" worldview.
3. The later philosophical schools seem to have used reason more in the modern sense.
4. For a more detailed discussion of this issue, see Cornelissen (forthcoming).
5. According to the *Sankhyas*, the original Consciousness, which is one with Existence, splits itself in two: "the consciousness that sees and the consciousness that executes and formalises what we see" (Aurobindo 1997, pp. 194). The first is called *Purusha*, or Self, the second *Prakriti*, or Nature. Sri Aurobindo makes extensive use of the *Sankhya* philosophy, especially as a practical means to rise above the ego-sense. It is interesting that in the system of the *Sankhyas*, mental processes are considered part of nature and illumined by the self, but not part of the self. This comes quite close to the modern division between objective thought-processes and subjective experience. In this "standard" scientific view mental processes are seen as correlated with, or even identical to, objective processes in the brain while consciousness is seen as a subjective phenomenon of a different character. One may note that this is very different from the traditional dualism of Descartes, who placed thinking without the slightest hesitation on the side of the self. Technology has thus naturalised the information aspect of knowledge and has left, as in ancient India, only pure consciousness on the side of the self.
6. Dean Radin (1997, pp. 269) actually suggests a similar theory of "interconnectedness" to explain the positive results in many "paranormal" cognitive phenomena.
7. One should not confuse this involuntary, pathological dissociation with the spiritual Void. The inner emptiness the schizophrenic feels is a terrible state, which, if genuine and not a ploy to manipulate the environment, often leads to suicide. The spiritual state of

emptiness is a completely different state going together with a sense of utter fulfillment and beatitude.

8. It is interesting to consider that the European Enlightenment was supposed to have freed the collective human mind from the darkness of superstition and authoritarian religion, into the clarity of the reason, while the Indian concept of enlightenment is used for the release of the individual consciousness out of the semi-darkness of the reasoning mind into the light of the Spirit. Are we ready for a collective change in this direction?
9. This is not to deny that meditative techniques have been used in some monastic orders. But in contrast to the Indic tradition such inner disciplines have in the West never been a central focus of mainstream culture. In the West science has focused on the outer reality and religion has been based on faith, authority and grace.

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A metaphysics of living systems

Reductionism and emergentism in the *Yōga-Vāsiṣṭha*

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Abstract

The Yōga-Vāsiṣṭha is a rich and complex philosophical 'poem' (kāvya) *of epic length, written in classical Sanskrit by an unknown author some time between the 6th and 13th centuries CE, probably around the 7th century. It is notable for its eloquent praise of self-effort and enquiry or analysis, and for its severe disparagement of the notion of fate. It views consciousness as (a) characterising all living forms (including plant and insect life), (b) being atomic, and (c) analogous to the emergence of waves and whirlpools in water; it therefore grapples with what today would be called the problems of reductionism and emergentism. Notions of the survival of the fittest, and of a dynamic process of creation and loss, are expressed with characteristic force. The paper presents a selection of verses (each with an English translation) setting forth these views, and a brief analysis of their implications.*

Introduction

The purpose of this talk is to present a certain selection of verses from the complex but very rich work known as the *Yōga-Vāsiṣṭha* (=Vasiṣṭha's Yoga; Śāstrī Pansīkar 1981). A major reason for choosing this work to talk about is that it appears to represent a philosophy that I believe working scientists of today can live with, and perhaps even live by.

As is so often the case with Indian works of this kind, it is difficult to identify the author or date of the *Yōga-Vāsiṣṭha* with confidence. The work is formally attributed to Vālmīki, the author of the famous epic *Rāmāyaṇa,* and purports to be his account of a series of public conversations between the nearly 16-year old Prince Rāma and the celebrated *guru* of his royal family, Vasiṣṭha. It is however hard to believe that the true author of the book (longer than the *Rāmāyaṇa,* by the way) is Vālmīki. Scholars consider that the work must have been written some time between the 6th and 13th centuries; Athreya (1993) has presented some very persuasive arguments that the work was written around the 6th or 7th century CE – i.e. around the same time as or slightly earlier than Śaṁkara.

The *Vāsiṣṭha* is basically a long philosophical poem, written in simple, classical, lovely Sanskrit. One of the most striking features of the philosophy underlying the work is its praise of *vicāra* (enquiry, analysis)[1] and *pauruṣa* (human effort)[2], and its disparagement of the notion of *daiva* (fate)[3]. Indeed the *Vāsiṣṭha,* whose ideal is *jīvan-mukti,* i.e., liberation while living (or *living free,* so to speak), takes the view that even a man of affairs may attain liberation.[4] This view leads to much debate in Vidyāraṇya's famous work (13th c.) *Jīvan-mukti-vivēka* (Mokṣadānanda 1996: 311-314, towards the end of Chapter 4), with the *guru* being persistently asked by his disciple whether Vasiṣṭha is not guilty of *vyavahāra-praśamsā* (=praise of worldly involvement). The *guru* denies this, but I get the impression that the debate ends lamely, on an inconclusive note.

The eloquent advocacy of the overriding importance of human effort in the *Vāsiṣtha* modulates an otherwise generally *advaitic* view: the book seems to champion a 'soft' *advaita*[5]. A discussion of these points is available in a separate work of the author (Narasimha 2000). And a fascinating account of the *Vāsiṣtha* view of reality and illusion is given by O'Flaherty (1984).

General *Vāsiṣtha* attitudes

Vasiṣtha would have approved of the opening line of Timothy Williamson's recent book (Williamson 2000): 'Knowledge and action are the central relations between mind and world'. Barely has the *Vāsiṣtha* got past the invocatory stanzas when Sutīkṣṇa demands from the sage Agasti unambiguous instruction about the path to liberation; and the answer he gets – stated in the seventh verse – is this:

It takes both of its wings for a bird	*ubhābhyām.ēva paksābhyāṁ*
To fly about in the sky –	*yathā khē paksiṇāṁ gatih,* |
So it takes both knowing and doing	*tath".aiva jñāna-karmabhyāṁ*
For man to perfect himself.	*jāyatē paramaṁ padam.* ||

(1:1.7)

Although the author of the *Vāsiṣtha* generally decries the notion of fate, he seems to recognize that there are certain immutable laws (*niyati*), as in the following verse.

He may know much, he may know all,	*sarva-jñō. 'pi bahu-jñō.'pi*
He may be Mādhava, or Hara Himself,	*Mādhavō.'pi Harō.'pi ca* – |
Or whoever: but he is powerless	*anyathā niyatiṁ kartuṁ*
To deflect the course of the Law.	*na śaktaḥ kaś-cid.ēva hi.* ||

(5:81.26)

Creation is not something which occurs on a certain day, not even something that might be attributed to God; it is a continuing, dynamic process:

The riches of creation, like sparks
from a fire,
Arrive, depart, ascend or fall
In that pure and unified space
That is without beginning or middle;
I don't think the cause
Is what is called God.

āyānti yānti nipatanti tath" .ōtpatanti
sarga-śriyah kana-ghatā
iva pāvak'.ōtthah |
yatra-amalam tad. aham. ēkam.
anādi-madhyam
manyē kham.ēva; na tu
kāranam. Īśvar' .ākhyam. ||

(6u:116.27)

Philosophically, therefore, for the *Vāsiṣtha* creationism is not an option, and absolute laws are not necessarily rejected.

Life

One aspect of the *Vāsiṣtha* view of life may be said to correspond to the view of a nature that is 'red in tooth and claw'; for example this is what Vasiṣtha tells Rāma:

All creatures in this jungle of life
Are plucked – and destroyed –
Continually; and, in delusion, feed
On each other and defend their feed.

ajasram. ēvam. āluna-
viśīrnam bhūta-jangalam, |
paraspara-malam mōhād.
adyatē raksyatē. 'pi ca. ||

(5:14.28)

In general, the author appears to be a realist in matters of this kind (including war and peace). His eloquent advocacy of self-effort, discipline, analysis and good cheer[6], and his categorical assertion that liberation (*mōkṣa*) can come only from both knowledge and action, appear to arise from a hard-headed appreciation of the true nature of the world, not from a soft or romantic view. However the book is also lyrical at many places about the beauty of nature, of young married love etc. Indeed its view of the human body is characteristically appealing (especially because it is such a contrast to the aversion that is so often expressed in much other Indian philosophical writing):

That great city known as one's body	*tasy'.ēvam bhōga-mōksa-artham*
Should be a source of joy, not misery;	*tajñasy'.ōpavan'.ōpamā* – |
To a wise man it's like a garden	*sukhāy'. aiva na duhkhāya* –
That gives him pleasure as it sets him free.	*sva-śarīra-mahā-purī.* ||

(4:23.2)

In fact, Rāma is urged to be (simultaneously) a great doer, a great enjoyer and a great renouncer (*mahā-kartā, mahā-bhōktā, mahā-tyāgī bhava.anagha,* 6p:115.1), albeit that these words are invested with a meaning somewhat beyond what would ordinarily be attached to them.

Atomism

Perhaps the most interesting aspect of the work, from the point of view of the present discussion, is the way it grapples with what today would be called reductionism and emergentism – currently matters of much vigorous debate.

The author seems convinced that the universe is made of atoms (= *aṇus* and *parama-aṇus*), which appear and reappear constantly in the dialogue between Rāma and Vasiṣṭha. But he sees them as mental constructs as well:

Of the billions of atoms that make up	*jagatām kōti-laksēṣu*
This universe, each and every one	*yāvantaḥ parama-aṇavaḥ,* |
Is seen as an internal world	*tēṣām.ēk'.aikaśō.' ntaḥsthān*
By the detached philosopher.	*sargān pāśyatv.asaṅga-dhīḥ* ||

(2:18.27)

He is thus certainly not critical of atomism (as Śaṁkara was), but does not see the world as a mere collection of atoms (6u:103.65), especially if atoms are inert (*jaḍās.tē parama-aṇavaḥ,* 6u:103.68). Nevertheless these atoms are also seen as an essential part of a living system:

That atom, with memory endowed,	*jīva ity.ucyatē tasya*
Is what is called *jīva* [live];	*nāma.aṇōr.vāsanāvataḥ;* |
At end of life it stays to reside	*tatra'.ev' .āste sa ca śav'* -
In the space of the body that's dead.	*āgārē gaganakē tathā.* ||

(3:55.6)

Thus it appears as if the *Vāsiṣṭha* does take an atomistic view in general, but considers that some additional element (*vāsanā*) is needed for life. The immediate question that arises is how this atomistic view is related to conceptions of mind and consciousness.

First the mind, which is seen as central to all our perceptions. The following verse is typical of the author's view of the connection between mind and world:

Understand, Rāghava, that the mind
Is the grand hub around which whirls –
Maddeningly – that magical wheel
Which is this world we see.

asya saṁsāra-rūpasya
māyā-cakrasya Rāghava |
cittaṁ viddhi mahā-nābhiṁ
bhramatō bhrama-dāyinaḥ ||
(5:50.6)

Shades of *māyā* here, of course; that is a word that does keep cropping up, although it does not dominate the debate. But the connection with the atom is that its 'structure', if we may use that word, is also a construct of the mind. Indeed,

Wherever rests the inconceivable
Spirit of the beholder's mind,
There – even in the belly of an atom –
Rises up a splendour of perception.

acētya-cit-svarup' -ātmā
yatra yatr' .aiva tiṣṭhati, |
draṣṭā tatra.asya dṛśya-śrīḥ
samudēty.apy.aṇu.-udarē. ||
(3:1.27)

This is only a forceful extension of the author's view (widely shared in Indian philosophies) that everything that is seen is in the seer:

Like the essence in the substance,
Like the fragrance in the flower,
Like the oil in the seed – so the idea
Of what is seen is in the seer.

yathā rasaḥ pada-arthēṣu,
yathā tailaṁ til '-ādiṣu, |
kusumēṣu yath" .āmodas.
tathā dṛṣṭari dṛśya-dhīḥ. ||
(3:1.43)

And the mind, and its behaviour, are complex and rich:

As water displays itself richly
In current, wave, foam and spray,
So does the mind exhibit
A strange, splendid diversity.

dhārā-kaṇ' -ōrmi-phēna-śrīr.
yathā saṁlakṣyatē.' mbhasaḥ, |
tathā vicitra-vibhavā
nānāt" . ēyaṁ hi cētasaḥ. ||
(3:110.48)

(This is incidentally one of the many interesting fluid-flow metaphors in the book: one personal reason for its attraction to a fluid dynamicist like me!) Here is a hint of what is called 'emergentism' (i.e. the notion that structures may emerge in a system without the intervention of an external agency): the water of course is only inert atoms, but out of it emerges a great variety of striking phenomena.

Consciousness

Let us briefly consider the book's view of consciousness, which is seen as characterizing all life, including insects, trees etc. (6p:10.23). Consciousness is of course central to its philosophical discourse, and references to it are so numerous throughout the book that an attempt to summarise all of them in a short talk would be hopeless. In general, much of this would not be unfamiliar to followers of advaitic philosophy. I shall therefore confine myself here to quoting below a few verses that are intended to capture what appear to me to be somewhat unusual views, and ones that may resonate with a scientific view of the world.

In the first place the physical world, the mind and consciousness are declared to be different spaces (this verse is from a dialogue between Sarasvatī and a Princess Līlā):

Gracious lady, please understand:	*citt'-ākāśaṁ, cid-ākāśaṁ,*
There is physical space, there's mental space,	*ākāśaṁ ca tṛtīyakam;* |
And, more tenuous than either of them,	*dvābhyāṁ śunya-taraṁ viddhi*
There is the third space of consciousness.	*cid-ākāśaṁ, Var'-ānanē!* ||
	(3:17.10)

Consistent with the author's atomism, this 'space' of consciousness is also seen in atomic terms (reductionism again!):

Within the atoms of consciousness lie	*cid-aṇōr.antarē santi*
Particles of *all* experience,	*samagra-anubhava-aṇavaḥ,* |
Even as in taste of honey lie	*yathā madhu-rasasya.antaḥ*
All riches of flower, fruit and leaf.	*puṣpa-patra-phala-śriyaḥ.* ||

(3:81.35)

Particles of all experience! It is almost as if the author was saying that experience could be quantized, digitally stored! If he were here with us today, he would be talking about (if I may invent the word) 'cognons'!

Emergentism?

How then do we explain the relation of the universe to this atomistic consciousness? The answer is suggested through analogies:

The universe rests pervasively	*viśv-ākāśaṁ cid-ākāśē*
In the space of consciousness,	*viṣvag-viśrāntim.āgatam* |
Like emptiness in sky, gust in wind,	*spandō dravatvaṁ śūnyatvaṁ.*
And like fluidity in water.	*anilē.'mbhasi khē yathā.* ||

(6u:103.73)

(Note that *drava* in Sanskrit is both *fluid* and *flowing.*) The author is again getting very close here to emergent phenomena, and it appears as if he would be very comfortable with this modern notion, as this verse indicates:

The space of consciousness doesn't differ	*jagac.ciṁ.nabhasōs.tasmān.*
From the universe at any time;	*na kadā-cana bhinnatā;* |
The two are like gales and wind –	*ēkam.ēva dvayō rūpaṁ*
Two forms of the self-same thing.	*pavana-spandayōr.iva.* ||

(6u:103.77)

Indeed, he suggests that consciousness and apparent understanding appear 'spontaneously' – by their own nature – the same way that eddies appear in fluid motion:

From it arises, by itself,
A form of some understanding
Just as the streak of a whirlpool does
From the fluid throb of water.

samudēti svatas.tasmāt
kalā kalana-rūpinī |
jalād.āvarta-lēkh'.ēva
sphuraj.jalatav''.ōditā. ||

(6p:9.3)

There is only consciousness, and what we see are merely its vibrations:

The sole stuff of the whole universe
Is consciousness, as water is of the seas;
And it vibrates through the intellect
As water pounds through ocean-waves.

ēkaṁ vastu jagat sarvaṁ
ciṅ.mātraṁ vār.iva.ambudhiḥ;|
tad.ēva spandatē dhībhiḥ
śuddha-vār.iva vīcibhiḥ ||

(6p:101.54)

Whirlpools, eddies, gusts in wind: these are recurring metaphors throughout the book, as the author speaks of the beauty of vortices (*salil'-āvarta-sundarī,* 4:47.41) and the inherent restlessness of wind (*spand'.aika-dharmavān vāto,* 4:36.21). It is hard to avoid the impression that these phenomena – so easily visible to the naked eye, so accessible to common everyday experience – fascinated the author, precisely because he had to connect them with his belief in the atomistic nature of the universe.

And he finally offers us his version of an astonishing hypothesis (with apologies to Crick 1994):

The inert is not in any way
Distinct from the intelligent;
There is essentially no difference
Between all of creation, all that exists.

na tu jāḍyaṁ pṛthak kiñcid.
asti na.api ca cētanam; |
na.atra bhēdō'.sti sarg'-ādau
sattā sāmānyakē na ca. ||

(3:55.57)

Conclusion

This discussion has been brief; its purpose is to provide the reader with a glimpse of a view of life and nature that, in the large, recognizes that they may often be harsh, but that advocates hard work, action, self-control and discipline, and an overall sense of joy and good cheer, because the notion of fate is absurd, and the past can be defeated. There is also a commitment to atomism, in that life is seen as made up of atoms – but possibly endowed with memory or some special ingredient. But out of these atoms arise complex phenomena, like eddy, wave, foam and spray on water; and the author of the *Yōga-Vāsiṣṭha* would not at all be disturbed by the notion that consciousness emerges in some similar way from those atoms, without being forced by something beyond them.

Notes

Here, and throughout the paper, a relatively free translation of the Sanskrit is presented along with the original text, so that the reader can make his own valuation of the *Vāsiṣṭha* view. References accompanying the quotation are given in the form book: canto.verse; 6p and 6u refer to the *pūrva-ardha* ('earlier half') and *uttara-ardha* ('later half') of the sixth book.

1. All wealth, dominion and pleasure – And liberation, everlasting – Are the fruits of that magical tree Known as Reason, Rāghava!	*rājyāni sampadaḥ sphārā –* *bhōgō mōkṣaś.ca śāśvataḥ –* | *vicāra-kalpa-vṛkṣasya* *phalāny .ētāni, Rāghava!* || (2:14.10)
2. Such is the nature of human effort That a man who so conducts his affairs Does not find his efforts wasted – Not ever, no matter who he is.	*sva-rūpaṁ pauruṣasy' .aitad.* *ēvaṁ vyavaharan.naraḥ,* | *yāti niṣphala-yatnatvaṁ* *na kadā-cana kaś-cana.* || (2:5.26)
3. Fate has been invented by fools Who sink into ruin, obsessed by it; Whereas the wise, by manly effort, Attain the most exalted heights.	*mūḍhaiḥ prakalpitam daivaṁ –* *tat-parās.tē kṣayaṁ gatāḥ;* | *prājñās.tu pauruṣa-arthēna* *padam.uttamatāṁ gatāḥ* || (2:8.16)
4. The enlightened man who's busy in the world, And the enlightened man who dwells in a forest – Both of them are – without a doubt – Equal: they reach the same goal indeed.	*vyavahārī prabuddhō yaḥ,* *prabuddhō yō vanē sthitaḥ,* | *dvāv.ētau susamau nūnam* *asandēhaṁ padaṁ gatau.* || (5:56.12)

5. Soul filled with the thought 'The Real is not dual';	*bhāva-advaitam.upāśritya,*
Embrace the thought that Being is non-dual;	*sattā-'dvaita-may'-ātmakah* – |
But reject the thought that Action is not dual –	*karma-advaitam.anādṛtya*
And be full of both dual and non-dual!	*dvaita-advaita-mayō bhava.* ||
	(5:17.29)

6. At the gate to Freedom, they say,	*mōkṣa-dvārē dvāra-pālāś.*
Stand these four mighty guards:	*catvārah pari-kīrtitāh;* |
Discipline, analysis, good cheer,	*śamō vicārah samtoṣaś.*
And, fourthly, wise company.	*caturtham sādhu-sangamah.*||
	(2:11.59)

7. As Gell-Mann has described it, the doctrine of emergentism is that 'we do not need *something else* in order to get *something else*' (Horgan 1996: 213-4); and he added, interestingly, 'there are lots and lots of eddies in that process' which leads to 'many violations of that tendency' of the universe to wind down thermodynamically.

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Section 4

The elusive self in the spatio-temporal net

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Abstract

Consciousness is multidimensional. Its dimensions are life, awareness, continuity, unity and sense of self. Memory enables the continuity of conscious experience. The combination of episodic memory with that of working memory and current sensory experience gives the continuity of the past with the present. Prospective memory extends the continuum to the future. There is a continuous construction wherein the momentary present becomes the remembered present, which is integrated with the past, and projections are made about the future. This gives continuity to consciousness.

The tools for the construction are the executive functions of the brain, which are predominantly mediated by the prefrontal areas. Cognitive functions such as set shifting, inhibition of prepotent responses, goal-setting and problem-solving choose the relevant experiences from immediate and recent/remote past and combine it with the current present to form continuous consciousness.

It is hypothesized that though this construction is present throughout waking experience, there has to be a distinction between the past, the present and the future. Without this distinction of time, consciousness would have no anchor in the time continuum. The result would be disorientation of time, which is seen in dementia. In order to maintain the distinction in time a sense of self is maintained. The sense of self is an epiphenomenon of the construction of consciousness.

The proof for this is that whenever the content or the process of integration is faulty the sense of self is distorted. Impairments of the contents of integration such as memory and the processes of integration such as executive functions are associated with abnormalities of behaviour. Abnormalities of behaviour are accompanied by distortions in the sense of self as seen in different mental illnesses. Severe damage to memory or executive functions or both is associated with a loss of the sense of self as seen in dementia.

Conversely, voluntary cessation of the process of construction as in meditation is associated with the temporary cessation of the sense of self. The continuous process of integration of experience from different time domains gives the flow or stream of consciousness or the wave upon wave of thought in the mind. This is accompanied by a sense of self. Cessation of this construction can be associated with brain damage or not. Associated with brain damage, cessation is permanent and is accompanied by a permanent loss of the sense of self. Cessation with an intact brain is accompanied by temporary cessation and by temporary cessation of the sense of self. This temporary cessation is the Samadhi, described wherein the knower, knowledge and the process of knowing are not separate, for construction has ceased.

The self is close yet far. It is an essential part of our being but is difficult to define. It is dynamic and changeable, yet quiet and stable. Self is the essence of our being. *What is this being and What is this self? Are the two identical or different?* Is the self the body, intellect, mind or knowledge? The answer seems to be that the self is each of these and all of these. Again the self is the background to our experience, quiet, unchanging, observant; a spectator of the drama of experience. The self is also dynamic and ever changing. Awake or asleep; thoughtful or agitated; angry or happy; the self is multifaceted and shining in kaleidoscopic colours.

The *Advaita* philosophy of the Hindu tradition has an answer to the seeming confusion. Sri Ramana Maharshi distinguishes between the I thought and the I-I thought in *Upadesha Saram* (Natarajan 1984). The former is a reflection of our being, while the latter is described as the spring from which thoughts arise. The *Bhagavad Gita* describes the quiescent, unchanging and therefore permanent self as the true state of our being. The changing, thereby impermanent self is defined as the ego or *Ahamkara*. According to this treatise, the Ego or *Ahamkara*; the Mind or *Manas*; the Intellect or *Buddhi*; are the three sense organs of knowledge (Swami Chidbhavananda 1970). Stated differently, the ego, mind and intellect enable knowledge, while the traditional sense organs of eye, ear, nose, skin and tongue enable perception.

Distinction between the two selves

There are two selves. The Self as being and the Self as the means of knowledge. Proof for the existence of the two selves is in the three states of consciousness. These are the states of Waking, Dreaming and Deep Sleep or Dreamless Sleep. These three states are termed *Tripura* (three cities). The self as 'being' is present in all the three states. The evidence offered is that a sense of continuity of oneself upon awakening from deep sleep. The self as the means of knowledge i.e. the Ego or *Ahamkara* is present only during Waking and Dreaming but absent during Dreamless Sleep (Swami Ramanananda Saraswathi 1962).

Brain bases of the difference

The Brain bases of these three states are also different. Waking is accompanied by global, coherent activation of Thalamocortical Systems. The brain stem reticular activating system, as well as the glutamatergic, noradrenergic, cholinergic, GABAergic neurotransmitter neurons are active. These project in a parallel widespread manner to the Hippocampus and the Neocortex. They provide a state-dependent rhythmic input which activates the cortex. It promotes activity within the Gamma and Theta frequencies, providing a temporal organisation for coherent discharge in spatially distributed, yet functionally linked cortical neurons. The rich variety of waking experience and consciousness ensues. The REM sleep or the Dreaming State has active glutamatergic and cholinergic neurons. Noradrenergic neurons are off. The brain state changes. Sensory transmission and motor output are blocked. Prefrontal cortical regions are relatively inactive. The sensory-motor, association and memory circuits within the thalamocortical and limbic systems are active. Therefore there is no input into the system or output from it. The prefrontal cortex being inactive, episodic and working memories which could have catalogued the ongoing events also do not occur. Global activation during dreaming provides a replay of waking material from recent and long term memory stores. This provides a process for formation and consolidation of old and new associations.

The dreamless state or slow-wave sleep is characterised by the attenuation of both the brain stem reticular activating system and the thalamus. However the brain is not inactive or totally unresponsive. There is activation in limited primary and secondary sensory regions of the cerebral cortex giving rise to limited imagery and thought processes. These are less organised and less vivid and have less emotional content than in the dreams of the REM sleep (Jones 1998).

The dream and dreamless stages of sleep have been studied using Positron Emission Tomography. Relative changes in blood flow to the different regions of the brain are tracked to find the regions of the brain which are active or inactive during particular brain states. This is possible in the normal brain. Dreamless sleep is characterised by deactivations or decreases in the pons and mesencephalon, cerebellum, thalami, basal ganglia, basal forebrain/hypothalamus, prefrontal cortex, anterior cingulate cortex, precuneus and in the mesial aspect of the temporal lobes. Dreaming or REM sleep is characterised by activations present in the pons, thalami, the limbic areas of amygdala, hippocampus, anterior cingulate, and the posterior cortices of the temporo-occipital cortices. The dorsolateral prefrontal cortex, parietal cortex, and the posterior cingulate cortex, as well as the precuneus are significantly deactivated (Maquet 2000).

Differences in brain activity between waking, dreaming, and dreamless sleep signify the rain bases of the three states of consciousness. The Self as being pervades these three states. The brain bases of Self or Ego as a means for knowledge would be described in the following account. Henceforth the term Self would refer to the Ego or *Ahamkara*.

Need for the self

Self is omnipresent in our experiences. It is present in the perception of the external environment by the senses, internal sensations arising from the body, memories, feelings, thought manipulations which lead to understanding, and in speech. This ubiquitous presence of the self suggests that it serves an important function. The self being an attribute of the body and the mind/ psyche, the function that it serves would be psychobiological. The need for self as an attribute of the body is easily appreciated. The physical world in which our body exists has spatial coordinates such as up–down, and right–left in which the body has to move. Therefore the body, to navigate in a spatially complex environment among other objects and people, requires a referent. The individual's body becomes a referent for space. Spatial divisions are understood with reference to one's own body as the referent.

The body would have sufficed and a separate tag of "self" would not have been necessary but for the need to represent the body in the mind. A Self may not have been necessary if there had not been one more dimension to the physical world, that is time or the temporal dimension. The external physical world changes in space and time. The spatio temporal changes have to be perceived by the sense organs, abstracted or encoded and consolidated by the mind and responded to by the motor systems. A common referent is required for coordination among these three systems which appears to be the self.

Utility of the self

The mind exists as a continuity, as a "stream of consciousness". Experiences of the body are divided by time and space because of the constraints of the physical world. Experiences of the body represented in the mind, manipulated by the mind as well as influenced by the mind seem a continuous flow throughout our waking period. The continuity is maintained because of Self as the common referent to spatial and temporal divisions.

Nature of the mind

Mind is not a monolith or an entity, but an active process which is being constantly constructed. The mind enables an existence connected to, yet outside of the physical world. The ongoing sensory experiences occur as spatio temporal events. These events occur in ensembles again connected by space or time. The learning of these associations or connections between events and their storage are essential for giving continuity to experience.

Sensory experiences and memories are the chief *contents* of the mind. The contents of the mind are constantly changing and are being manipulated upon. The contents are manipulated or acted upon by the Tools of the mind. The tools are mechanisms by which the contents are chosen, altered, embellished, anticipated, learnt, stored or acted upon. Attention and Motivation choose the contents; emotions embellish the contents; planning anticipates the contents; working memory and organisational strategies influence how the contents are learnt and stored. Action plans determine how the current contents are acted upon to obtain new contents. The tools can be classified into those that are necessary for acquiring information from the environment, necessary for associating and storing the information, and functions for manipulating the information to form newer combinations.

Mechanisms to acquire information

The process of sensation, perception and attention are the means of acquiring information from the environment. Modality specific sensory cortices mediate the process of analysing the basic features of the physical stimulus. The sensory association cortices, together with the posterior polymodal cortices mediate the process of perception. Perception is a cascading process wherein the elementary features of the stimulus are built up to a complex percept through several levels of computations extending from the primary sensory cortex to the polymodal association cortices. The elementary features of the stimulus can have spatial and temporal divisions.

Attention amplifies the processing mediating perception through a mechanism known as re-entrant processing. The posterior attention networks mediate in sensory perception. These networks are located in the parietal areas for visuo-spatial attention and in the temporal lobes for auditory attention. The anterior attention system located in the anterior cingulate and the prefrontal areas mediate sustenance, focussing and division of attention; as well as attention for action.

Mechanisms to store information

The information acquired is grouped and linked to chunk it into smaller bits. The process of grouping and linking is an essential process to manage information, termed as the process of association. Association can be between elements separated by space, by time or by both. The information so associated and grouped is consolidated by transferring it to long-term memory. The hippocampus and the associated structures of the limbic system such as the parahippocampal gyrus are essential for association and consolidation. Items which have entered the long term memory are stored as patterns of reverberating neuronal circuits (Hebbian model) and as changes in the proteins in the nerve cells. The storage occurs widely in the heteromodal association cortices.

Mechanisms to manipulate information

The information acquired is modified by what is stored. That which is stored is in turn modified by what is acquired. This interplay between acquisition and storage requires mechanisms known broadly as executive functions. Working memory or the capacity to store and manipulate information on line, fluency or the capacity to generate new concepts, planning or the capacity to look ahead, response inhibition wherein highly practised or prepotent responses are inhibited, set shifting or the capacity to shift from one mental set to another, error detection, self monitoring, organisation and formation of strategies, and abstraction, are executive functions. As the name suggests these functions are involved in goal-directed behaviour. Executive functions are the tools of the mind and are mediated by the prefrontal areas. The basal ganglia and the cerebellum also have a role in their mediation (Joseph 1996).

Working memory can store temporarily incoming information, combine different parts of the incoming information, and combine the incoming information with that recalled from long-term memory (Baddeley 1986). Thus working memory brings the past into the present, also termed as the "remembered present". Further it stores perceptual/mnemonic contingencies for a brief period to enable the preparation of action plans. Specialised cells are present in the prefrontal cortex of the monkey which fire during this delay period (Fuster 2000). The manner of grouping information through associations is based on spatial and temporal contiguities. Organisational strategies influence associations and groupings, thereby improving the storage and recall. Accuracy of recall and acquisition is controlled by self monitoring and error detection. Lack of these lead to confabulation.

Initiation of motor acts is mediated by the anterior cingulate and supplementary motor areas. Inhibition of prepotent motor acts or highly practised responses are mediated by the orbitofrontal cortex. Initiation of new responses and inhibition of highly practised responses form the building locks of volitional processes or will. The ability to shift from one mental set to another, be it a perceptual, conceptual or motor set is another aspect of the volitional process which is mediated by the dorsolateral prefrontal cortex. Intentionality requires the maintenance of a motor plan or motor memory to subserve an action plan. This is the short-term attentive set which anticipates a motor response and prepares for it. It is also called as "memory for the future" or "look forward in time". The attention set and working memory are the means to manage "Cross Temporal Contingencies", a process wherein present action is dependent on a past contingency, i.e. working memory. Future action is determined by the present contingency i.e. attention set. Thereby a seamless integration takes place between the past, present and the future (Fuster 2000).

The energy and direction for behaviour come from motives, habits and emotions. Biological motives such as hunger and thirst mediated by the subcortical structures drive behaviour. Habits, be they motor patterns, mood states, or thoughts give direction to behaviour. Subcortical structures in the basal ganglia, the cortical premotor and prefrontal areas mediate habitual motor patterns and thoughts. The right hemisphere mediates mood states. Emotions which can suddenly initiate behaviour have both cortical and subcortical centres. The hypothalamus in the subcortex is the highest centre for autonomic activations. The amygdala in the limbic system and the orbitofrontal cortex are the cortical centres for emotional processing.

The different centres which mediate the different functions detailed above do not function in isolation. There are two-way cortico-cortical connections, both intra-hemispheric and inter-hemispheric; as well as cortico-subcortical connections which modulate the functioning of any area through activities arising elsewhere. The influences can be inhibitory or excitatory.

Fragmentation and reconstitution of information

The brain has specialised processors in the form of areas and networks for the multitude of psychological processes. Information is processed in its constituent elements in the appropriate centres for sensory perception and rebuilt into a composite whole using the tools of executive functions and stored as memories. Information processing proceeds by this ongoing fragmentation into constituent elements and rebuilding of the composite whole.

The chief divisors for fragmentation are those of space and time. Sensations and memories which are the contents of mind are subject to this space–time divisions. Space–time divisions seem essential for dividing the enormous amount of information impinging on the brain into manageable levels. Division into spatial and temporal elements would necessarily require a recombination into spatio-temporal wholes.

Centres for spatial processing

The centres for spatial processing extend from the posterior to the anterior cortex.Visual spatial stimuli are processed in the occipital, parietal and temporal cortices. The "where" pathway which encodes location of the stimuli extends from the occipital cortex to the parietal cortex on the dorsolateral surface (Mishkin and Ungerleider 1982). The parietal cortex computes figure–ground relationships as well as other bases for complex visuo spatial perception. The Parietal cortex is connected to the hippocampus and feeds spatial information to the hippocampus. The hippocampus constructs a spatial map of the environment. The parieto-hippocampal system mediates the construction of the spatial map (Kandel *et al* 2000). Short-term memory for location information as well as manipulation of this information is mediated by the visual working memory located in the right prefrontal and parietal cortices (Fuster 1997). Damage to the hippocampus disturbs maze learning in rats. The right hippocampal damage in humans leads to poor learning and consolidation of visual material (Milner 1971). Right hippocampus damage also leads to deficits in the transpositions between egocentric and allocentric space. Right dorsolateral prefrontal deficits are associated with disturbances in working memory for locations (Jonides *et al* 1993).

The essential nature of spatial processing is that spatial coordinates are snapshots in instants of time. It follows that the spatial dimension is independent of the temporal dimension. In right-handed individuals the right hemisphere or non-dominant hemisphere specialises for time-independent processes. Allocation of spatial attention, construction of spatial maps, visual spatial perception and construction, and processing of emotions, all of which require simultaneous or time-independent processing, seem to be lateralised to the right hemisphere.

Centres for temporal processing

The temporal dimension unfolds across successive points and is not instantaneous. The major function which requires passage of time to unfold itself is language. Spoken, written or aurally comprehended speech unfolds over time. Language is mediated largely by the left hemisphere. The left hemisphere has been termed the time-dependent processor.

The prefrontal cortex and the cerebellum are important centres for the processing of time. The cerebellum computes divisions of time in the milliseconds to seconds range. The prefrontal areas compute divisions of time in the seconds range (Mangels *et al*

1998). The prefrontal areas which specialise for working memory mediate in temporal processing. The central executive of the working memory system integrates information which is currently available with items from long-term memory. Working memory therefore integrates the present with the past in a smooth flow termed as the "remembered present" (Fuster 2000). Planning functions and prospective memory are again mediated by the dorsolateral prefrontal cortex (Joseph 1996). Planning function elaborates on the present to set goals for the future. Prospective memory or the memory for future goals helps to enact the plans. This combination of the present with prospective memory extends the present into the future or telescopes the future into the present. The ability to implement future plans through motor responses is mediated by the attention set. It is a short-term attention set which anticipates a motor response and prepares for it. This is also called "look forward in time" or memory for the future (Fuster 2000). Integration of information occurs across the three dimensions of time, i.e. past, present and the future. This is predominantly achieved by the dorsolateral prefrontal cortex with contribution by the basal ganglia and the cerebellum. The point to note is that separate brain areas process spatial and temporal dimensions of information.

Interconnections between centres for temporal and spatial processing

Anatomical interconnections between brain areas support interaction between these two dimensions. The hippocampus wherein spatial maps of the environment are constructed is connected to the dorsolateral prefrontal cortex, wherein the temporal integration takes place. The connection is through the medial prefrontal cortex. The dorsolateral prefrontal cortex is indirectly linked to the limbic regions of the parahippocampal gyrus through connections with the anterior and posterior cingulate regions. There are also sparse but direct connections between the dorsolateral prefrontal cortex and the limbic regions of the entorhinal cortex, subiculum and hippocampus. The functional significance of these direct and indirect connections is hypothesized to be maintaining contextual information on a moment-by-moment basis. At the level of the local areas, interdigitation is present between the prefrontal and parietal neurons. Axon terminals from labelled neurons in the lateral prefrontal and the posterior parietal heteromodal regions converge in fifteen different cortical regions of the primate brain. There is interdigitation of inputs from the prefrontal and posterior parietal regions (Kaufer and Lewis 1999).

The prefrontal cortex which is the centre for processing the temporal dimension and the parietal cortex which is the centre for processing the spatial dimension are thus interconnected at the wide area network and local area network levels. The two areas are connected through long fibres enabling mutual transfer of information. This in turn translates as spatio-temporal integration of ongoing experience. The modular interdigitation from the parietal areas specialised for spatial encoding and the prefrontal areas specialised for temporal encoding suggest that even at the level of local area networking, spatio temporal integration occurs.

Candidates for the brain basis for self

The brain constructs the mind through its interactions with the environment. Distinct areas of the brain mediate the contents of the mind (perception and memories), tools of the mind (attention, executive functions), and energisers of the behaviour (motives, habits and emotions). The brain basis of Self is however elusive. The sense of Self is present whenever the cortical networks are active as in waking and dreaming. It is absent when the cortical networks are disengaged from the subcortical arousal systems as in dreamless sleep.

The verbal interpreter in the left hemisphere is a possible candidate for the Self. The ongoing experience is transmitted to the left hemisphere where language areas are located. The language areas give a verbal narration of the experience whether cognitive or emotional. There is a constant running narrative of our actions, emotions, thoughts and dreams. "It is the glue that keeps our story unified and creates our sense of being an unified, rational agent. It brings to our bag of individual instincts the illusion that we are something other than what we are," The self is inherent to this verbal interpretation and not outside of it. Self is the by-product of inserting an interpreter into a functioning brain. Self is the answer to the question posed by the interpreter as to who is posing the questions (Gazzaniga 1998). The limitation of the theory is that it restricts Self to language. Aphasic patients who have language impairment do not suffer from deranged or loss of selfhood. The self seems to reside in as well as out of the domain of language.

Another theory localises the self to the confluence regions of the heteromodal association cortex. The process of binding the internal and external experiences together with the intentional and motoric processes is hypothesised to be its location. The anatomical basis of this identification is described as follows: The cingulofrontal (networks between prefrontal and cingulate cortices) and parieto temporal (networks between parietal and temporal cortices) bind the internal features of self with the external features of self. The purpose is to utilise the different motor and cognitive systems to implement the intentions of self. The confluence regions are critical for decision making in relation to the internal/external and motivational parameters of mental activity for processing self-significant information. Another brain area closely associated with the sense of self is the right hemisphere. The awareness and image of self, and the relation of self, visuospatially and psychologically, to the environment are altered by lesions to the right hemisphere (Vogt and Devinsky 2000).

A close examination of the above hypotheses show that the self is resident or associated with each of these and is present outside of each of these processes. The very existence of three different hypotheses localising the Self to different centres in the brain using three different processes upholds this statement. The self is unified by language-based interpretation, it resides in physical awareness, and in intentional motor plans for internal/external environmental contingencies. Where then is the Self?

Elusive self caught in the spatio-temporal net

The answer to the question, "where is the Self in the Brain?", may be examined by asking a counter question "when is the Self absent?"

1. The first candidate is Dreamless Sleep, which is not associated with the Self or 'I' thought, as there is no recollection of the 'I' thought during dreamless sleep.
2. The second process, wherein the self is absent, is during sudden and intense emotion, be it positive or negative. Emotion is a sudden and unexpected energisation of behaviour. The terms – fit of rage, seized by fright, ecstasy of joy – suggest the suddenness and intensity of the experience. The moment of emotion is defined by the present. There is no past or future to it. The moment or moments of intense emotion are not accompanied by a sense of Self. Recollection of the emotion is accompanied by Self.
3. Self is absent during intense sensation such as intense pain or ecstatic pleasure.

The above three processes have one thing in common. The mind is not being constructed as thoughts are absent. Further, these processes are involuntary.

There is yet another process which is voluntary during which the Self is absent. This is the process of *Samadhi*. *Samadhi* is a state of mental quietitude wherein the mind is quiet as there is absence of thoughts. The mind is systematically dismantled by stopping the thought processes. The *Upadesa saram* describes this state of lack of thought as associated with the loss of Self or the absence of the "I-I" thought. There is dissolution of the Self as Ego or *Ahamkara*. The perfect stillness of mind (*Manolaya*) or destruction of the mind (*Manonasa*) is achieved by absence of thoughts which in turn is associated with a loss of Selfhood (Natarajan 1984). In fact, moments of intense sensations and intense emotions described previously do not have thoughts. The absence of Self herein is termed as "*Sahaja Samadhi*" in *Tripura Rahasya* (Swami Sri Ramananda Saraswathi 1962). Sahaja Samadhi is fleeting, while practised Samadhi lasts for a longer time.

The essence of the evidence is that self is present wherever thoughts are present. Thoughts are a loose term for the contents and tools of the mind described previously. Therefore wherever and whenever the tools of the mind are constructing or manipulating the contents leading to thoughts, Self is present. It was seen earlier that the construction of the mind, i.e. the contents being acquired and manipulated upon by the tools (i.e.

formation of thoughts) require divisions into space and time, as well as integration of space and time. It was also seen that the Self is present when thoughts are present and Self is absent when thoughts are absent. Thoughts are dependent on divisions of time and space as well integration of time and space. Therefore Self which is closely associated with thoughts appears to manifest when space–time divisions and space–time integrations are made. The self resides in the space–time net.

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Neural plasticity and Yoga

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Abstract

Neural plasticity is a general term referring to the ability of neurons to alter their structure and functions, in response to internal and external stimuli. The process is life-long, though differences occur with the phase of development (i.e., infancy, childhood, adulthood). Yoga is an ancient Indian science and way of life, which has been described, in traditional texts as a systematic method of mind control. Current scientific research has not shown structural changes in the brain related to yoga. However, present research suggests that yoga practice modulates brain functioning in different ways and at different levels. Electrophysiological studies of the electroencephalogram (EEG) and evoked potentials have shown that experienced yoga practitioners differ from novices to yoga, in their activity pattern. More recently, changes in neural function during yoga practice have been demonstrated by using positron emission tomography (PET) and functional magnetic resonance imaging (fMRI). These studies have demonstrated characteristic changes in brain function during the practice compared to a 'control' state. Apart from these

direct measurements of brain activity, differences between yoga and non-yoga practitioners can be inferred based on their performance in tests for perception, memory, responses to laboratory stressors, and other functions. These effects of yoga practice may also explain certain benefits of yoga practice in the rehabilitation of persons with impaired physical or mental functioning. Hence when the inner experiences related to yoga practice are repeated over time, there appear to be definite changes in neural functioning which can be used to influence health, performance, rehabilitation, and possibly to bring about a conscious evolution of the personality.

Neural plasticity is a general term, referring to the ability of neurons to alter their structure and function in response to internal and external stimuli. This is a continuous, life-long process, though the magnitude of change possible is maximum during the critical period of development. In humans this period is the last trimester of intrauterine development and the first two years after birth.

Yoga is an ancient Indian science and way of life, which provides a systematic method of mind control. In the Bhagawad Gita it is said "*Samathvam yoga uchyathe*" (Yoga is Equilibrium) and the sage, Patanjali (approximately 300 B.C.) said "*Yogah citta vritti nirodhaha – Patanjali Yoga Sutra (PYS) I:2*" (through Yoga one can remove modifications of the mind). Hence it is evident that the practice of yoga works on, and through the mind. It was also said by Patanjali: "*Etena bhutendriyesu dharma laksanaavastha-parinama vyakhyatah – (PYS) III:13*" (these transformations of the mind are reflected in the quality, tendencies and behaviour-patterns at the structural as well as the functional levels of Man's being). Hence, with the background of these descriptions in ancient texts which suggest that considerable change does occur in brain structure and function following yoga practice, the present paper attempts to determine the evidence for change in brain structure and (or) function related to the practice of yoga.

Any review of scientific studies on yoga includes the earliest experiments on specific techniques at Kaivalyadhama, Maharashtra (Kuvalayananda 1925), followed by investigations of exceptional feats performed by yogis (Brosse 1946; Anand *et al* 1961a), and the relatively large number of studies on the effects of Transcendental Meditation, beginning with the epoch-making studies of Keith Wallace and others (Wallace 1970; Wallace *et al* 1971). Most of these studies describe 'state' or 'acute' effects of yoga practice and involve assessments made before, during, and after a session of yoga practice. In order to understand the long-term impact of practising yoga on neural plasticity, two approaches are followed. These are: (i) comparing long-term practitioners with those who have no experience of yoga, and (ii) following up yoga practitioners longitudinally, from having 'no experience' of yoga, till they have practised yoga for a period of time. Both approaches have their own advantages and drawbacks, which will be described below.

In the first approach (i.e., comparing long-term practitioners with those who are novices to yoga), many of the early studies investigated extraordinary abilities and feats of experienced yogis.

For example, some studies investigated abilities of yogis to alter their metabolism at will, so that the yogi could stay in an airtight chamber even after a lit candle went out, apparently due to lack of oxygen (Anand *et al* 1961b). Other studies investigated unusual examples of voluntary control over 'involuntary' functions, such as the heartbeat (Anand and Chhina 1961; Kothari *et al* 1973) or the surface temperature (Benson *et al* 1982).

A more specific neurophysiological study, showed that in four experienced meditators and in two other yogis, whose pain threshold was elevated believed to be related to their practice of yoga, there was an absence of desynchronization of the electroencephalogram (EEG) even when the subjects were practising meditation (Anand *et al* 1961b). These results suggest that experienced meditators are able to 'shut out' external stimuli at will.

The main drawback of making inferences based on the studies cited above, is that all the subjects were experienced yoga practitioners, who were spending a significant amount of time in their practice and were also otherwise leading lives of austerity and seclusion. For example, subjects who were able to alter their surface temperature at will, were monks practising Tibetan Buddhist Meditation and living at the foothills of the Himalayas (Benson *et al* 1982). In all these cases the unusual lifestyle of the subjects might itself have caused changes in brain structure and function, without taking into account the effect of yoga practice. This drawback is in part overcome by studying practitioners of Transcendental Meditation, who live an ordinary lifestyle.

On the whole, the most characteristic electrophysiological change in long-term practitioners of Transcendental Meditation, is an increase in EEG coherence. Coherence is a mathematical quantity which measures the 'sameness' of the phases of the EEG within a specified frequency band, at different locations on the scalp (e.g., the frontal and occipital regions, or over the left and right hemispheres). In general, long-term meditators show an increase in the coherence within alpha and theta bands over symmetrical sites on the left and right side of the scalp (Banquet 1973). This suggests an increase in the long-range orderliness of the brain.

However, even these studies on TM practitioners versus non-practitioners have a serious drawback in that subjects of both groups are influenced by a wide range of factors (including meditation), which could influence neural plasticity. To some extent, these intra-individual differences can be taken care of by longitudinally monitoring subjects before and after their initiation to yoga. Even observations in such cases are liable to be 'contaminated' by other life events and the normal process of aging and development. There is also no ideal control for such a study.

Most studies of longitudinal follow-up of subjects after learning yoga have demonstrated changes in prowess in performing certain tasks of perception and motor skills. For example, it has been shown that the practice of yoga improves performance in various tasks for motor skills (Pelletier 1974; Telles *et al* 1993; Manjunath and Telles 1999; Dash and Telles 1999, 2001), visual perception (Brown *et al* 1984; Ramana Vani *et al* 1997; Telles *et al* 1997), spatial memory (Naveen *et al* 1997), and in specific tasks for planning (Manjunath and Telles 2001). The latter was especially interesting, since a positron emission tomography (PET) study (Herzog *et al* 1990–91), as well as a more recent functional magnetic resonance imaging (fMRI) study done by us (Khushu *et al* 2000), demonstrated an increase in frontal blood flow during meditation. Since planning is a function of the pre-frontal region, it may be inferred that meditation practice over a period of time may facilitate pre-frontal function. A single electrophysiological study of middle latency auditory evoked potentials (EP) demonstrated that 18 months of yoga breathing (pranayama) practice, brought about changes in the neural pathway at the baseline, with better function (evidenced by reduced latency of the corresponding EP component) at mesencephalic–diencephalic levels (Telles *et al* 1992).

Hence in summary, there is some scientific evidence of changes in the brain with yoga. These changes include increase in prowess to perform skilled motor tasks, better perceptual sensitivity, improved performance in 'higher brain functions' such as memory or planning, and in special cases, ability to regulate involuntary functions voluntarily. Some of the studies also suggested changes at specific levels, for example the pre-frontal cortex and the mesencephalic–diencephalic region.

In addition to these studies which have demonstrated changes in (the brains of) persons practising yoga, it has also been shown that practising meditation may create a change in the 'consciousness field', so that persons at a distance are seemingly inexplicably influenced by it (Orme-Johnson *et al* 1982). Hence there is evidence for considerable change in the brain with yoga practice. Finally it is interesting to note that our preliminary studies have demonstrated that this possibility for change persists through different phases of life, from intrauterine development (Narendran 1991), through childhood (Naveen *et al* 1997; Telles *et al* 1992), adulthood (Ramana Vani *et al* 1997; Manjunath and Telles 2001), and even for the promotion of positive mental health in a geriatric population (Manjunath and Telles 2000).

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Neuro-endocrinology and consciousness

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Abstract

The presentation comprises (a) a concise review of the current knowledge on neuro-biological substrate of consciousness, (b) neuro-endocrine correlates of different states of consciousness, (c) the subjective and objective correlates of 'Dhyana' practice in physiological and neuro-endocrine terms, and (d) a concluding conceptualisation. My presentation draws heavily from my own experience as a practitioner of 'Dhyana-sampradayas' for the last three decades.

Introduction

Grammatically 'Consciousness' is the noun form of the adjective 'Conscious' (The Oxford Dictionary of Current English (ed.) 1996) – meaning awake and aware of one's surroundings and identity. Even this elementary definition of consciousness brings to sharp focus the unresolvable *conundrum* of the subjective–objective dichotomy of life. Side-stepping the related semantics and polemics, I shall proceed with the simple, convenient, yet inescapable assumption that consciousness is overwhelmingly a subjective phenomenon and any attempt to study and understand it by methods and concepts of objective scientific inquiry can at best yield only partial success.

In this presentation, I shall briefly outline in general terms the available facts of the biology of consciousness under two broad categorisations: (a) the neuro-anatomical substrate of consciousness, and (b) its neuro-endocrinology. In the final part of this presentation, I shall dwell in some detail on the nature of some forms of consciousness including the transcending and transforming mystical states. These are experienced and documented by religious prophets, seers, gifted artists and poets of trans-cultural appeal as well as scientists with an over-arching intuitive perception of truth. Even the common garden variety of ordinary mortals like me, on rare occasions, transiently stumbles on similar overwhelming and expanded forms of consciousness.

The Neuro-anatomical substrate of consciousness

During the past decade, which was declared the decade of the brain, there has been a snowballing scientific excitement about consciousness and its neurological correlates. Technological innovations like PET and functional NMR imaging (De Certaines *et al* 1992), which made it possible to image the functional anatomy of the human brain, have played a pivotal role in the genesis of this excitement. Today we map with great precision the metabolically active and inactive regions of the brain in various states of consciousness (Belliveau *et al* 1991), like sleep, wakefulness, dreaming as well as different affective and behavioral states. Moreover, we can now map the area of the brain involved actively in diverse specialised functions of heightened conscious states such as intellectual activity and aesthetic pursuits.

Curiously, the above developments have thrown up as many questions about the functioning of the brain as they have helped to answer! For example, such imaging studies have shown that not only movements of, say, for example, of the thumb, but also the mere *'thought'* of it, 'light up' the cortical part of the brain that represents it, indicating increased blood supply and metabolic activity in the area. While in the first case, we can rationalise and understand that afferent impulses from the moving thumb may have caused the concomitant circulatory and metabolic perturbations in the representative cortical area, it remains to be explained how the mere 'thought' of moving the thumb brings about the same change, and also which part of the neuro-axis is responsible for the mysterious *volition and initiation* of this phenomenon!

Addressing such enigmatic questions posed by state-of-art neurobiology is central to the understanding of consciousness because it involves, in the ultimate analysis, solving so 'subjective' a riddle as 'volition'. Volition, quintessentially, is an act of consciousness and Free Will! Implicit in the idea of free and willing consciousness is the notion of *'self'*, the *'me'* – the sensing, feeling, moving *'me'* – the sum and substance of our individual existence – the *consciousness* that is *'me'* – the *Jeevatma* that is me. Here we have already reached the *conundrum* I referred to …! but more of it later.

I learned as a medical student that the various sensory and motor tracts that course up and down the spinal cord and brain stem to reach into and out of our cortical Homunculus, send innumerable collaterals into the central core of grey matter. This mass of grey matter comprises billions of intricately interconnected neurons, extending all along the neuro-axis. They communicate to and from within our neo-cortex through reverberating bio-electric circuitry of unimaginable complexity and this may be the anatomical substrate of our conscious mind. This evocative concept was very appealing to my imagination then and is so even today.

The neuro-anatomist tells us today that there are several structures belonging to this long stretch of grey substance which, in consonance with the neo-cortex and thalamus, are involved in the elaboration of consciousness (Steriade *et al* 1990; Singer 1998; Steriade 2000). Such structures include the reticular formation of the brain stem and the important sub-cortical aggregations of neurons like the thalamus, the striatum, amygdala, the hippocampus and other parts of the *limbic brain*. They are linked interactively to the phylogenetically recent and more massive body of nerve cells organised on the surface of the brain called the neo-cortex. These two large bodies of nerve cells involving an estimated 100 billion neurons and their intricate bio-electric interconnections through several trillions of synapses, harbour the mystery of our consciousness; the consciousness that perceives, emotes and acts out *Life* in our mortal coil.

Neuro-endocrinology and consciousness

As an undergraduate I was taught that the physical paradigm of brain activity is electrical impulse formation and transmission along the axo-dendritic circuitry to integrate spatially and temporarily discrete events in the nervous system. Over the course of the last four decades there has been a change in the conceptualisation of brain activity. Today the brain can be considered as a huge multi-humoral organ that self-generates and self-integrates throughout life with the mediation of an incredibly large number of chemical signals. These chemical signals and related excitation, inhibition or modulation, maturation, organelle formation, and even proliferation of nerve cells happen along and across membrane-bound subcellular and transcelluar compartments, tunnels and roadways (Ingber 1998). The building materials used to fabricate these nano-structures are bio-molecules of varying size, composition and structure held together by the so-called weak interactions or by dynamic states of equilibrated reactions between mechano-molecules. The chemical bases of the electrical fluxes and action potentials unique to the nervous tissue are ionic fluxes incidental to the complexly interacting macromolecular medley along and neuronal membranes.

Highly specific 'configurational' and 'equilibria' shifts can be engendered in the subcellular and transcellular molecular flux that is neural activity, by a large number of evolutionarily fashioned regulatory molecules, elaborated by cells of neuro-ectodermal derivation, and delivered discreetly or diffusely on predetermined loci of neurons in the brain. Such evolutionarily fashioned regulatory molecules acting on the brain, I believe, can be called neuro-hormones.

Neuro-hormones and their complex system of heterogenous receptors play a pivotal role in the anatomical growth and development, functional maturation, electrical activation, and bio-energisation of the brain. They also fashion the myriads of oscillating neurocircuitry, which are the neurostructural correlates of behaviour (Fluckiger *et al* 1985; Harris-Warrick *et al* 1991; Marder *et al* 1996; Marder 1998). I shall illustrate these with some examples.

Thyroxine, an iodothyronine chemically fashioned in the primordial sea, acts in concert with its complex receptor system as well as the enzymes that regulate its activation *in situ*, and plays a pivotal role in the growth and maturation of the human brain early in life (Marcos *et al* 1985; Kochupillai and Ramalingaswami 1986). Its deficiency or defective action results in stunted dendritic elaboration, dysregulated programming of cell death, defective myelination and deficient expression of adrenergic receptors in the developing brain (Smith *et al* 1985). The result is a meek and retarded individual with constricted awareness and compromised content of consciousness with poorly energised mind, flatness of affect, deficient drive and depressive frame of mind (Querido 1986).

The female steroidal hormone estrogen, in concert with the neuro-peptide oxytocin sculpts the feminine consciousness by acting on specialised receptor systems for the respective hormones that get expressed on appropriately interacting neuronal pools situated in the prefrontal, olfactory and limbic cortex as well as sub-cortical nuclei such as nuclei acumbans to elaborate the joyous and selfless love of mothering (Carter *et al* 1992; Carter and Getz 1993; Gimpil and Fahrenhdz 2001)! In lower mammals like rodents, oxytocin, along with estrogen, elaborates behavioural traits like pair-bonding, monogamy, parental care and other affiliative behaviour, which are perhaps phylogenetic fore-runners of established human behavioural traits that form the basis of family life and related life-affirming social impulses of *Homo-Sapiens-Sapiens*. There is emerging evidence pointing to the role of prolactin – a peptide hormone secreted by the pituitary gland – in the elaboration of positive emotions like love as well as transcendental states of consciousness. Interestingly, an important neuro-anatomical substrate involved in such life-affirming behavioral traits among lower animals is the mesolimbic dopaminergic reward areas. In this context, it is pertinent to quote a recent report related to autism, a congenital human behavioural defect characterised by poor or absent social skills due to abnormalities in oxytocin and arginine vasopressin activity related to elaboration of neuronal circuitry relevant to social behaviour (Frith *et al* 1991, 1993; Gimpil and Fahrenhdz 2001).

A pivotal neuro-endocrine system that has been recognised as being important in the elaboration of consciousness is that of aminergic neurons. A technical breakthrough made it possible to map intra-neuronal bioamines in the sixties. Studies using this technique revealed that such neurons, mainly situated in the brain stem, send extensively branching terminals to most sub-cortical regions relevant in the elaboration of conscious states and complex motivated behaviour (Austin 1999). Aminergic neurons, a total estimated one million in number, spread out to an average of 500,000 nerve terminals per neuron to reach out and exert their influence on billions of neurons in sub-cortical and cortical structures. These are perhaps the most important neuro-endocrine structures relevant to the elaboration of human consciousness.

There are three major bio-amines of neuro-biological importance – dopamine, nor-epinephrine and serotonin. The dopaminergic system of aminergic neurons have two major components, the dorsal (caudate and putamen) and the ventral (the ventral legmentum). The ventral system send most of its afferent fibres to the nucleus accumbans and the perfrontal and cingulate regions – all important structures involved in the elaboration of conscious attention, quick activation of complex and patterned motor activity and goal-directed behaviour. Animals with activated dopaminergic pathways are extroverted, energised and aggressive. In man, drug-induced stimulation of the dopaminergic system makes individuals optimistic, energetic, aggressive and extroverted with an overpowering sense of "feeling good". However, most such drugs are addictive and their action is transient.

The noradrenergic (NE) and serotoninergic systems also project to important sub-cortical and cortical regions relevant in the elaboration of conscious states (Austin 1999). The two major collections of NE neurons are (1) in the locus cerulius and (2) central paragiganto cellular nucleus of medulla. (To this important part we shall return presently.) The NE system is also involved in the elaboration of visuo-motor and spatial reflexes and data processing. They also mediate 'pain'-related behavioural states, besides subserving vital instinctive functions of major survival value, for example, cardio-respiratory regulation. The serotonin system, mainly centred in the Raphe nuclei of the brain stem, influences, through its aminergic projection, such important structures relevant to conscious behaviour as the thalamus, septal region, the CA cells of the hippocampus, the frontal lobe, as well as the lower brain stem. It plays an important role in visual perception, association and interpretation and is also involved in the elaboration of rapid eye movement (REM) sleep, social behaviour, as well as psychic response to pain and stress.

Thus the complex and extensively branching aminergic neuro-endocrine systems play cardinal roles in the elaboration of the phenomenon of consciousness in all its varied and complex manifestation.

There is an incredibly large number of neuropeptides (Harris-Warrick and Marder 1991) involved in modulating and fine-tuning neural activities in different regions of the brain, relevant to the phenomena of consciousness. For example, the peptide cholecystokinin (CCK) can be immuno-chemically demonstrated all over the neo-cortex as well as in several sub-cortical neuronal structures. It is supposed to play an excitatory neuro-modulatory role in concert with other neuro-transmitters like dopamine, acetylcholine etc. in the elaboration of neural activity relevant to conscious states (Austin 1999). The number of other such neuro-active peptides in the brain is too large to permit inclusion in the present paper.

Biological correlates of *Dhyana*

The transcending direct awareness that impelled Adi Shankara to proclaim – *Brahma Satyam, Jaged Midya, Jeevo Brahmairhinaparah!* was perhaps an eruptive expansion of consciousness.... An experience so overpowering in its visual clarity and so compelling as an emotive experience of *"Truth that is Beauty"* that he revived and recreated the revelatory experience in the sublime poetry of 'Soundaryalahari' using mystical mind-body imagery and metaphor.

Transcending poesy transports mortal beings to immortal experience! The American poet A E Houseman describes several bodily experiences that such poetry evokes in him. As a clinical endocrinologist, I would characterise those bodily experience as essentially neuro-endocrine. The poetry-induced mind-body experience described by Houseman is not unique to him. Anyone who shared the riveting experience of aesthetic beauty with gifted poets would bear out the truth in Houseman's description. Many Sanskrit words used in my mother tongue Malayalam accurately describe them. Words like *Anandashru, Romancham, Gadgadam, Nirvrithi* etc. accurately describe those psycho-physical experiences.

Every bodily experience, sensory or motor, have neuro-anatomical localisation. Most of the physical experiences described by Houseman can be referred to neural activity at the level of the brain stem. However, the accompanying psychic experience of a sense of "joyous liberation" has its origin at a higher level, perhaps involving complex circuitry linking several cortical and sub-cortical structures. Also, perhaps, it is the neural influence originating from these areas that funnel down to the brain stem nuclei to bring about the physical effects of the psychic experience described.

There are no human data obtained by modern imaging techniques to locate the neuro-anatomical substrate of the higher psychic experiences referred to above. However, there are reported meditative states which qualitatively reproduce similar experience. In a recent monograph on *Zen and the Brain* published by the MIT press (Austin 1999) the clinical neurologist James Austin categorises several graded stages of meditative depths and intensity. According to that grading, the above described psychic experience would fall under stages V, VI A, and VI B. As documented by Austin, these stages of meditative depth bring about a state of mental calm and peace, feeling of joy, all-encompassing love and happiness. They are always transient. In the higher stages, there can be a profoundly blissful sense of enchantment, rapture, and ecstasy associated with such changes in one nature as reinforced positive emotions. As one progresses further to higher states (VII, VIII, and IX) one's self awareness (bound self) tends to progressively decline and disappear, and a sense of detachment from cravings and aversions dominates;

there is progressive transformation of a quasi-permanent or permanent type in one's emotive nature with the enlightened awareness of awakened consciousness, characterized by selfless love and compassion (*a la* Mother Theresa), an inexpressible sense of joyous purity of being without any subject–object dichotomy – perhaps a state of transcendental communion with the *Universal Spirit*. Austin abstracted his concept of meditational staging from the Zen tradition.

Sage Pathanjali (2nd/3rd century BC) (Swami Vivekananda 1999) is the enunciator of the yoga tradition of meditative practice through his *Yogasutra*. According to Pathanjali, there are three broad meditative states: They are, in order of progressive attainment, (a) *Dhyana*, (b) *Dharana*, and (c) *Samadhi*. Through these progressive stages the *sadhaka* extinguishes *Chitta Vritti* or the *'activities'* of the conscious mind. What are the *Vrittis* of our mind? According to Pathanjali there are five types of *Vrittis*. They are (a) *Pramana*, (b) *Viparyaya*, (c) *Vikalpa*, (d) *Nidra*, and finally (e) *Smriti*. *Pramana Vrithi* has three subtypes namely: (i) *Prathyaksha*, i.e direct sensory awareness, (ii) *Anumana* i.e. inferential awareness, and (iii) *Agama* i.e. awareness of revealed knowledge. These three sub-types together account for the awareness content of our conscious mind. The second *Viparyaya Vritti* refers to the illusory content of our consciousness. The classic example in this regard is the serpent–rope paradigm. The third category *Vikalpa Vritti* refers to the delusions that infest our consciousness. The fourth category refers to the state of sleep. We all know sleep; but many of us do not recognize it as an activity of our conscious state. But, interestingly, it is recognized as an active state of consciousness by both Patanjali and modern science! And finally the fifth *Vritti* of *Smriti*, which is the memory traces that lurk around in our conscious mind. All the five *Vrittis* defined by Patanjali comprehensively cover the totality of the content of our conscious mind.

After defining the *Chitta Vrithis* which the *sadhaka* should try to eliminate, Pathanjali systematically dealt out his prescriptions to achieve the same. The prescription is a six-fold plan of action – collectively named *Tapas* – The steps of *Tapas* are: (a) *Yama*, (b) *Niyama*, (c) *Asana*, (d) *Pranayama*, (e) *Prathyahara*, and (f) *Samadhi*.

These six-fold psycho-physical and spiritual disciplines of *Tapas*, when practiced with *Shraddha*, will enable the *sadhaka* to experience the pure, transparent, and transcendent state of Consciousness. *Tapas*, Patanjali says, would cleanse our consciousness of all its *Vrittis*, which are the dust-haze of aeons and years of experiential assault (*prarabdha*) through phylogeny and ontogeny, responsible for our cloudy, murky, distorted consciousness filled with *Vritti* ....

........But, can we experience the pure, transcendent form of *Chitta*, the *Chitta* resplendent in Truth and Beauty; the "*Sat Chit Ananda*"? By following the prescription of Patanjali, I believe it is possible; may be for a few exceptional ones among us!

Of the six- fold practice prescribed by Patanjali, *Yama* and *Niyama* are well-known tenets of psycho-physical and spiritual disciplines prescribed for spiritual pursuit by most religions. *Asanas*, which are dynamic and static focussing and posturing of our mind and body are designed to promote elaborate, intricate and complete mind-body, awareness as enunicated in '*Hatha-yoga Pradeepika*' (Singh 1991). Interpreted in anatomical and physiological terms, these esoteric practices, turn out to be the most complete and comprehensive set of psycho-physical practices, scientifically designed to forge our mind and body into a mutually re-discovering, re-inforcing and re-invigorating experiential Gestalt. But the real practice that kindles our fire and enlighten our Conscious Being is *Pranayama*. The Sanskrit word *Prana* cannot be translated. To my mind it represents a comprehensive concept of an energising-integrating current that weaves life out of *Prakriti*. It is there in the air currents of our breath, as also in the flux of bio-electricity through the myriads of axons and dendrites of billions of nerve cells that energise and integrate our being. It is there in the energetics of the millions of equilibrated bio-chemical reactions integrated within and across cell barriers, tissues and organ systems to engender the marvellous phenomenon called 'Life'. The word *Pranayama* perhaps means the ebb and flow of this life-giving current. To me, it has been a matter of abiding curiosity to understand the meaning of *Pranayama*.

How can one reconcile the apparent incompatibility between the over-arching concept of *Prana* on the one hand and the mundane act of breathing and related exercise that the word *Pranayama* has come to represent in popular parlance on the other?

One can readily concede that breathing is an all important activity that sustain life: However, how can that fact, *per se*, give *Pranayama* the mystical power that it is supposed to bestow on its practitioner? While oxygen intake and CO_2 expulsion are central to the physiology of respiration, it is important to realise that there is another equally vital neuro-endocrine dimension to that physiology – the rhythmic respiratory drive that originates in the cardio-respiratory centre of the brain stem reticular formation. We have already learned the key role played by brain stem reticular formation and the related aminergic influence that emanates upward from it to impinge on all the important cortical and sub-cortical neural formations that form the anatomical substrate of man's conscious mind. These facts clearly establish a link between breathing and consciousness. I have already referred to the current knowledge that focusing awareness and attention (consciousness) on any bodily activity enhances blood supply and metabolic activity in the corresponding part of the brain that represents/controls that organ/activity. On the basis of these observations, it can be deduced that rhythmic breathing (and its variants) with full and focused awareness of the process (*Pranayama*) cannot but neuro-biologically influence the brain stem reticular formation and therefore *the whole brain activity gestalt* known as consciousness. In what manner *Pranayama* can influence consciousness is well-documented by sages and seers, poets and mystics from their personal experience. The various techniques used to effectively focus attention and awareness in the breathing process are also well documented in our tradition. The incredible psycho-spiritual transformations that long practice of *Pranayama* and *Dhyana* can engender in our being is celebrated in our cultural and religious lore.... in our music and in our poetry. The mystical Meera and her love songs of transcendence, the spiritually overpowering resonance of Andal's *Vellai Vilichank* (Padmanabhan 2000) the cerebrally compelling insights of Patanjali's *Yoga Sutra* (Swami Vivekananda 1999), the *Prema of Human Hridaya* in *Narada Bhakti Sutra* (Swami Sidhinathananda 1985) the spiritually intoxicating brew of Goswami Tulsi Das' *Ram Rasayan*, the transporting quality of Tyagaraja's *Swara-raga-sudha*, the soul stirring poesy of *Sufi Sants*, the "Whistling, love-stirring breeze" in the soul of St. John of the Cross (Kavanaugh and Rodriguez 1996) .... the list goes on and on through the history of human experience to vouch for the Transcending Truth revealed in mystically expanding Human Consciousness!!

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Genes and brain circuits

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Abstract

The success of the genome project in elucidating the order of 3050 million base pairs in human DNA is a remarkable event. It give us direct access to the entire set of specifications contained in our genetic material. In the following pages I argue that, in order to understand what genes have to do with brain and behaviour, the sequence of bases in the genome is important but not enough.

Introduction

In a seminar on consciousness and genetics one might begin by declaring one's metaphysical predilections. I am not going to say very much about consciousness and even less about metaphysics. I believe that consciousness is in the head both as a matter of fact and in a deeper scientific sense. Brain is the organ, which can transact information on a scale necessary for sentience and cognition, not heart or liver. So far as we know, living organisms are the only objects in the universe which contain an internal description of themselves. This description enables organisms to develop and evolve and, in general, exhibit properties which set them apart from inanimate objects. Knowledge of the genome sequence gives us direct access to the internal description of an organism. This is quite remarkable and makes one wonder what genomes have to say about brain and behaviour.

DNA does not directly determine the final properties of animals and plants, their phenotype. It does so through a host of other molecules, some large and complex, others simple. The organised ensemble of structures and activities at different levels of complexity, gives to biology its charming variety, biochemistry and biophysics at the molecular level, cell types and organ systems at an intermediate level and whole organisms and their communities at higher levels. Progress in molecular biology of genes has greatly illuminated our understanding of all levels of biology. But it does not exhaust any one of these. Sensory and cognitive biology, for instance, is now on much securer foundations but our understanding of affective functions, pain, pleasure, motivation or sleep is not so satisfactory.

Table 1. Sizes of selected genomes in millions of base pairs.

Humans	3050
Puffer fish	400
Drosophila	165
C. elegans	100
Yeast	14
E coli	4.7
Mycoplasma	0.6

Are 30,000 genes enough?

The important function of DNA, apart from duplicating itself, is to preserve and convey genetic information. It does so through an intermediary molecule RNA to make proteins. RNA and protein are at the centre of other activities. You might ask, are 30,000 genes in humans enough to generate our unusual properties. Genomic analysis provides us with useful insights

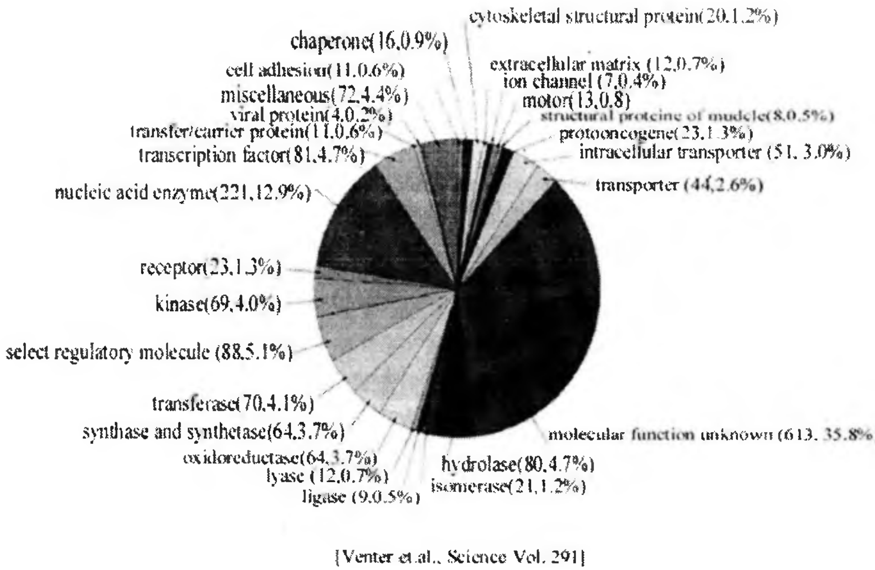

Figure 1. Proteins performing different biochemical functions in humans. The numbers in parenthesis indicate proportions in a sample of 2700 proteins.

into such questions. The human genome contains 30,000 protein-coding genes; flies and worms have 15,000 and 10,000 respectively. Does this mean we are only two or three times as complex as flies or worms? Clearly not. The mammalian brain has a hundred billion (10^{11}) neurons, the flies have a few hundred thousand (10^5) and the lowly worm *C. elegans* only 300. The difference between the three species is not in their DNA content but in the proteins they make. Our own 30,000 genes probably make between 150,000 and 250,000 different proteins. The genes and proteins work in combinatorial subsets in different tissues, not one at a time. Thirty thousand is, therefore, a very large number. In principle, combinations of genes can generate phenotypes exceeding the number of atoms in the universe.

Table 2. Expansion of protein families in humans compared to the fruit fly *Drosophila.* Numbers show multiplication of proteins in different functional classes.

Regulators of development	5.6 X
Immune response	3.8 X
Signalling	2.48 X
Adhesion	2.5 X
Cell death	2.7 X
Cytoskeleton	2.7 X
Neuron structure and function	1.4 X

Comparative genomics tells us how evolution of complexity has proceeded. Simple bacteria make a few thousand proteins, which take care of essential biochemistry. The advanced enkaryotic cell needs a few thousand more for added housekeeping functions. The evolution of multicellular animals and plants was accompanied with a massive increase in the number of proteins and their families. Most of this expansion in protein families has to do with regulation of development, specially of brain structure and function. The uniqueness of higher mammals lies not so much in their genes but in the enormous redundancy of their proteins. About 99.8% of our genome is identical with that of the chimpanzees. The differences, genetically speaking, reside in a few hundred genes.

Table 3. Shared protein functions in humans and fruit flies.

Protein interaction domains	97.8%
Signalling	97.3%
ECM adhesion	95.8%
Cytoskeleton	90.0%
Neural structure and function	72%
Regulators of development	42%
Immune response	10%

Genetics of neural connections

In order to understand the development of brain connections, we need to know how neuronal genes work. This is the subject of a relatively recent field of research called neurogenetics. At the elementary level, genes specify proteins essential for neural functions: the generation of electrical signals. The basic hardware of nerve cells, sensory receptors, membrane channels, synaptic proteins and other molecules, which transduce and amplify signals appeared early in evolution and have been conserved. Other conserved genes control the number and diversity of neuronal types and the formation of nerve connections. Yet other genes regulate migration of neurons and axonal pathfinding. Axons grow by traversing short segments bounded by landmarks. Molecular cues guide the growing axons, enabling them to make turning decisions at choice points. Netrins are diffusable proteins that provide attractive cues, ephrins cause repulsion, semaphorins drive axons to fasciculate. The overall organization of the brain is similarly regulated by genes. Homologous neurons in different species can often be recognized. They preserve their transmitters and connectivity. Occasionally entire neural circuits are preserved across phyla. The neural circuits tend to be generalists. The network, with appropriate modulation, can reconfigure itself to acquire new functions. All told, there are more than a thousand proteins regulating neurons and their connectivity.

But genes do not specify brain circuits in the same straightforward way that they specify sequences of amino acids in a protein. They work in a highly interactive fashion to bring about an overall pattern that is relatively invariant. This pattern exhibits a remarkable degree of flexibility. Although early stages in brain development are independent of actual neural function, the formation of final connections and their maintenance is critically dependent on correlated patterns of electrical activity. Genetic regulation of brain is not strictly deterministic. It is stochastic, nonlinear and probabilistic, and strongly influenced by environment and experience.

Genes and behaviour

Is there a direct correlation between single genes and behavioural traits? The answer is sometimes yes and sometimes no. It is claimed that traits such as intelligence, aggression, criminality, homosexuality, feminine intuition, musicality and mathematical ability have a strong genetic basis. These same traits also have an important experiential component. Behavioural traits depend upon interactions between environmental factors and multiple genes called quantitative trait loci (QTL). Separation of the environmental and genetic components of behaviour by conventional genetic methods is not easy. Most of the information about heritability of behaviour comes from statistical studies on twins and adopted children. These studies are sometimes controversial. The conclusions reached by the investigators are influenced by the methods of investigation they choose and their philosophical bias, not an uncommon phenomenon in science. Refined methods for studying QTLs by means of single nucleotide polymorphism (SNP) are now available, which should greatly improve the state of knowledge in this area.

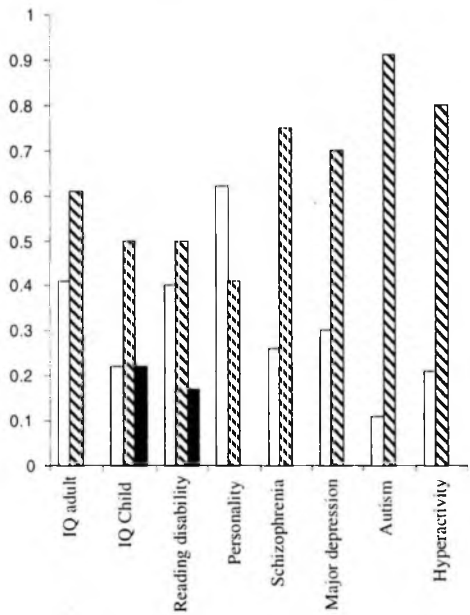

Figure 2. Heritability of behavioral traits in humans based on twin studies. Adaptive genetic variance(▧); Variation attributable to shared environment(□); Variation due to unshared environment(■).

Evolution of human brain

It is often argued that no amount of tinkering with the brain or its molecular hardware is going to tell us much about consciousness, which is a part of a larger cosmic force accessible to introspection and intuition alone. I will leave this argument aside and conclude with a remark about the evolution of the human brain.

It seems to have taken a bit over two million years for the brain to evolve from early primates to modern humans. Most of it happened in a sudden spurt of change. The causes of this spurt are not known. About 100,000 years ago mankind spread from its original habitat in sub-Saharan Africa to the rest of the world. It is unlikely that our brain genes have changed much in this period. The change that has occurred is not so much genetic as cultural and social. The results of human genome analysis reinforce this conclusion. To borrow the words of Svante Paabo, the man who sequenced Neanderthal DNA:

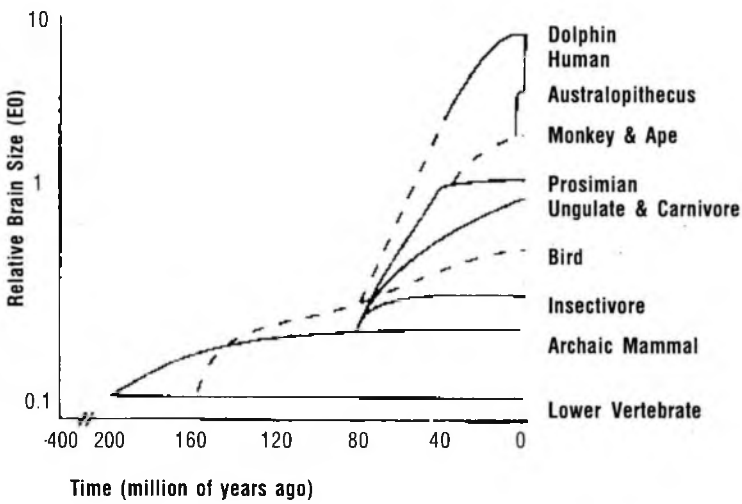

Figure 3. Evolution of brain capacity in vertebrates. Note the sudden spurt of increase in this capacity in primates in the last few million years.

"It is a delusion to think that genomics in isolation will ever tell us what it means to be human. To work towards that lofty goal we need an approach that includes cognitive sciences, primatology, social sciences and humanities. With the availability of the human genome sequence, genetics is in a position to play a prominent part in this endeavour."

Consciousness-elusive or can one grasp it?

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Abstract

'Elusive' refers to a substance or an object that at one time appears within one's grasp and at other times, unreachable. Consciousness seems to be a similar entity, eluding the grasp of scientists and philosophers and the public. The primary reason is that different people define consciousness in different ways and then proceed to deal with it, their ideas being often at variance with others interested in the same subject. The biologists' or the neuroscientists' views are specific and are that consciousness is based on some sort of neural activity. There are others who combine self-awareness and awareness with consciousness, thus denying the existence of consciousness in most animals and plants. There are others who hold that consciousness is an entity that is different from the neural basis and it is consciousness that activates the mind. Philosophers suggest that consciousness pervades the whole universe and can be found in animate and inanimate objects, only varying in the degree of its intensity. Thus the difficulties in grasping consciousness are obvious.

This paper discusses the different approaches to consciousness, the scientific, the philosophers' and the lay public's. It also suggests that people discussing consciousness should start by defining what they mean by consciousness. This will make mutual dialogue easier. In addition, the paper deals with the state of super consciousness where the human brain is able to reach heights of performance not ordinarily available to lay humans. The change in brain function and structure that makes such a supernatural state possible makes fascinating study and is a goal for neuroscientists of the future.

1. Consciousness

The study of consciousness has three aspects:

(1) To understand the basic mechanisms of consciousness and mentation;
(2) To verify the existence of the state of superconsciousness and then understand and explain the phenomenon;
(3) *And most important*, to prove the benefits of the daily practice of meditation undertaken over the years; to establish how it benefits an individual's bodily health, improves his efficiency and induces mental equanimity;

The third one is as important as the others. It is easier to do and will benefit a large number of people of the world.

Consciousness and all other aspects of thought, mentation and the state of superconsciousness have interested Indians for many centuries and they have made great contributions to this science, that have stood the test of time and of scientific study.

The Western interest in this problem is about two or three centuries old and has become more intense in the last fifty years. The approaches, the definitions, and the language used to describe the problems of consciousness differ widely between the East and the West. It appears that Western scientists have a problem in defining consciousness and one sees different interpretations of this entity, Consciousness. They are mixing up consciousness, mentation, awareness, self awareness etc. and often use these terms interchangeably. This makes scientific study difficult. The

Indian view, which I will deal with later, seems to be more realistic and intellectually satisfying and more amenable to proper scientific study.

2. Western concepts of consciousness

Some of the definitions used by Western scientists interested in the study of consciousness are mentioned below and you would see the difficulty.

"The most elusive and inescapable of all phenomena is consciousness, our immediate subjective awareness of the world and ourselves" (John Horgan, science writer). *Here consciousness, awareness of environment and self awareness are clubbed together.*

Consciousness, according to Francis Crick and Christof Koch, is really synonymous with awareness and all forms of awareness, external and subjective.The mechanism is one that combines attention with short-term memory and they suggest that self-awareness may be unique to humans. If consciousness and self-awareness are the same, then according to Crick, only humans who have self-awareness have consciousness!! *Is this tenable?*

Antonio Damassio: "A theory of consciousness must show how each of us acquires a sense of self, it must take into account not only the brain but the whole body" (nearer to our ayurvedic concepts). He further adds "a neural model of consciousness will probably have to be supplemented by cognitive and social theories?" Here also consciousness and self-awareness are clubbed together. *Is this the sort of consciousness that we plan to discuss?*

"Consciousness is a common biological phenomenon occurring not only in humans, but in many other animals – and certainly all the primates". (Flanagan in his book, *Consciousness reconsidered*, 1992). *Does this mean animals below the level of the primates have no consciousness – are they unconscious??!!*

Consciousness is the supreme level of mental reflection of objective reality, <u>inherent in man exclusively</u>, by virtue of his sociohistoric essence (Petrowsky and Yaroshewsky, 1987). *This definition implies that all other beings have no consciousness.*

There are also statements like "Consciousness is the general master of psychological functions, improperly identified with some mental functions (most often with attention or thinking)" and *"for scientific psychology, consciousness is complete fiction."*

What do we know about consciousness? It is the name that we apply to the condition of ourselves that we experience and report for most of the day. We realize that there are serious difficulties in specifying the use of the word. In saying that one is conscious, one means awake and aware and open to receiving and giving out information (Young 1979).

William James, the philosopher, stated that the "stream of consciousness" is a river, forever flowing through a man's conscious waking hours. This metaphor may be poetic but is confusing.

When we wake up we are still the same person as before. So, if consciousness and mind can come and go it is very difficult to see how they can be the carriers of our character and individuality.

But why is there so much confusion around the definition of consciousness? Part of the reason is *the unfortunate use of a single word to signify something that has so many different facets*. Dictionaries define consciousness as "awareness of one's own existence, sensations, thoughts, surroundings," or "the contents of mind," or "consciousness of wrongdoing," or "the collection of one's thoughts at a given moment," or a host of other meanings. "So what are people talking about when they talk about consciousness?" asks Antonio Damassio, maturing in his views.

"An intelligent conversation about consciousness cannot take place clearly without first announcing which phenomenon is being discussed. The need for sharp distinctions is even more important for those actually investigating these phenomena. Consciousness is not conscience, nor is it merely the contents of the mind. *Consciousness is the biological phenomenon that permits us to survey the contents of our minds: our feelings, thoughts and knowledge*. Consciousness is not the feelings themselves, nor is it merely the accumulated thoughts and knowledge. It is an elaborate rite of passage into these feelings, these thoughts and this knowledge – *into everything that makes us human!!"*

These are a few examples to show that western scientists do not differentiate between consciousness, awareness, and self-awareness.

2.1 *Consciousness: Is it semantics or only an abstract concept?*

There is another viewpoint to be considered. Are we just using a word (consciousness) which has in reality no existence and has come down in time by the use of language? Wittgenstein mentioned that language always gets coloured by the social culture of the people using it.

Is there really an entity like consciousness or does it indicate a basket where many ideas are mixed up? If so what are we investigating?

Is consciousness a word we have given for a certain state of function? *If so, how can science be expected to clarify abstract entities? Is it a will o' the wisp?*

3. Other views on consciousness. The biologist's definition of consciousness

"Consciousness is the ability to react to environment."

In evolution, it is seen that the capacity to interact with environment is inherent in the smallest of living organisms, including unicellular organisms and viruses. As evolution advances, the capacity to perceive and store information and react to the environment increases, by the development of a nervous system. From these levels, the nervous system has become bigger and better organized in the higher animals, ending up with this magnificent organ that we all possess and with which we are trying to investigate our own brain powers.

Neurobiologists define the term consciousness as the ability of the organism to respond purposefully to changes in the environment, and thus consciousness is a basic function of life at all levels of evolution.

In ancient Hindu writings on medicine, great importance has been given to the term consciousness. In *Charaka Samhitha, Sareera Sthana* (Suthra 16), it is observed "Man is said to be the sum of the six elements, namely ether and the four other proto-elements, the sixth being the element of consciousness". *By some the conscious element alone is said to constitute Man.*

This definition of consciousness is quite satisfactory to biological scientists including medical scientists. Doctors assessing the higher neurological functions of the patient call the patient 'conscious', if he reacts in some form or other to environmental stimuli, and based on the varying types of reaction have graded the levels of "consciousness", e.g. the Glasgow Coma Scale.

Under the above definition one can certainly say that animals, plants and other living organisms exhibit consciousness.

3.1 *Awareness of oneself and the environment*

This takes us one step higher in the evolutionary scale. While there is no doubt that human beings are aware of themselves and their surroundings, are all living beings aware of their "self"? This self-awareness, if present, is not obvious to us in the lower forms of life, but perhaps in the higher levels of the animal kingdom, with a well-developed nervous system, this is likely to be present.

The biologist's concept of consciousness being different from the popular concept of "awareness" is well demonstrated below. The understanding of the doctor and the patient of what is implied by the term "consciousness" (specially in the East) varies, the patient or his relatives having a different concept of the word "unconsciousness".

In India, if you ask a patient who had a head injury, "How long were you unconscious"? he may reply "for about fifteen days". Unless you understand what he means, you may assume that he had a severe head injury and had suffered from prolonged loss of consciousness. But actually this is not so. What the patient means is that he was "not aware" for fifteen days and not 'unconscious' in the neurological sense. This means that he knew what was happening, was able to drink and eat and respond appropriately at the moment, but cannot remember any of these responses, i.e.

that he was not "aware" for those days. Thus though the patient was conscious according to the biologists, according to his own concept the patient was "not aware".

3.2 *Collective consciousness*

Going lower down the scale, do insects have awareness of themselves and others of their own kind? If we look at a colony of ants, they seem to be as well organized as human society. Similar is the behaviour of bees. Is it possible that such insects, have, in addition to individual consciousness, a collective consciousness also? Going further down, does the plant kingdom have awareness? Do they communicate with each other in ways unknown to us?

3.3 *Consciousness at the cellular and subcellular levels*

The human brain has 1000 million cells. Is consciousness a function of the whole brain or does each neuron possess consciousness? Similarly do other living cells possess a modicum of consciousness so that they may react meaningfully to changes in their environment?

The DNA helix acts as a guide and blueprint for every development in the foetus and in the adult body. There are protein molecules that may attach themselves to the DNA molecule and prevent and modify its actions. Has the DNA any consciousness of what it is doing when it acts as a blueprint or, do the protein molecules possess consciousness when they attach themselves to the DNA and alter its working? How and why do they perform this function?

3.4 *Consciousness at the subatomic level*

Does the biologists' definition cover all objects in existence? Does a nonliving thing like a stone have consciousness? Apparently not, from the point of view of our perception.

The physicists have shown clearly that a stone is made up of large molecules and atoms with enormous space in between them, and that these molecules and atoms are in constant motion and reacting with each other, obeying certain laws, i.e. reacting to their own environment; In other words they are "conscious" according to our definition, though the stone itself is not conscious. Can there be a very low level of consciousness in the stone which we are not able to perceive or measure with our available means? Here the definition of the word "consciousness" has undergone a complete change and has no reference to the concept of biological scientists. Particle physicists trying to understand the smallest particles have described it as a matter energy continuum operating on the principle of uncertainty and probability. Observation of matter at such smallest subatomic levels convinces physicists that at such levels, energy–matter follow the same laws that are present in the largest objects all over the Universe.

3.5 *Consciousness is a universal phenomenon present everywhere, from the smallest to the biggest objects in the Universe*

All matter/energy in the universe is subject to some sort of law or control and the response to this control or law may be conceived as "consciousness". Under this concept, all objects in the universe including those on this planet Earth, manifest some level or other of this force "consciousness", depending on the matter constituting them. Thus the manifestation of "consciousness" is maximum in the higher "evolved" beings rather than in those at the lower level.

3.6 *"Time-space-consciousness" hypothesis (R K Mudgal, India)*

R K Mudgal of the Institute of Science and Religion has suggested that all objects in this Universe are part of a graph bound by a parameter of time on one side and that of space on the other; and there is another parameter in the third dimension, viz., "Consciousness". The inherent property of all objects (described as goal in religion), is to cross the time–space barrier and reach the ultimate of infinite consciousness.

The Time-Space-Consciousness hypothesis states that everything in existence anywhere is moving through time and space towards infinite consciousness. This necessitates another postulate that "Consciousness is a fundamental of the most basic subatomic particle/wave and its primary property is manifestation".

"Manifestation at the atomic level may be correlated to the probability factor in the behaviour of the particle/wave function in quantum mechanics. There is evidence in the evolution of complex molecular systems that statistical probability of combining with other atoms has always moved in the right direction. The Nobel Prize physicists Yang and Lee, along with Madame Wu at the Brookhaven National Laboratory, USA, have proved nearly a decade ago that radioactive cobalt has the ability to distinguish right from left and in emission of its electrons, appears capable of making a choice between the two directions.

Belgian Nobel Laureate, Ilya Prigogine, while applying the principles of physics to chemistry and progressing from the study of how molecules interact to why they do it, proved that in certain chemical reactions substances develop in complexity by interacting with their surroundings. At the animate level, this manifestation is illustrated at every step in Darwin's theory of evolution.

"Consciousness in the atomic, molecular and inanimate systems appears dormant/unmanifested to us" not because it is not there or its quality at these levels is any different, but because of the limitations of the constituent body and also our capacity to see it in that perspective in the given system.

"How could consciousness be working through any given body or system in relation to its environment? Possibly by resonance with the Infinite Consciousness and also with other constituent bodies/ systems at higher, lower or the same level of consciousness. Our noetic science will have to advance a little further to explain the details; but telepathic communication, pre-cognition, retro-cognition, clairvoyant perception, channeling etc. should not appear so strange for the human system in advanced stages of consciousness"

4. Neuroscience and consciousness

The neuroscientist's view of consciousness and brain is presented by Prof. P N Tandon, President of the National Brain Research Centre. To preserve continuity in this paper I would mention a few salient ideas.

For many centuries, the Western world believed that the mind is an immaterial substance which somehow acted upon the body and the brain and made people conscious. This view was reinforced by Rene Descartes who emphasized the duality of the mind and brain. However, things changed rapidly in the 20th century. We are told that as early as 250 BC, Hippocrates said that the brain is a messenger to consciousness. He described the activities of the brain and proposed that all sensations, emotions and other mental functions arise from the brain.

After this, there was no special study till, in the 18th Century, Descartes localized consciousness to the pineal region. In the present century, vigorous work was initiated in the neurophysiology of consciousness with the discovery of the *brain stem reticular system* and its role in maintaining alertness in animals. In the humans, injury to the brainstem, induced unconsciousness. As neurosurgery advanced it became evident that removal of large areas of the cortex in human patients did not induce unconsciousness. Hence, Wilder Penfield (1975) of Montreal, after extensive studies conducted on human brains during surgery under local anaesthesia, proposed that the centre of consciousness is in the *centrencephalon,* in an area above the upper brain stem, where all the tracts converge and he called these areas the highest brain centres. "The integration within the central nervous system which makes consciousness possible did not take place in the cerebral cortex but below the cortex and above the midbrain in the centrencephalic structures".

It is strange that after decades of observations on the living human brain, Penfield reverted to a dual theory after his retirement. Sir John Eccles did the same. Perhaps, as one grows old one gives up science and takes to philosophy i.e. from *neurology to neurosophy* (Penfield 1975). "For my own part, after years of striving to explain the mind on the basis of brain-action alone, I have come to the conclusion that it is simpler (and far easier to be logical) if one adopts the hypothesis that our being does consist of *two fundamental elements*. If that is true, it could still be true that energy required comes to the mind during waking hours through the highest brain-mechanism". (What does this mean?)

Young (1979), in *Programs of the Brain,* after asking, "Is the mind a single entity"? replies that the entity we refer to as the mind is perhaps that part of the brain's functional organization of which we are conscious and concludes that the whole system is controlled by one central reticular system and produces in each of us a single stream of consciousness.

Consciousness, as an entity: Is it *localized* to any part of the brain? It is apparent that the higher brain stem centres are essential for the maintenance of a conscious state. Proceeding to further stages like awareness and mentation, are these abilities localized in some areas of the brain or are they *a total function of all the neurons* of the brain? As awareness, self-awareness and other mental faculties are seen more in humans with large frontal and temporal lobes, and are much less manifest in less developed brains, there is no doubt that the later additions to the brain form an important substratum for mental activities.

One also has to consider the view expressed by Sir Charles Symmonds, neurologist, London. "Consciousness is not an unvarying independent entity. Consciousness is a varying quantity, that is, we are from moment to moment differently conscious. We do not really suppose there is one fixed seat of consciousness."

Symmonds suggested that *consciousness and mentation extend down to the lower forms of life as well*. This was contrary to the views expressed by most of the neuroscientists of the day. As Christianity teaches that animals have no soul, many of these scientists confused soul with consciousness and denied consciousness to the lower forms of life! Symmonds also asked, how low in the evolutionary scale can we detect mentation, by observation of behaviour? He quoted an instance where ants were able to mine a tunnel under the rails, when they found that wagons crushed them while they crossed the top of the rails. Hence ants contain a prototype of the anatomical substrata of the mind. *Lower animals manifest behaviour that shows that they have powers of reasoning.*

Further progress took place by the study of electrical activity of the brain during sleeping, dreaming and wakefulness and it was found that a human can control his brain waves. Young (1979), in *Programs of the Brain*: "People can learn to produce at will, bursts of the particular type of electrical activity known as alpha waves. These bursts can be made to be long or short, and so serve (within limits) as elements of the Morse code. *The subject can thus send out messages from his brain without speaking.*"

Apart from neurophysiologists, mathematicians got interested in the problem of consciousness.

Kurt Godel (of the '*Incompleteness Theorem*'). "In the future it would be deemed a great oddity that 20th century scientists had discovered the elementary physical particles but had failed even to consider the possibility of elementary psychic factors". "There exists a world of concepts to which humans have access by intuition".

Roger Penrose suggests an important *role for quantum mechanics in the determination of consciousness.* "No deterministic rule-based system, like classical physics, computer science or neuroscience, can account for the mind's creative powers and ability to ascertain the truth". Roger Penrose takes *consciousness to the micro levels.* He suggests that consciousness and intelligence are not computable, and we have to apply the quantum theory to explain these entities. He feels that it is the indeterminate functioning of the dendrites and neural nodules that determine consciousness and also proposes that each one of these areas have their own consciousness.

The question posed by Damassio is interesting and challenging. The body and the brain are public, exposed, external objective entities. The mind is a private hidden subjective entity. *"When and where then does the dependence of a first person mind on a third person body occur precisely?"*

Neural Darwinism was suggested by Gerald M Edelman. "Our sense of awareness stems from a process called neural Darwinism, in which groups of neurons compete with one another to create an effective representation of the World." (Bright Air Brilliant Fire 1992). This was described by Crick *et al* as obscure jargon.

Toamassio Poggio of MIT thinks that mechanisms that bind together groups of firing neurons responding to various stimuli, combined with the brain's ability to change its circuitry frequently may form the basis of consciousness. The binding together of groups of neurons may be due to synchrony of firing or oscillations.

Baars (1988) proposes that consciousness is the result of *a global workspace in the brain* that distributes information to the huge number of parallel unconscious processors that form the rest of the brain. He treats the brain as a large group of separable, very specialized systems that are unconscious much of the time that they operate. At least some of these processes can, one by one, become conscious, and the successive outputs of these processes constitute conscious experience.

Baars (1988) also cites evidence from biofeedback studies which show that a degree of *voluntary control can be gained over virtually any neural event.*

While vigorous efforts are being made to understand and study consciousness, *there are skeptics.*

"Conducting an investigation with the very instrument that is being investigated makes the definition and approach difficult" are the views of some philosophers.

"Neuroscience is still not complete and hence may not be able explain all mental phenomena". Further progress in neuroscience will make this easier. This view is held by the majority of people working on consciousness. It is difficult to see how to study consciousness in a way that would completely separate it from other mental phenomena with which it so frequently occurs.

There are others who feel that the human brain is not capable of understanding its own functioning of consciousness. Colin McGinn (Rutgers University) opines: *Human brains have limitations.* Just as rats and monkeys cannot even conceive of quantum mechanics, so we humans may be prohibited from understanding certain aspects of existence such as the relationship between mind and matter. Consciousness, in other words, will forever remain beyond human understanding.

5. The Indian approach

Compared to the Western concepts of mind and consciousness, the *Indian approach appeals more to reason and scientific analysis.* While in the West, all mental functions are included under the one word "mind" (which often included the soul), India has always looked at mentation as a many-layered entity.

The basic level is consciousness, known as *pragna* or chethana. On this base, the sensory and motor systems (*the gnanendriyas and the karmendriyas*) create the mind (*manas, chittham*), which responds to the impulses from the senses (*indriyas*). The response could be positive or negative, leading to attraction (*raga*) or repulsion (*dwesha*). These build up emotions and create enjoyment (*sukham*) and distress (*dukkham*) and resulting in desire (*kama*), anger (*krodha*), avarice (*lobha*) and hatred (*dwesha*). All these are still at the mind level (*manas*) and the whole system is included in the *indriyas*. *"I am the mind among the indriyas" says Lord Krishna in the Bhagawat Geetha.*

Above this mind or *manas* or *chitta*, operates intelligence (*buddhi*) which is capable of discrimination and also capable of imposing its decisions on the mind. Above this level is the feeling of "I"ness or self-awareness (*Ahamkara*). This "I"ness leads to the feeling of possession, "mine" (*mamatha*) the sense of ownership of the whole body and of all the mental activities including all emotions.

It has been often stressed in Indian thought, that the senses, the mind, the intellect and "I"ness are all material and subject to growth and destruction. There was never any confusion with the soul or the *athma* which is immaterial and all pervasive and does not influence the material mind and body, except to act as a witness (*saakshi*).

It is a pity that for two centuries, the Europeans did not care to study the Indian concepts of the mind and the body, even though they were ruling us. If that had been done, Renes Descartes would not have created the dual mind–body problem nor would have made the now popularised statement, *Cognito, ergo sum. (I think: therefore I am.) He would have said "I am: therefore I think"* and neuroscience or European philosophy perhaps would not have lost almost a century in their investigation of the mind.

The Indian concepts presented above closely fit in with our present knowledge of neuroanatomy or physiology. Consciousness (*pragna* or *chethana*) resides in the upper brainstem area called higher brain centre by Penfield (1975). Injury or disease of this area leads to disturbance of consciousness, leading to coma (*achethana, moorcha*).

The senses and the sensorimotor system and emotions all included in the word "*manas*" reside in the limbic system and in the sensorimotor cortical and subcortical levels. These centres present in many lower species, gradually assume more complexity in the apes and finally in the humans.

Discrimination or *buddhi* is a later addition in evolution, as the frontal lobes enlarged and reached the maximum development in the humans. Discrimination, sense of right and wrong, moral and ethical values and conscience all constituted intellect known as *buddhi, manisha, dhee,* or *mathi* in India. The frontal lobes (intellect) are capable of influencing the lower levels of the nervous system, i.e. the mind (*chittha* or *manas),* but are often unable to do so. In spite of their massive size, the frontal lobes are unable to control the powerful limbic system and the hypothalamus, and thus arise the problems facing the human race.

The sense of "I"ness and 'mine'ness is in the temporal lobes. Neurologists have often seen disturbance of the I and mine feeling in temporal lobe epilepsy. Temporal lobe dysfunction may also enlarge the sense of 'self-awareness' to make one feel differently towards one's surroundings – a feeling of universal awareness for a few seconds (transcendence). All of us know and can easily experience that our 'self' can stand back and watch the constant roving of the 'mind' and for most of us, however much we may try, our mind or thoughts drag us along their own path.

When we observe two- or three-year old children, we see that, up to a certain age, they identify themselves with their name. They will say it is "Vivek's toy", "Vivek's mother", "Vivek is hurt" etc.

Only at about the age of 3 or more, when the temporal lobe develops, they talk about "my toy", "my mother" or "I'am hurt". It is clear now that the Indian (Hindu) concept of consciousness and mentation was appropriate and realistic and today's physiology confirms these levels.

5.1 *The four states of consciousness*

Another important aspect of the Indian view of consciousness has to be considered. Our rishis, after keen observation and study, have suggested that consciousness is a varying entity at different times and in different individuals and beings. They have classified consciousness into four states.

> Awake state (*jagratha*)
> Dream state (*swapna*)
> Deep sleep state (*sushupti*) and
> Fourth state (*thuriya avastha*) (discussed in the next section).

Many philosophical and metaphysical comments and observations have been raised and answered in India from ancient times while discussing the relationship of the individual with the first three states (wakefulness, dreaming and deep sleep) of consciousness. *Chethana, chittham, buddhi and ahankara* (consciousness, mind, intellect and "I"ness): where are these faculties during sleeping and dreaming? Where is the I feeling or the doer (*kartha*) feeling during these states? What provides the continuity when you wake up after a dream or sleep? The great philosophers of India have based their arguments on the relationship of the states of consciousness to the individual to prove the existence of the *athma* or the soul. But, this will take us into deep waters and we should leave it to the wisdom of the philosophers. According to Indian thought, a continuous thread of consciousness exists through all the three states.

5.2 *Importance of sleep research*

In a study of consciousness, sleep research should be included to verify ideas expressed in Indian philosophy about sleep. How do, "awake-consciousness" and "asleep-consciousness", vary physiologically, biochemically and electrographically? Sleep and dreams are facets of consciousness and their study can reveal clues.

6. Superconsciousness or the fourth State: (The Thuriya avastha)

6.1 *Introduction: some western views*

Quoting Gordon R Taylor (1979), the Zen Buddhist teacher Suzuki describes "the void experience". "All things have the character of emptiness. They have no beginning, no end, they are faultless and not faultless, not perfect and not imperfect. Therefore, O Sanputra, here in this emptiness there is no form, no perception, no name, no concepts, no knowledge. No eye, no ear, no nose, no tongue, no body, no mind. No form, no sound, no smell, no taste, no touch, no objects.... There is no knowledge, no ignorance, no destruction of ignorance... There is no decay nor death" And he concludes with an unambiguous statement: "When the impediments of consciousness are annihilated, then he becomes free of all fear, is beyond the reach of change, enjoying final Nirvana. After describing all this, Taylor concludes; *"He is, in short, a vegetable!". What an unfortunate conclusion without realising the supreme powers of the mind and brain at this state of Yoga.*

Taylor in his book also mentions the experience of the great psychologist William James, who after taking nitrous oxide and having a luminous experience, wrote: "One conclusion was forced upon my mind at that time, and my impression of its truth has ever since remained unshaken. It is that our normal waking consciousness, whilst all about it, parted from it by the filmiest of screens, there lie *potential forms of consciousness entirely different*. We may go through life without suspecting their existence; but apply the requisite stimulus, and at a touch they are there in all their completeness, definite types of mentality which probably somewhere have their field of application and adaptation. *No account of the Universe in its totality can be final which leaves these other forms of consciousness quite disregarded".*

Does the mind have undiscovered powers? Taylor asks, "Has the mind powers not recognized by orthodox science such as the powers of telepathy or of foreseeing the future?". *If it does, it becomes definite that science needs some new postulates.*

Our seers have written, taught and shown that apart from the three levels of consciousness (awake, dreaming and asleep), there is another level of consciousness which transcends the state of self-awareness leading to *universal awareness*.

Self-awareness present in all of us limits our awareness and interests to our mind, body and the sense experience of everyday life. According to our rishis, self-awareness and thought processes are neither the finality of mental power nor of human development. Self-awareness should widen into universal awareness and *this is possible for every one by practice. This is not magic or mumbo jumbo as* mistaken by the West, but something that can be experienced by everyone.

6.2 *What is this state*?

In this state, thoughts cease to exist and later mind (*manas*) in the Indian sense stops functioning. At this stage, there is a feeling of "just being" (*sath*), all pervading "knowledge" (*chith*) and great happiness or bliss (*ananda*) . They tell us that it is the final goal and final duty of every human being to realize and experience this state, for his own good and the good of all beings (*sarva bhootha hithey rathaha*).

Having said this, our rishis have also indicated many paths that one may take to achieve the thought-free state (*Pathanjali*) the most important being that of yoga.

The definition of yoga begins thus: *Yogaha chitha vritthi nirodhaha:* "Yoga is the control of mind waves". This definition is followed by two pithy statements.

1. In this stage of control, the individual resides in his own self,
2. *Thadha dhristuhu swaroopey avasthanam*
3. *In other states,* the individual identifies himself with his mind waves. *Vrithi saroopyam itharathra.*

In other words, the mind is not you: Your true self will be experienced when you control the mind by yoga.

Then Pathanjali teaches us the various steps that will lead to the thought free state; beginning with self control (*yama* and *niyama*), postures (*asanas*), breath control (*pranayama*) and futher stages of meditation, withdrawal from sense objects (*prathyahara*), concentration (*dhaarana*) and finally deep meditation (*samaadhi*).

This sounds fine, but this is an individual's inner experience, and what can we scientists do who have to observe, measure and compare?

The answer is that apart from the inner bliss experienced by the yogi, *there are bodily changes that can be measured*, lowering of blood pressure, pulse rate, respiration, body temperature, metabolism, changes in biogenic amines in the urine, electrical and magnetic changes in the brain or other new observable parameters. (Such investigations have been done already by earlier workers in Delhi, Chennai, Bangalore and other cities and countries).

6.3 *Extraordinary powers*

Pathanjali also asserts that when a person reaches the thought-free or superconscious state, he develops certain extraordinary powers (*siddhis*). He can transcend time and space, can make himself very heavy or very light etc. Is this possible and if so how are we to investigate and prove these assertions?

It is our prime duty, as Indians, the proud inheritors of such a tradition and knowledge, to find out by all possible means whether these are all true. While we cannot measure inner experience, luckily neuroscience and other sciences have advanced so much that we can record changes occurring in the body and the brain in the yogic states.

What are the systems involved? What are the energies involved? As drugs also can cause a feeling of bliss, is the whole process a voluntarily controlled modulation of neurochemical processes in the nervous system? We can also seek to find out if the human brain is capable of producing distant effects (telepathy, telecommunication, clairvoyance etc). If so, on what basis? Physical or physiological? As Penrose has suggested, if it is all quantum mechanics in the axonal or dendritic junctions *then we have to seek the help of Indian mathematicians*.

Present day neurophysiology stops after describing thinking processes as the highest level of the functions of the brain. *The* *complicated structure of the brain, the extravagant abundance of neural and glial elements in the brain, the infinite possibilities of synaptic junctions and synaptic transmission – all these point to the definite possibility of a much greater level of performance and achievement for the human brain than has been apparent so far.*

In recent decades, many frontiers are being crossed in the field of science. A similar breakthrough is essential in neurosciences to discover the untapped energy of the brain. *New paradigms are needed.*

6.4 *Beyond logic and reason*

Our study and research must go beyond the boundaries fixed by our preconception that thought is the ultimate of brain function and it has no further capability. This concept has been ingrained in us by our scientific upbringing based on theories of logic and reason and *limited by Cartesian–Newtonian models* of ourselves, our earth and the universe.

In recent years our colleagues, the physicists, faced with the problem of trying to understand the nature and movement of subatomic particles found that logic and reason on which classical physics was based did not take them forward and different models and concepts had to be adopted to explain these phenomena. Thus started the concepts of "uncertainty principle", "illogical computing" etc. Many of you know that the great teachers of Zen Buddhism make *every effort to break down the bondage of logic and reason from the mind of the aspirant,* by giving them "koans" to meditate upon. Koans are impossible conundrums and powers of the brain beyond reason or intellect are needed to solve them. As these teachers are able to transcend intellect and reason, it is obvious that the human brain has powers greater than we credit it with.

6.5 *Search beyond classical boundaries*

As neurophysiologists interested in consciousness it will be a pity if we stay with classical physics and impose a boundary on the powers of the brain, which according to Eastern seers are far beyond what we imagine. It may be stressed here that this is *not mere speculation but a real experience* – a state experienced by many rishis in India, China and Japan, the whole of the Orient.

6.6 *Possible neurophysiology*

In the yogic state, the aspirant attempts to keep out all sensory impulses entering his consciousness including the internal sensations from the body.

An organism is protected from the continuous onslaught of sensory impulses, through numerous inhibitory mechanisms present at all levels throughout the sensory system. These mechanisms often operate unconsciously. This inhibition can also be selective as in a mother sleeping in a busy railway station responding only to her infant's crying. Cannot these inhibitory mechanisms be activated whenever we want, i.e. "at will"? This is what the yogi does. *Neural inhibition is the basis of the science of Yoga* and the yogi must be achieving it by using a central inhibitory mechanism. Or does the inhibition occurs globally throughout the brain and the nervous system?

6.7 *Inhibit and Ignore*

Can we train our will to ignore these stimuli when the stimulus is strong (even painful) or when the stimulus is of a pleasurable nature? "Yes, we can; by practice" says the science of Yoga. With practice, even nociceptive stimuli can be prevented not only from reaching consciousness, but also from causing limbic or autonomic responses, usual concomitants of painful stimuli.

It is clear that higher cortical areas can exert control over incoming impulses. This control occurs at many inhibitory levels and not only in the reticular system. If there is too much suppression of reticular mechanisms, sleep may be induced. The reticular system has to be involved in a major way in deep meditation for such intense inhibitory control of impulses to be possible without causing sleep.

6.8 *Thuriya is not a sleep state*

In the yogic state of deep meditation, therefore, there is a complete inhibition of the entry of sensory impulses into the brain. During this practice, as less and less sensory impulses reach the brain, sleep often supervenes automatically for a few minutes, but the yogi has to get over this tendency gradually; deep meditation is not a "sleep state".

As the meditator is gradually controlling his thoughts he may adopt either of two techniques. One is to suppress actively the thoughts that arise and concentrate only on one thought. The other technique is to allow whatever thoughts arise to flow through the mind, without in anyway controlling them. "To stand back and observe". In course of time, the extraneous thoughts die down and only one thought is left. After some more practice, even this one thought dies down and the yogi reaches the thoughtless state. *"Standing back" is the essence of Buddhist Vipassana meditation.*

This is also mentioned in *the Bhagavad Geetha, "Gunah Guneshu Varthanthey Iti Mathva Na Sajjathe"*. Realising that natural elements like mental waves and disturbances reside in the nature of our body, the wise man does not get attached (he stands back).

Where do thoughts arise? Some conjecture is permissible here. It is possible that *de novo* thoughts, conceptual thoughts, and thoughts that arise without sensory stimulation occur through mechanisms in the frontal lobes and the associated cortex. Conceptual nonverbal thoughts may arise from the athalamic areas of the cortex.

As mentioned earlier, the feeling of "I" and "mine" possibly reside in the temporal lobe as deduced from a study of patients with temporal lobe epilepsy.

While thoughts are events that take place in the frontal and associated cortex, the ability to stand back and observe these events probably resides in the temporal lobes which are well developed in humans. Thus we are able to be observers or "*Sakshi*" to our mind's activities.

I have talked only of *anatomical sites*. Surely there would be the involvement of as yet undetected *neuromessenger* systems involved in the process.

What happens in the "thought-free state"? Obviously brain activity does not stop. In the "thought-free state", we are told that the brain stops bothering with ordinary things and becomes engrossed in consciousness. "The brain silent and motionless trafficks with the imponderable" as Sir Geoffry Jefferson, the great British Neurosurgeon put it so aptly some years ago.

The brain isolates itself from "unnecessary" activities, and develops its power to comprehend "consciousness" and tries to go beyond time and space and beyond the boundaries of logic and reason and this is the *Thuriya* or the Fourth State.

6.9 *Suggestions for research*

Our research into consciousness has perforce to be many-sided and scientists other than biologists have also to be involved vigorously. Some suggestions are given here from the neurobiology angle.

6.10 *Temporal lobe studies*

Penfield called the temporal lobe cortex the interpretative cortex and assigned functions, viz. to interpret the relationship of the individual to his immediate environment and to bring back strips of past experience. Except for the areas concerned with speech and hearing, the anterior (front) portion of the temporal lobe appears to have no function. The first 5 cm of the front of either lobe can be excised without causing any obvious disability to the person. Then what is its function?

Bilateral temporal lobe removal, if it involves the medial structures like the sulcus or the hippocampus leads to loss of ability to store memories. Bilateral anterior temporal lobe removal leaving the medial structures on one side has been done in epileptic patients. Did these people lose their sense of self-awareness? Then where does self-awareness arise? The temporal lobes are not 'centres' but must be an integrating field where impulses from the frontal or other lobes as well the midline brain structures are modified and integrated to create self-awareness.

The one-and-a-half to two-year-old child is not self-aware, but, within a year, self-awareness sets in. What are the circuits that are completed, or that mature during this period in the temporal lobe that create self-awareness?

6.11 *The study can be many-fold*

1. Clinical, psychological and other studies of patients with temporal lobe epilepsy in whom self-awareness is disturbed.

2. Electrographic and other studies during surgery on such patients and a study of the pathological specimens removed if any.
3. Study of head injured patients with unilateral and bilateral temporal lobe contusions. Does any interference with self-awareness occur in any of these patients? If there is, the clinical findings can be correlated with the CT, MRI and EEG findings.
4. Study of the neural circuits with cytoarchitectonics in temporal lobes of children up to the age of 4 in autopsy specimens.
5. Study of specially the temporal lobe activity in persons who are meditating.
6. And other ideas. *(Let us sit down and think)*.

These will require *a multicentric study* spread over a few years, done under rigorous scientific scrutiny.

6.12 *Study of neurochemistry*

The key role played by neurochemicals and neuromessengers in brain function is becoming clear. Hence, while studying the effects of meditation, neurochemical changes have to be taken into consideration. When synaptic inhibition occurs at all levels, what happens to the various neuropeptides? Is their production reduced and stopped or do they accumulate in large quantities and cause so far unthought of changes in brain chemistry, leading to the brain acquiring extra ordinary powers? Do these chemical changes get reflected as energy changes that may explain the powers exhibited by the yogins. What is this energy, something that we know about already or something that will have to be discovered?

It is strange that neuropeptides present in the brain and the nervous system are also seen in organs like lungs, the intestines, the liver and the pancreas. This would imply a global chemical control system of the whole body by the brain, apart from its instantaneous neural and longtime endocrine control. (*Here we are approaching the Ayurvedic concept of global control.*) During the yogic state, it is quite possible that the yogi modifies the chemicals not only in the brain but also throughout the body.

It should be possible to find out or infer these chemical changes by examining the urine, saliva, sweat and skin reactions, and using other noninvasive techniques available in the present day.

6.13 *Right and left brain*

The different functions and capacities of the two halves of the brain have been studied and there can be left or right brain dominance in men and women. It is also possible that the dominance varies in the same person at different times. (Chandrasekar doing mathematics and his listening to and playing music.) Such left and right half changes need to be studied in the yogic state.

Logic and reason which ordinarily limit human brain function by the dominant left hemisphere have to be overcome to reach the thought free state (Zen teachers have been practicing this). In India, illogical processes, beyond reason have been mentioned in the Tharka Sasthras . This is not a recent western discovery. If logic and reason reside in the left hemisphere, is it easier for people with right brain dominance, to practise yoga?

6.14 *Women and yoga*

Practising higher yogic states has not been encouraged in women by our ancient rishis, though great yoginis are mentioned in the literature. One reason given was the burden of menstruation and child-bearing borne by women, which may make higher yogic states harmful to them during their reproductive age. Many women have right brain dominance and go beyond reason and logic in reaching conclusions, often by intuition. Would yoga be easier for them provided we eliminate any possible harm that may come from marked endocrine fluctuations?

6.15 *Mental disorders*

The study of *schizophrenia* by modern techniques may lead to some answer to the problem of consciousness. In these patients, there are divided personalities, each one self-aware and aware of the other personality. Where do these two units of self-awareness exist and how do they reach each other? A study may give some clue to understanding consciousness.

In *obsessive compulsive neuroses*, thought processes endlessly go round and round the patient's mind and make life miserable. In such cases, in the sixties and seventies, we performed bilateral anterior cingulumotomy with good benefit. In some cases, we had to combine it with a basofrontal tractotomy. These operations are performed nowadays in selected centres. These results may imply that one of the tracts involved in transmission of thought is the anterior cingulum. We also know that in frontal tumours, if the cingulum is involved, thought processes go awry. Hence, a study of the cingulum bundle may help. But how do we study this in a yogi?

6.16 *Glial cells*

Nature has provided a very large number of glial cells, almost equal in number to the neurons. For performing only a "glue function", is such abundance necessary? Recently we have come to know glial cells have a reciprocal metabolic relationship with neuronal cells. But the question is: Do they provide a type of energy or a communication system different from that of the neurons, i.e. apart from the electrochemical system? Does this system, dormant in the normal human being get activated by higher yogic practice to produce what we now call extraordinary or supernatural powers? These are some indications for future research.

7. The training of "Yogonauts"

It is important that we decide on the future priorities for research in consciousness. Indian scientists may pursue the same path followed by the West and try to localise various functions of consciousness in the networks of the brain (refer earlier). This would be useful and also keep our young researchers in the forefront of such research. *However the more important direction is for India to concentrate research into meditation and the thought-free state, or superconsiousness or the Thuriya state*. Our country is particulary suited for such research because of our background of knowledge of yoga and tantric sciences for over two thousand years. Only a few scientists outside India are really interested in this phenomenon of the thought-free state. In fact, some of them have dismissed the thought-free state as a vegetable state, without realising the great potentialities of the yogic state for the future of mankind. Hence research into Yoga and meditation and the thought-free state must be given top priority. Yeoman work was done in this field by scientists at the All India Institute of Medical Sciences, like Dr. B K Anand and Dr. Chinnha and others and by Dr. Desiraju at NIMHANS. Dr. Karan Singh, when he was the Health Minister, took a keen interest in the subject and encouraged research. The problem facing Indian scientists at this moment is the *lack of the appropriate latest sophisticated equipment like magnetoencephalogram*. EEG though useful is too crude a tool for research in yoga. We need to measure the various energy changes in the brain by other possible means. *The most difficult part of this research is to get subjects who practise yoga*. They are few and often do not come forward to submit themselves to study. Others do come but often prove to be fakes. There is only one way of approaching this problem. *Just like astronauts were trained for space flight, the NBRC and the Ministry of Education must have a scheme of selecting about 50 interested young men to practise yoga from their early teens*. The selection must be made carefully, bearing in mind the background of the individual, his intellectual level, his health and his determination to pursue the yoga course. They must observe the rules of training (*Yama* and *Niyama*), prescribed for yoga students in India from time immemorial. This will not be difficult, as even today a majority of Indians follow these rules of restraint. Selected young men must be offered a substantial monthly scholarship and placed under good yoga teachers. They will continue their normal education simultaneously. All the parameters of mental and physical health and yogic achievements can be measured every 3 months and the changes noted, as they continue to mature in yogic practices. Many of them may fail to fulfill the goal, but at least about 10 may be available in the end for study. With more finance, more people can be chosen. One could have a pilot programme and depending on its success, the scheme can be enlarged.

We cannot excel in physical prowess (see our Olympics results) but we certainly can win the intellectual race (witness the Indian Brain Power all over the world). The one area in which India can really contribute to the world's knowledge and happiness, is in the research into yoga and the understanding of the various energies released in the thought-free state (*Pathanjali Yoga Suthra*). This will also be in tune with the progress in other fields in other countries. No doubt, new energy forms will be discovered in the new millennium and we should not miss the one area in which we can excel. We cannot allow the West once again to steal our glory.

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Section 5

Genes and social behaviour

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Abstract

Descent via modification is the hallmark of evolutionary change. It is believed to come about by means of natural selection, a theory first put forward by Darwin and Wallace. Taken together with the modern picture of genes and heredity, this would seem to imply that to the extent that the properties of plants and animals are moulded by natural selection, to that extent they must be based on heritable properties, in other words, on their genetic makeup. Thus, assuming that our behaviour is a product of natural selection, there would be a genetic basis for behaviour (the term taken to include social behaviour). To what extent is the supposed genetic basis merely a necessary pre-requisite for the appearance of behaviour and to what extent is it, in explanatory terms, both necessary and sufficient? In the latter situation one might speak of genes 'for' behaviour. This essay considers whether it is justified to speak of genes determining behavioural traits or social behaviour. That genetic influences on social behaviour exist is a fact. The degree to which genetic inputs have been selected for as mediators of social

behaviour, as opposed to being merely facilitators (that were selected for other reasons), remains unknown. But the influences of genes and environment on the phenotype in general, not just on behaviour, are complex and interacting. This makes it difficult to think of a purely genetic component to social behaviour.

Introduction

If one were to list the basic principles that underlie all of biology, they would be three in number: (a) Evolution by natural selection (Darwin and Wallace), (b) Mendelian Genetics (Mendel; rediscovered by de Vries, Correns and Tschermak) and (c) the structure of DNA, the genetic code and ongoing advances in our understanding of the regulation of gene expression (Watson and Crick, Brenner, Nirenberg, Khorana, Jacob, Monod and a host of others). These three principles are integrated as follows. DNA, which is a gigantic molecule consisting of a pair of chemical strings, is the carrier of hereditary information. The information is in the form of a code; three successive bases or 'letters' of the DNA molecule stand for a particular amino acid 'message' (or convey the information that a contiguous string of messages is beginning or ending). Other DNA sequences bind proteins, or take up specific three-dimensional shapes, and thereby increase or decrease the probability that a particular stretch of encoded information gets decoded. The information contained in DNA is passed down from parents to offspring through a sequence of events that can be described mathematically by Mendel's laws. Finally, natural selection decides which sequences of DNA, or which genes, spread through a population and which are weeded out. To understand this all-important final step, one needs to know a bit more about what constitutes a living organism.

A short description of a plant or animal would be to say that it consists of a set of traits: a certain form, a certain size, a certain colour, a certain set of specialised tissues, a certain mode of development, a particular means of reproduction, and so on. Taken together, the traits are said to constitute a phenotype. Strikingly, a very large fraction of the phenotype – indeed, almost every aspect of the phenotype - can be correlated, at least in part, to the presence or absence of a particular protein or set of proteins.

For example, consider ovalbumin (egg-white), haemoglobin (the oxygen transporter in blood), myosin (responsible for muscle contraction and therefore also movement in general), antibody molecules (the body's defenses against foreign proteins and infections in general), collagen (the building block of tendons, bones and cartilage) and growth hormone (the regulator of bone growth). Each of these embodies an identifiable trait; all are proteins. Every protein can be defined by a sequence of amino acids, which in turn is specified by a sequence of 3-letter messages or 'codons' in the DNA. The traits that characterize an organism are intimately bound up with the proteins that make up that organism. It follows that the ability of an animal to survive and to reproduce successfully must also depend on the proteins that it is made of. The concept of fitness is central to the Darwinian picture of evolution. Fitness, also known as reproductive fitness, is the universal currency in which evolutionary transactions take place. The fitness of an individual is roughly equal to the number of offspring that it has, relative to the number of offspring born to the average member of its own species. What we have said so far shows that fitness must be correlated with the spectrum of proteins possessed by an individual. But the spectrum of proteins depends on the DNA sequences, or genes, in that individual. This is why the end result of natural selection ('survival of the fittest') is that some genes spread through a population whereas others are weeded out.

Natural selection acts on the phenotype and so on the spectrum of proteins in an individual. Genes that spread encode proteins that are better than average at doing their job; genes that are weeded out encode proteins that are worse than average. It is worth noting that in this formulation one speaks of genes and not individuals. This might appear strange. After all, it is the individual that reproduces. However, the process of sexual reproduction brings together and shuffles genes quite efficiently. Because of this, it is just as meaningful to speak of genes as the 'real' players in the evolutionary process, as the entities that 'actually' evolve, as it is to think about evolution in terms of plants and animals. The two views are equivalent. If one adopts this new and somewhat unusual point of view - that of thinking of evolution in terms of genes rather than in terms of plants or animals -, one can think of individual organisms as the vehicles (in Dawkins's phrase) used by genes to move from one generation to another. The visible manifestation of natural selection is that living creatures appear to be products of exquisite design: the traits that they possess are said to be *adapted* to the particular environments that they live in and to the life-styles that they display (the traits themselves are referred to as *adaptations*). This outcome is a consequence of two processes. One, there is a tendency on the part of 'good' genes to spread; and two, 'bad' genes tend to be weeded out. As used here, 'good' and 'bad' are relative terms. They refer to the relative number of copies of a particular gene in a population, meaning relative to the total number of copies of itself plus all other exiting alternatives to itself. Alternatively, one can think of 'good' or 'bad' as being reflected in the reproductive fitness of one individual *relative* to another. Because fitness is a relative concept, any trait which increases the fitness of an individual, or of a gene, automatically decreases the fitness of all others that lack that particular trait.

There is one aspect of the phenotype that we have ignored in this discussion, namely behaviour. Suckling in an infant, exploring the environment, communicating with others, foraging for food, defending oneself against a predator, searching for a mate, reproducing and taking care of the young, are all examples of different kinds of behaviour. Each of them serves as an example of a trait exhibited to different extents, or in different ways, by the members of a species. Do these differences have anything to do with proteins? In a trivial sense, they obviously do. Anything which involves movement must depend (as far as we know) on the action of contractile proteins such as actin and myosin. Anything which involves sensing must be mediated by the action of sensory proteins such as the receptors for vision in the eye, for touch in the skin or for taste on the tongue. Anything which involves sensation and feelings must be the result of electrical activity in the nervous system, which depends on the properties of special proteins that enable nerve cells to transmit electrical impulses in an all-or-none fashion. In short, proteins are required for behaviour as much as they are required for form, shape, size and colour. Therefore, it would seem quite reasonable to speak of behaviour having a genetic basis and, by extension, of behaviour evolving by natural selection. Indeed, there are sound experimental grounds for believing that many aspects of behaviour are adaptive. Having come this far, one might think of carrying on with this way of thinking to include social behaviour as well. A trivial extension might be all that is needed in order to speak of genes for social behaviour and of the evolution of social behaviour. But, as we shall see, there is a problem in trying to think about the evolution of social behaviour via natural selection.

Social behaviour: The problem of altruism

E O Wilson has described a society as "A group of individuals belonging to the same species and organized in a co-operative manner". He goes on to add that "the bond of the society is simply and solely communication". In turn, communication is defined as "Action on the part of one organism (or cell) that alters the ... pattern of behaviour in another organism (or cell) in an adaptive fashion". In short, **A** and **B** are said to members of a society if they belong to the same species and co-operate with each other by making use of signals to communicate with one another. **A** signals to **B** in order to convey some information. Upon receiving the information, **B** responds in a manner that is typical (even if only in a probabilistic sense) for the signal and for the context within which it was communicated. Here 'context' encompasses the phenotypes of the sender and receiver and their social, biological and physical environments. The behavioural response of **B** to **A**'s signal is adaptive, implying that whatever **B** does is, in an evolutionary sense, beneficial. But, in the first instance, the benefit is to **A**. Here is the crux of the problem. Why should **B** do something which, in a manner of speaking, helps **A**? Even worse, why should **B** do something that guarantees, as it does *ipso facto*, a lowering of its own reproductive fitness relative to that of **A**? And most importantly, assuming that **B**'s behaviour had a genetic basis, how could the associated genes spread through the population - given that they were harming their own interests, so to speak?

The puzzle sketched above is the apparent paradox of altruism, posed in an extremely truncated form. There are well-documented cases in which the paradox seems to apply. Instances of social behaviour in which an individual appears to behave altruistically towards another, meaning that it seems to forsake its own genetic fitness in order to ensure the genetic fitness of another individual, are legion. The classic case is a whole range of traits exhibited by individuals belonging to the worker castes in the social insects.

For example, honeybee workers are sterile individuals, neuters. They spend their lives taking care of the nest, gathering food, fighting off predators and tending to the queen, all the while abstaining from reproduction. Their behaviour appears to be innate, as opposed to being learnt: nests founded by single queens, with the workers having no opportunity of learning from other workers, testify to this. Therefore, the behaviour is inherited and quite plausibly gene-based. But in that case, given that the workers have no offspring to pass on the behaviour to, how could it have evolved? (There is little doubt that the altruistic behaviour displayed by social insects is a product of evolution; the ancestors of these insects led solitary lives, with altruism not being called for.) The paradox of altruism is exhibited in an enormous range of organisms from amoebae to vertebrates. In the cellular slime mould Dictyostelium, single, free-living, amoebae graze a patch of soil that contains bacteria, their normal food. When all the bacteria in a given area are used up, the amoebae signal to each other by means of a chemical attractant that makes them aggregate. Having done so, the amoebae within an aggregate, which were until then more or less identical in form and behaviour, start exhibiting a division of labour; they proceed to differentiate. A minority die and pile up, one above the other, to form a rigid support and the rest turn into spores. The spore mass, which is capable of surviving long periods of starvation, forms a ball that rests on top of the stalk-like rigid support. It appears that the sole purpose of the amoebae that go into forming the stalk is to see that the spores are positioned at a height - a location that aids in their dispersal, with luck to some place where food might be available. At an other extreme, Thomson's or Grant's gazelles that sight a predator (say a pack of wild dogs) start to run in a conspicuous, stiff-legged, jumping gait with raised tails. This form of locomotion is known as stotting. Stotting is an example of an alarm signal. In a typical alarm signal, the signaller gives the impression of putting himself or herself at risk while at the same time trying to ensure the escape of others by warning them. As in the case of the Dictyostelid amoebae, one sees here a form of social behaviour that appears to be altruistic and, in an evolutionary sense, self-destructive. What might explain the origin of altruistic behaviour?

Before considering the alternatives that have been put forward, we need to get a seemingly facile explanation out of the way. The explanation is that what is being recognised as an altruistic act is indeed so, but is it for the 'good of the group' or the 'good of the species' that the act is being performed. 'Good of the species' arguments are superfically attractive. But they flounder on a very serious objection. The objection is that it is individuals that are born, reproduce and die, and moreover do so at rates that far exceed those of groups. Therefore, if something that is advantageous to the group is disadvantageous to the individual, it is most unlikely that it will spread. The reason for saying so is that the harm caused to the individual will weed it out more rapidly than the good caused to the group will enable it to spread. To put the argument the other way round, traits that benefit groups but extract a cost from individuals will always be counteracted - successfully counteracted - by traits that benefit the individual even if they disfavour the group. In the case of the slime mould amoebae, a variant amoeba that decides never to form part of the stalk, but invariably to form a spore, is guaranteed to improve its chances of passing down genes to the next generation. This holds true even though the resulting shorter stalk may mean a lowered probability of successful dispersal and so a smaller chance of reproduction for all spores. In the case of the honey bee workers, a genetically variant worker that managed to prevent its ovaries from degenerating and so kept alive its chances of reproduction (assuming she could get away with it) would be counted a success relative to the other workers. Again, this would be true even if she lowered the overall productivity of the hive by acting in this fashion. In the gazelles, presumably a confirmed non-stotter would never draw the attention of a predator to itself and so would improve its own chances of survival. In contrast to 'altruistic' behaviour, behaviour of this sort is referred to as 'selfish'. When exhibited by a selfish individual who is the lone deviant in a group of altruists, it is also referred to as 'cheating'.

Before proceeding further, let us summarise the argument so far. In principle, social behaviour can have a genetic basis. But social behaviour often implies cooperation, at times leading to altruism. And between two genes whose possession leads to different degrees of altruism, the one that is correlated with the greater degree of altruism must always suffer relative to the other. Logically, the situation should regress to one of maximum individual selfishness and zero altruism. Given that instances of apparently altruistic behaviour abound, one is left with two choices. Either there is an entirely different (non-genetic, or only partly genetic) explanation possible for altruistic social behaviour, or there is some way that social systems can guard against cheaters and so foster altruism.

Inclusive fitness

In a pair of seminal papers published in 1964, W D Hamilton indicated a possible route out of the paradox of altruism. The solution that he proposed had been anticipated by both R A Fisher and J B S Haldane, two of the founders of mathematical evolutionary theory. Neither of them developed the idea as fully as Hamilton did. Haldane's formulation has a well-known anecdotal version. The story goes that while walking along the bank of a canal with a friend, Haldane said that he would be willing to dive into the canal, and in the process risk certain death, if by doing so he could guarantee the survival of more than two of his brothers, or more than eight of his first cousins, and so on. As explained in a more sophisticated formulation by Hamilton, the reasoning goes as follows. Assume that the performance of an altruistic act confers a benefit b on the receiver while extracting a cost c from the performer. As always in evolution, costs and benefits are measured in units of reproductive fitness. Suppose the performer and the recipient are related by a factor r (roughly speaking, r is the fraction of their genes that they share because they can trace a part of their descent from the same set of common ancestors). It is easy to see that the altruistic act is at the same time advantageous - to the recipient - and detrimental - to the doer. If one looks at the genes in the performer, their reproductive success is harmed by the performance of the altruistic act; this is by the very definition of 'altruism'. Now, assume that the performance of an altruistic act is correlated with the presence of a particular gene – in other words, assume that there is a genetic basis for altruism. Then, if r is not zero, there is a finite probability that the very same gene or set of genes is also present in the recipient But, again by definition, the reproductive prospects of these genes have improved when looked at from the viewpoint of the recipient of the altruistic act. What might be the net consequence of the simultaneous advantage and disadvantage?

Hamilton pointed out that under certain circumstances there could be a net advantage to the genes that were correlated with the performance of the trait. Such would be the case whenever the benefit to the recepient, b, was greater than the cost to the performer, c, *after devaluing the benefit* by an appropriate factor to take into account the fact that the recipient is not genetically identical to the donor. In fact the factor of devaluation is just the co-efficient of relatedness, r. The mathematical requirement for an altruistic trait to spread can be expressed very simply in the form

$$b.\, r > c \quad \text{or} \quad b > c/r$$

(> stands for 'greater than'). Siblings share half of their genes on average (r=1/2) and first cousins share one-eighth of their genes on average (r = 1/8), which explains how Haldane made his suicidal offer on the canal bank. Hamilton coined the term inclusive fitness to take into account both the direct component of fitness, as measured by number of offspring, and the indirect component of fitness, as measured by number of offspring born to relatives, the second number being devalued by the coefficient of relatedness. An altruistic act can result in an increase in the performer's inclusive fitness if the loss in the direct component is more than made up by a gain in the indirect component. The problem of altruism appeared to have been solved by adopting a gene's eye view of evolution.

But a number of conditions need to be satisfied before one can judge whether Hamilton's formulation works in any given situation. Firstly, the behaviour in question must have an innate component: different versions of the behaviour must reflect, at least to some extent, different genetic constitutions. Secondly, individuals must be capable of recognising those with whom they share genes by common descent – their relatives. Thirdly, and crucially, the values of benefit (b), cost (c) and relatedness (r) must be measurable and must satisfy the relation $b.r > c$. What are the facts?

Testing Hamilton's formulation

Studies hinting that there might be a role for genes in the performance of various behaviours have a long tradition. In the sense of there being an instinctive aspect to behaviour, they go back all the way to Darwin's *The expressions of emotions in man and animals,* a book that was published in 1877, well before the rediscovery of Mendel's laws. Today, the genetic basis of behaviour – or, more accurately, the genetic basis of differences in behaviour – is a well-established field. A huge number of cases are known in which genetic variation, most commonly caused by mutation, is correlated with behavioural variation. In some cases the findings are striking. The trait of 'waltzing' in mice carries with it a host of behaviours. These include shaking the head, circling rapidly and being irritable. Waltzer mice breed true; crosses with non-waltzing inbred mice lead to the conclusion that waltzing is due to a simple genetic change. In technical language, the waltzing trait exhibits a segregation pattern characteristic of a simple Mendelian locus. More astonishing are the findings of Rothenbuhler with honeybees. American foulbrood is a bacterium that infects honeybee larvae and kills the pupae after the larval cells have been capped. Rothenbuhler found that some hives were resistant to what was otherwise a virulent epidemic caused by the bacterium. Careful tests uncovered the basis of this resistance. The workers in the resistant colonies exhibited an unusual form of 'hygienic' behaviour that involved uncapping a hive containing a dead pupa and then removing the corpse. Remarkably, both uncapping and removal segregated as single Mendelian recessives (recessive means that the normal unhygienic traits were expressed in the offspring of matings between hygienic and unhygienic strains).

As it happens, these cases are exceptions. The rule is that the genetics of behaviour is, firstly, extremely complex, depending not only on many loci (i.e., on a large number of genes) but also on the overall genetic 'background' and environmental influences, including those of the social environment. Secondly, behaviour is so strongly overlaid by learning that the genetic basis may be trivial. It may amount to little more than saying that a creature needs to be alive before it can see, so that any gene that is essential for life can be thought of as a gene 'for' seeing.

Even if variations in a trait are influenced by many genes, it is possible to make an estimate of the extent to which the variation is due to genetic effects and the extent to which it is due to everything else. In order to do so one needs careful observation and experimentation. Here 'everything else' includes effects due to the environment as such as well as effects caused by interactions between genes and the environment. An example may help. Suppose two inbred strains of mice are being compared with regard to an aspect of social behaviour, say a tendency on their part to forage in pairs. The first strain may be more social than the second at low temperatures, less social at high temperatures and, at any temperature, display more variability than the second. Evidently part of the difference between the strains could be caused by innate factors (genes), part by the manner in which genes are expressed in particular environments, and a residual effect may be attributed to a 'pure' environmental effect. Disentangling these is difficult. Further, as will be illustrated later, even seemingly innate causes may be strongly dependent on the environment. But, in theory, if the separation is possible, one can make an estimate of how much genetic factors influence behaviour. The estimate depends on something called heritability. Loosely speaking, heritability is a measure of the extent to which variations in a trait can be ascribed to genetic causes.

More precisely, heritability in the narrow sense ($\mathbf{h}_N^2$) expresses the relative extent to which something called the additive genetic variance contributes to the overall variance in a trait. Additive genetic variance reflects (again, speaking loosely) the extent to which the resemblance between parents and offspring is due to shared genes. Therefore, it plays a central role in both heredity and evolution by natural selection.

What are the observed values of $\mathbf{h}_N^2$? Obviously, the answer depends on the trait under examination. For example, much work has gone into studying so-called 'open-field' behaviour exhibited by mice. An example of open-field behaviour would be the level of physical activity in the open. Such behaviours have been monitored using a whole range of techniques. These include family studies (which are focused on extents of resemblance as a function of degrees of relatedness), comparisons within and between inbred strain, matings carried out in various combinations between genetically marked stocks and attempts at selection. Overall, they yield a narrow-sense heritability estimate of about 0.25 for a variety of 'open-field' behaviours exhibited by mice raised for 30 generations. How about human data? Here one runs into the obvious problem that controlled breeding experiments are impossible. The best one can do is to measure correlations between relatives under various circumstances. A favourite method of researchers is to compare monozygotic ('identical') twins, who share all their genes in common, when they are raised together (i.e., supposedly in the same environment) or raised apart (i.e., very likely in different environments). Roughly speaking, resemblances that persist even when the twins are raised apart hint at a significant genetic component to the trait under study. Extensive as the studies are, it turns out that in most instances the best outcome that one can hope for is an estimate, not of the narrow-sense heritability $\mathbf{h}^2_N$, but of something quite different, known as heritability in the broad sense and symbolised by $\mathbf{h}^2_B$. The difference between the two is that besides reflecting the additive component of genetic variance as $\mathbf{h}^2_N$ does, $\mathbf{h}^2_B$ also includes that part of the variance that is due to gene-gene interactions. A typical consequence of a gene-gene interaction would be that the effect of one gene would be modified by the presence or absence of a quite different gene – in the jargon, by the presence of a gene at another locus. Such interactions are transitory in the sense that they depend on the co-existence of both genes in the same individual. The co-existence stops once gene combinations are broken up in the course of the inevitable shuffling of genes that accompanies meiosis, the central element in sexual reproduction. Therefore $\mathbf{h}^2_B$ overestimates the extent of variation that is, evolutionarily speaking, significant in the sense that it is available for selection . *If* the behavioural trait under study is influenced by a number of genes acting more or less independently (the 'beans in a bag' model of population genetics), the overestimate may be negligible. On the other hand, where gene interactions are significant for defining the trait in question, the overestimate can be serious. Keeping this caveat in mind, we note that known data typically yield estimates of $\mathbf{h}^2_B$ for behavioural traits of about 0.5. Thus, in the sense of providing the raw material on which evolution by natural selection can act, significant genetic influence on behaviour is, to put it colloquially, unlikely to exceed 50%. And that goes for social behaviour as well.

In the light of this observation, what is the current status of Hamilton's explanation for the evolution of social behaviour in terms of inclusive fitness? The best answer at the moment is that social groups, whether of amoebae or insects, do not appear to be characterized by especially high levels of genetic relatedness (**r** in the earlier notation). Therefore Hamilton's condition $b.r > c$ would seem to require testing more in terms of the associated benefits and costs of altruistic behaviour, **b** and **c**, rather than in terms of **r**. This is quite difficult, because both measurements require long-term observations in the field combined with close monitoring.

There is an alternative model to explain cooperative social behaviour that has been put forward by Trivers. It goes by the name of reciprocal altruism. In brief, Trivers's hypothesis states that an altruistic act by one individual towards another can be favoured by natural selection *even when the two individuals are unrelated*. This can happen so long as there is a reasonable expectation on the part of the first individual that the second individual will reciprocate in the future by behaving altruistically towards it. Clearly, reciprocal altruism depends more on the ability of individuals to sense, remember and plan for the future than on the actions of genes *per se*. As with Hamilton's principle, it remains to be seen to what extent the Trivers hypothesis is a generally valid explanation for the evolution of social behaviour.

Why behaviour is only loosely linked to genes

Why is it that genetic explanations for social behaviour have proven elusive? One reason has been already stated, namely the difficulty of measuring benefits and costs of behavioural acts. Besides that, two additional reasons make it difficult to analyse the genetics of social behaviour. Firstly, learning is an important component of what shapes, not just human beings, but also all animals that have nervous systems and brains. Genes play a part in how the network of nerve cells and their connections develop during embryonic, fetal and even post-natal life. In this manner genetic information helps in the construction of brains. Having done so, genes sit back, as it were, and permit our sensory, associational and motor neurons to interact with the external world and be shaped by their experience while doing so. Thus, behavioural differences between individuals are to a large extent the outcome of interactions between nerve cells and the environment; for all practical purposes they are de-linked from genetic differences. Avital and Jablonka have recently amassed a huge amount of evidence to show just how important learning, especially social learning, can be in shaping behaviour.

There is a second reason why the role of additive genetic variation gets downplayed in accounting for differences in behaviour: subtle interactions between genes and the environment confound the issue. The nature of these interactions often leaves genetic factors and environmental factors entangled to such an extent that separating them can become practically impossible. On occasion it turns out that what appears to be a single genetic effect has in fact a strong environmental component. Designing the right experiment even to show that the two are entangled, let alone to disentangle them, can be a formidable task.

Here is an example from the work of Wood and colleagues. Experiments were carried out to mimic certain aspects of schizophrenia in rats. The aim was to examine to what extent genetic and environmental factors contributed to the behavioural symptoms characteristic of schizophrenia, in the animal model at any rate. Rats carrying lesions in a region of the brain known as the ventral hippocampus are known to display some of these symptoms, in particular post-pubertal locomotor hyperactivity. The symptoms differ between different inbred strains of rats, thereby hinting at an underlying genetic basis. Neonatally caused lesions in the ventral hippocampus showed that a particular strain of inbred rats, the Fisher strain, is extremely sensitive to a lesion. Hyperlocomotion can be readily induced in Fisher rats by the drug amphetamine. However, the amphetamine effect is absent in another inbred strain of rats, the Lewis strain. Clearly, the behaviour is specific to the strain of rat. An obvious hypothesis might be that generations of inbreeding have resulted in the accumulation of different sets of genes in the two strains, with the different sets being responsible for the different behaviours.
An elegant experiment showed that the inference was mistaken. Newly born Fisher and Lewis rat pups were allowed to be cross-fostered by females of the other strain and the ventral hippocampus was lesioned after some days. When monitored much later, it was found that the amphetamine-induced behaviour was affected by the strain of the foster-mother (the dam) raising the pup, rather than that of the pup itself. In short, rather than being due to differences in the genetic composition of the two strains themselves, the behavioural difference appeared to be

more due to differences in early environmental influences – here, the environment referring to that contributed by the mother while nurturing her pup. The findings leave open the question of the extent to which the differences in maternal behaviour can be attributed to genetic factors (and raises the intriguing possibility of an infinite regress). But they make it clear that as far as rats with a lesion in the ventral hippocampus are concerned, differences in amphetamine-induced hyperlocomotory behaviour in later life are more on account of differences in early environmental variables than in genetic differences between the Fisher and Lewis strains. The more general implication is, of course, that while analysing behaviour, it is difficult to draw a distinction between purely genetic and purely environmental influences.

Conclusion

In all higher animals, behaviour – including social behaviour – is among the traits under the control of the neuromuscular system. Behaviour depends on a great many inputs. Among the most important of them are (a) the set of genes that define the protein constitution of the individual animal, (b) the nervous system of the animal and (c) the environment of the animal including nurture and social interactions. All three inputs can be used as a part of the explanatory framework for describing and attempting to understand behaviour at various levels. At the genetic level, Hamilton's theory of inclusive fitness provides a potentially attractive explanation for social behaviour; but it remains fully to be tested. When one considers the problem of social behaviour in general, it appears that genetic inputs are inextricably entangled with other inputs. These, broadly speaking, derive both from other genes and from the environment. The prudent inference to draw would be that genes and gene products merely enable behaviour to occur. But, exceptional cases apart, they do not in any meaningful sense cause it, much less programme or direct it.

Further Reading

(The list is far from comprehensive and is meant merely to serve as a set of signposts.)

Two popular books by Dawkins contain gene's eye views of evolution in general and the evolution of social behaviour in particular: Dawkins, R (1986) *The Blind Watchmaker* (Longman) and Dawkins, R (1976) *The Selfish Gene* (Oxford University Press).

A useful corrective to the extreme gene-centred view of biology can be found in Rose S (1998) *LIFELINES. Biology Beyond Determinism* (Oxford University Press). Two recent essays on the same theme are Bateson, P (2001) Where does our behaviour come from? *Journal of Biosciences* **26:** 561–570 and Newman, S A (2002) Developmental mechanisms: putting genes in their place. *Journal of Biosciences* **27:** 97–104.

The best introduction to the biology of social behaviour, including discussions of the ideas of Hamilton and Trivers, is Wilson, E O (1975) *SOCIOBIOLOGY. The New Synthesis* (Belknap Press, Harvard). The controversy that Wilson's book generated had much to do with human behaviour and is discussed by Segerstråle, U (2001) World views and Trojan horses in the sociobiology debate. *Journal of Biosciences* **26**: 549–554.

The experiments to estimate the heritability of open field behaviour in mice are described in DeFries, J C, Gervais, M C and Thomas, E A (1978) Response to 30 generations of selection for open-field activity in laboratory mice. *Behavioural Genetics* **8**: 3–13.

Social learning is dealt with in depth in Avital E and Jablonka E (2000) *Animal Traditions* (Cambridge University Press).

How early maternal influences can mislead one into imagining a direct genetic effect is described by Wood G K, Marcotte E R, Quision R and Srivastava L K (2001) Strain differences in the behavioural outcome of neonatal ventral hippocampal lesions are determined by the postnatal environment and not genetic factors. *Eur. J. Neuroscience* **14**: 1030–1034.

The biology of laughter

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Abstract

Laughter is a reflex action which, in humans, could be derived from higher level cognitive processes. Although laughter is a familiar behaviour, there has been very little research on its biology. This paper will summarize existing theories about the evolution of laughter and its social significance. It will also investigate the pathology of laughter, as well as the types of experiments and observations underway to study its context.

Is laughter a uniquely human phenomenon? Is it indicative of a higher level of cognition and consciousness? What is known about the anatomy, neuro-circuitry, ethology and pathology of laughter? This paper will present some recent work on the biology of laughter and will attempt to place this behaviour in a functional and evolutionary context.

The Scottish anatomist and surgeon, Sir Charles Bell, author of *Anatomy and Philosophy of Expression* (1806), and best known for the discovery of motor and sensory functions of nerves, claimed that the "Creator had endowed the human face with unique muscles that allowed man to express his unique emotions which reflected his unique moral nature". Such "anatomical chauvinism" (Ekman, 1998 in afterword to 3rd edition of Darwin, 1872) disturbed Charles Darwin and he is even believed to have written his seminal *The Expression of the Emotions in Man and Animals* (1872) to challenge Bell's claims. In this book Darwin attempted to find parallels between human and animal expressions and analysed their similarities and differences. Darwin was particularly intrigued by the possibility that humans throughout the world, although not in contact with each other, could recognise and respond to particular facial expressions in the same way. He had photographs of humans with various expressions sent to missionaries and explorers in remote places with specific instructions to show these to isolated peoples and gauge their reactions or to ask them to identify what those expressions meant. Darwin was helped in his study of human facial expressions by Guillaume-Benjamin Duchenne de Boulogne, a French anatomist who would collect severed heads from the guillotine during the French Revolution to study their anatomy and who wrote an important book *Mécanisme de la Physionomie Humaine* (*The Mechanism of Human Facial Expression*) in 1862. In this book Duchenne reproduced several photographs of a human subject who had facial palsy due to which his facial expressions as stimulated by the galvanic devices in use during that period could be very precisely restricted to the movements of a few muscles. Duchenne was thus able to discover the exact number of muscles involved in the human smile (which he recorded as 22), and as a tribute to his work, psychologists today categorise smiles as being of the Duchenne or non-Duchenne type.

Among animals, only man's closest living relative, the chimpanzee, is believed to produce a vocalisation that is similar to human laughter. Even in human laughter there are apparently some laugh utterances that are forbidden, eg. ha-ho-ha-ho-ha is forbidden as is he-ho-he-ho-he, while repeated utterances of some syllables such as ha-ha-ho-ho-he, ho-ha-ha-ha-ha or ha-ha-ha are permissible (Provine 2000). This may have to do with the basic neuro-musculature involved in laugh production which precludes certain utterances. Another fundamental difference between chimpanzee and human laughter is that chimpanzee "laughter" sounds are separated, onset to onset, by about 120 ms, while those of humans are separated by 210 ms (Provine 2000). This is because chimpanzees vocalise during both inhalation and exhalation while human laughter occurs by the syncopation of a single exhalation. This means that humans have much more control over laughter vocalisation than chimpanzees. This led Provine (2000) to suggest that the bottleneck in the evolution of ape speech probably lies more in the domain of sound production than in cognition and symbolic capacity. Provine therefore proposed the Bipedal Theory of Speech according to which the evolution of bipedalism set the stage for the emergence of speech by freeing the thorax of the mechanical demands of quadrupedal locomotion and loosening the coupling between breathing and vocalising; however, the evolution of bipedalism was a necessary, though insufficient, condition for the evolution of speech in primates.

Is laughter influenced by social relationships or gender? In a preliminary examination of dyadic interactions, both male and female audiences laughed much less when the speaker was a female while male and female audiences laughed the same amount as the speaker did when the speaker was a male. The evidence seems to indicate that females were the leading laughers while males were the one who got the most laughter in response (Provine 2000). There also appear to be many social uses of laughter, e.g. deflection of anger by appeasement, strengthening of social bonds, and assertion of power.

Laughter can be generated by the sensation of tickling. Chimpanzees also produce laughter-like sounds and smiles on being tickled and the cutaneous areas that can evoke the appropriate "laughter" on being stimulated appear to be the same areas that humans find ticklish. This was known and described by Darwin in 1872. However, an important point is that one cannot tickle oneself to laughter. The fact that one cannot self-tickle is specifically related to the recognition of whether the ticklish stimuli are self-generated was revealed by an interesting set of experiments conducted by Weiskrantz and Blakemore using tickling machines (Weiskrantz *et al* 1971; Blakemore *et al* 1998). These scientists found that a human's inability to self-tickle is due to the neurological cancellation of the sensory consequence of self-produced movements. When robotic tickling machines were designed such that there was a delay of at least 1/5th of a second between the human subject moving a joystick and the receipt of a tickle, only then did the subject feel ticklish. This indicates that a minimum delay of 1/5 s between the movement generating the tickle and the receipt of the tickle was required to prevent self-recognition.

To define an act as funny if it evokes laughter appears to be circular. However, it is acknowledged that the cognitive abilities of individuals determine the levels of humour that can be appreciated. The phenomenon of laughter is now being used in psychological tests to determine the theory of mind (TOM) capabilities of individuals. For example, people with various types of disorders of empathy, autism and schizophrenia, may appreciate visual cartoon-level humour but cannot appreciate higher levels of humour that require "mentalising" (Corcoran *et al* 1997). Individuals with Asperger's syndrome (a disorder of empathy) can neither appreciate metaphor nor understand subtle humour, but tend to take words at their literal meaning. Thus individuals with impaired social skills owing to impaired psycho-neurology tend to fail on laughter scores. Children also experience an ontogeny of humour appreciation. Younger children respond to visual cartoon humour or slapstick comedy while older children begin to find more complex humour also funny. Adults can appreciate satire, rhetoric, black comedy and farce. Laughter is therefore used as a litmus test for some higher-level cognitive functions.

There is a taxonomy of laughter pathologies which has helped to determine the neurological circuitry that produces laughter. Gelastic seizures or laughter seizures are typical of hypothalamic harmatomas (Sturm *et al* 2000) and are the equivalent of neurological storms in the brain that occur during epileptic seizures. Laughter also occurs as a result of trigeminal neurinomas and damage to the right frontal lobe (Bhatjiwale *et al* 1996). Removal of such tumours often causes a subsidence of the laughter symptoms. Certain genetic disorders, e.g. Angelman's syndrome which is due to a maternally expressed imprinted gene mapping on to chromosome 15q11-13, have laughter as a symptom (Albrecht *et al* 1997). This is why children with

Angelman's syndrome are often characterized as "happy" children. The various pathologies of laughter have resulted in the suggestion that laughter is caused by a neuroanatomical circuit that includes the anterior cingulate gyrus, the caudal hypothalamus, the temporal amygdala and the pontomedullary centre (Mendez *et al* 1999). Laughter can also be contagious and sometimes pathologically so. This may even include elements of hysteria, as was described in a set of schools in Tanzania where so-called laughter epidemics broke out resulting in temporary school closure (Provine 1996).

Coherence, incongruity and the element of surprise are necessary ingredients for laughter in a subject with normal or non-impaired cognitive functions. Therefore the presence of an anomaly in an unfolding scenario or situation is essential in the anatomy of humour. Ramachandran (Ramachandran 1998) proposed the False Alarm Theory of Laughter based on experience of patients with pain asymbolia. In this condition, a patient will claim that he feels pinpricks but that it no longer hurts; such patients may even start giggling or laughing when pricked with a pin. The insular cortex normally receives sensory input including pain from the skin and viscera and sends the output to the limbic systems such as the cingulate system which will then initiate a strong aversive reaction such as withdrawal of the hand from the pinprick. However, according to the False Alarm Theory, if the neurological damage were to disconnect the insular cortex from the cingulate gyrus, one part of the brain, i.e. the insular cortex, would be telling the brain that there was pain while the other part of the brain, i.e. the cingulate gyrus, would be reporting that there was nothing wrong owing to the discontinuity in the complete circuit. This perception of an anomaly would then end in laughter as a result of the two key ingredients of the laughter circuit being present, i.e. threat followed by deflation. Ramachandran (1998) therefore proposed that the only way to resolve this paradox is to laugh. This may then therefore also explain why laughter occurs on tickling as in this situation also there is only mock threat. This could be why babies only respond with laughter or smiling when tickled by known people, especially their mothers, but should a stranger perform the same tickling action, which should stimulate the same sensory neurons, the result is usually tears rather than laughter.

In conclusion, laughter appears to be largely an involuntary action that can be evoked as a result of both lower and higher level cognitive processes. Although man appears to be uniquely capable of laughter in response to incongruous or anomalous situations, laughter-like sounds and laughter-like responses to tickling are also produced by chimpanzees. Recent experimental work has indicated that chimpanzees do have theory of mind as they appear to know the mental states of other chimpanzees (Hare et al 2001). Theory of mind appears to be a necessary requirement for humour appreciation. Are chimpanzees then merely constrained by vocalisation abilities in communicating higher level cognitive processes? The chimpanzee "smile" which is often given in "appeasement" sequences is thought to be derived from a threat grimace which has lost its aggressive content (Provine 2000). Much more research on chimpanzees and related higher apes obviously needs to be conducted to understand their levels of cognition and consciousness.

Is Koestler (1964) right then when he claimed that for the emergence of *Homo ridens* (laughing man), "…a level of evolution had to be reached where reasoning had gained a certain degree of autonomy from the 'blind' urges of emotion ….Only at this stage of 'cortical emancipation' could man perceive his own emotions as redundant, and make the smiling admission 'I have been fooled'."

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What is it like to be a monkey? Attribution and intentionality in wild bonnet macaques

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Abstract

Empirical and observational studies of animal consciousness will truly benefit if different manifestations of consciousness can be defined functionally; this becomes particularly important because, in animals, consciousness has to manifest itself as behaviour, behaviour that can be unambiguously ascribed to an effect of being conscious. Two proposed functional definitions of consciousness include perceptual consciousness (the state or faculty of being mentally conscious of anything) and reflective consciousness (the recognition by the thinking subject of its own actions and mental states). Current thinking holds that certain nonhuman primates may indeed be perceptually conscious, at least on occasions, but are unlikely to be reflectively so. An important functional manifestation of perceptual consciousness is attribution. To attribute beliefs, knowledge and emotions to both oneself and to others is to have what has been termed a theory of mind. Social primates appear to be knowledgeable about one another's behaviour to different extents. But do they know as much about one

another's beliefs and intentions? Are they adept at recognising the similarities and differences between their own and others' states of mind? Attribution of mental states to other individuals could manifest itself in diverse situations as, for example, when individual animals closely observe the actions of others, when they interact competitively, or when they deceive each other in the social sphere. Such behavioural constructs need to be analysed carefully in order to ascertain whether true higher-order intentionality can indeed be invoked as underlying mechanisms governing these acts. This paper will examine the possible cognitive bases of social knowledge and tactical deception, processes that appear to be integral to the development and maintenance of social relationships in wild bonnet macaques (Macaca radiata), a primate species endemic to peninsular India.

Evolution of the primate mind: Are primates conscious?

Empirical studies on the cognitive abilities of nonhuman primates and their underlying mechanisms developed primarily because we assume that their minds are most like our own and because of our belief that an understanding of nonhuman primate minds may eventually allow us to trace the evolutionary routes to the complexities of the present-day human mind.

A feature that seems ubiquitous to most palaeotropical primates including the great apes and humans is the presence of a social matrix in which individuals seem to spend most of their lives. Extensive social interactions between individuals of different ages, sexes, dominance ranks and kinship are thus typical of many of these societies (for reviews, see Smuts *et al* 1987). The development and maintenance of such complex social relationships – each different in its own way – is believed to have placed unusual demands and selected for enhanced cognitive abilities in individuals living in such societies (Humphrey 1976; see also Chance and Mead 1953; Jolly 1966). If this is true and if indeed there has been a general increase in social complexity – in at least some of its dimensions – during the course of primate evolution, does this provide at least indirect evidence that there has been a progressive evolution of the primate mind, culminating in the human mind, as well?

Although there is now increasing belief that primate minds can be rather complex, the question of whether nonhuman primates can be considered truly conscious continues to be a contentious one. Related to this problem is perhaps one of the most difficult aspects of studying consciousness – that of providing an objective scientific definition of the phenomenon. This definition obviously has to be functional in order that it can be dissected out analytically. And it becomes an even greater problem when studying nonhuman primates – because consciousness then has to manifest itself in behaviour – behaviour that can be unambiguously ascribed to being an effect of being conscious.

Two functional definitions of consciousness that have been proposed are *perceptual consciousness*, the state or faculty of being mentally conscious of anything, and *reflective consciousness*, the recognition by the thinking subject of its own actions and mental states (Griffin 1992). Thus, if an animal were perceptually conscious, it would be able to exist in certain mental states – it might, for example, believe, think, or remember. If, in addition, it were reflectively conscious, it would be aware of its own mental states – whether they are beliefs, thoughts, or memories. Current thinking holds that some of the higher primates may indeed be perceptually conscious, but are extremely unlikely to be reflectively so. The principal reason for this bias against the belief that primates can reflect on their thoughts and actions may, however, largely be methodological: people can tell us what they are aware of, monkeys cannot.

Intentionality and attribution

Functionally, an elegant theoretical framework to investigate higher cognitive processes in nonhuman primates in terms of mentalistic notions is that of Dennett's *intentional stance* (Dennett 1987, 1988). Thus, if one assumes that primates are intentional systems capable of mental states like beliefs, desires and emotions, different levels of intentionality can be clearly postulated:

Zero-order: An individual has no beliefs or desires at all. All behavioural actions are thus instinctive, invariably evoked in response to specific stimuli.

First-order: An individual has beliefs or desires, but no beliefs about beliefs. An actor may, therefore, intentionally generate behavioural acts but it need not necessarily have any conception of the audience's mental states.

Second-order: Some conception exists about both one's own and other individuals' states of mind. An individual may thus behave in a particular way because it wants others to believe in something.

Third-order: At this level, an individual may want others to believe that it itself has a particular belief or is in a specific emotional state.

Higher-order intentionality (including second- and third-order levels) is interesting because it requires the ability to represent simultaneously two different states of mind – that of the actor and of the audience. To do this, an individual must recognise, for example, that it has knowledge, others have knowledge, and that there may be a discrepancy between them – or, for that matter, between any of the intentional states held by these two minds. Unfortunately, very few studies – either in the wild or in captivity – have so far extensively tested for these alternative capacities of intentionality in primates.

It is clear from this discussion that a very important functional manifestation of higher-order intentionality, and therefore of perceptual consciousness, is *attribution*, whereby an individual is capable of attributing thoughts, emotions and desires to another individual (see also Cheney and Seyfarth 1990). Primates are evidently knowledgeable about each other's behaviour, to the extent that they can often predict and act upon this knowledge even before a behavioural interaction has occurred (Sinha 1998). But do primates know as much about each other's beliefs, emotions and intentions? To attribute beliefs, knowledge and emotions to both oneself and to others is to have a *theory of mind* (Premack and Woodruff 1978). And if indeed primates are able to attribute mental states to one another, are they capable of recognising the similarity and differences between their own and others' states of mind?

A hard problem!

Perhaps the most difficult problem in understanding cognitive processes in non-verbal subjects – be they pre-verbal human infants or truly non-verbal primates – is the question of whether an individual is discriminating between others' states of mind or simply reacting to differences in their behaviour patterns. While it is evident that true mind-reading can only be achieved through some form of behavioural analysis and can, therefore, perhaps be considered a sub-category of behaviour-reading (Whiten 1993, 1996), it becomes important in certain situations, as, for example, in the analysis of deceptive interactions, to differentiate between actual behaviour analysis and the more cognitively sophisticated (as well as evolutionarily advanced?) mentalism. Although many philosophers of mind have argued that these two processes represent mutually exclusive phenomena (for example, Fodor 1968), it can be better argued and examples provided from human cognitive processes to demonstrate that they represent two positions on a possible continuum (see also Whiten 1994).

A theoretical concept of how mental states could be considered as intervening variables, facilitating the recognition of a number of otherwise complex stimulus–response links (each of which could independently form the basis of a behaviour-reading process) has been elegantly proposed by Whiten (1993, 1996). Drawing from an earlier concept in psychology, it suggests that any number of observable conditions could lead an individual to recognise a certain specific mental state in another individual, and once this state has been attributed, to predict a definable number of behavioural outcomes depending on the ambient situation. A crucial advantage of this model is that the coding of each of these intervening variables (or the so-called mental states) would be more 'economic of representational resources' (Whiten 1996) than would be the multitude of the stimulus–response links that each now represents. This is particularly true for mental states which are achievable by very many different conditions and which can, in turn, affect a number of different outcomes. Mind-reading or the recognition of mental states, by such a definition, could thus constitute a more neurologically economic strategy than would a multitude of independent stimulus–response pathways that represent behaviour-reading. Note also that, according to this concept, mentalism arises gradually from behaviour analysis – if the intervening variable mediates the recognition of and response to only a single stimulus–response link, it is virtually indistinguishable from behaviour-reading.

Yet another line of evidence that can potentially argue for mentalism as an underlying cognitive process rather than simple behaviour analysis, at least in certain situations, is that of projection of experience (Povinelli *et al* 1992a; succinctly reviewed in Whiten 1996). This has stemmed from studies on role reversal in cooperative tasks in which an individual primate was first trained to perform a definite task to aid another individual in reaching a desired goal following which it was asked to take on the role of the other individual. These experiments have suggested that the great apes, notably chimpanzees, are able to master new roles with ease and perform novel tasks perhaps because they can attribute beliefs and desires to one another; their performance cannot be explained by simple learning of the behaviour of their partner before role reversal. Macaques, on the other hand, appear to lack empathy and have to learn their new roles afresh.

A philosophical assumption that seems to be implicit in all discussions over whether individual primates are able to recognise mental states or simply perform behaviour analysis is that principles of parsimony are violated when mind-reading is invoked in non-verbal nonhuman primates. Such an assumption perhaps owes its origin to the subtle influences that Biblical tradition and Cartesian philosophy seem to have had on Western scientific ideology, which has, often implicitly, valued the inherent superiority of man over all other forms of life. Although outside the scope of this paper, it is important to stress here that it is perhaps now time to re-evaluate such an assumption, and concepts such as that of mental states as economical intervening variables, discussed above, are important steps in this direction (see also Bennett 1991).

In the remaining section of the paper, the possible cognitive mechanisms involved in two complex social processes displayed by wild bonnet macaques – social knowledge and tactical deception – will be analysed. Particular attempts will be made to explore the conceptual contribution that attribution of mental states as well as orders of intentionality could offer towards an understanding of these mechanisms.

Bonnet macaques – The species and the troops

The bonnet macaque (*Macaca radiata*), a cercopithecine primate endemic to peninsular India, usually lives in multi-male, bisexual troops of about 15 to 60 individuals (Sinha 2001). Females of this species, almost as a rule, remain in their natal group throughout their lives, and during adulthood, form strong, linear dominance hierarchies with daughters occupying dominance ranks just below those of their mothers. Adult females develop strong social bonds and display extensive allogrooming and other affiliative behaviour towards one another. Juvenile and adult males, on the other hand, usually emigrate from their natal troops, but bonnet macaque males appear to be unique in being rather unpredictable in this regard, some individuals even staying back to become the most dominant males in their respective natal troops. Adult males form unstable dominance hierarchies through direct aggression and coalitions, and, unusually for most cercopithecines, exhibit extensive affiliative interactions with one another (Sinha 2001).

Our insights into the social knowledge underlying decision-making processes in bonnet macaques come from a three-year study (from 1993 to 1996) on a wild troop inhabiting dry deciduous scrubland and mixed forests around Bangalore in southern India. During the course of this study, the troop had 44–52 individuals, including 8–11 adult males, 11 adult females, and 22–30 juveniles and infants. Data on tactical deception are derived from observations on this troop as well as from a second troop, occupying an adjacent, partially overlapping home range during the same study period; this troop consisted of 30–35 individuals with 5–7 adult males, 10 adult females, and 15–20 juveniles and infants. In addition, tactical deception was also studied in a third troop inhabiting the Bannerghata National Park near Bangalore; this troop, consisting of 3–4 adult males, 6 adult females, 8 subadult males, and 8–14 juveniles and infants, was studied for a period of about 12 months during 1999–2000.

Data on social knowledge and tactical deception were obtained by behavioural observations on all individually identified adult and subadult animals in the respective study troops; each sampling day usually consisted of 10 hours of observation, from 0800–1800 hours. The sampling methods used included focal animal sampling with samples of 15 minutes duration each on an individual chosen randomly without replacement and opportunistic sequence sampling of rare behavioural events and social interactions involving more than two individuals. The results reported here are based on approximately 1800 hours of observation on the three troops, sampling effort being comparable across all adult and subadult individuals in all these troops. All instances of tactical deception were categorised and analysed according to Byrne and Whiten (1990) with certain modifications (Sinha and Datta-Roy, in press).

Social knowledge

A very important component of social cognition is the social knowledge that individual primates might possess with regard to certain attributes of other individuals that they regularly interact with within their social group. In addition to the obvious recognition of each animal as a distinct individual, the possible attributes that such knowledge might encompass could include their dominance ranks and affiliative relationships – factors that seem to influence much of the social behaviour observed in primate societies.

In bonnet macaques, a frequent triadic interaction – displacement of one member of an allogrooming dyad by a third, more dominant, female – provided evidence that adult females seem to be aware of the social attractiveness of other individuals, as measured by the allogrooming received by them from all other adult females in the troop (Sinha 1998). That individual females might also know the relative dominance ranks of their troop members was revealed by the typical patterns of agonistic behaviour and allogrooming choices that followed such complex interactions. They also appear to be able to evaluate their own individual positions in the rank hierarchy and in the affiliative networks that prevailed within the troop. Logistic regression models, constructed to unravel the possible domains of an individual's knowledge system that might critically influence social decision-making, showed that the nature of a macaque's social knowledge is egotistical – in that other individuals are evaluated relative to oneself, integrative – in that information about all other interactants are used simultaneously, and hierarchical – in the ability to preferentially utilise certain categories of knowledge for the storage of related information from other domains (Sinha 1998).

Mental representation of individual attributes

What is noteworthy is that individual macaques seem to be knowledgeable about the general social attractiveness of particular individuals in terms of the allogrooming that they receive, rather than remember specific pair-wise affiliative relationships, and use this information when making certain behavioural decisions during social interactions (Sinha 1998). Since, as mentioned earlier, they also know the relative dominance rank of each adult female in the troop, this seems to constitute a clear example of recognition of individuality and individual attributes by these animals. Furthermore, the decision to retreat or not to during triadic interactions also depends on the absolute position of the actor in the dominance hierarchy – the more subordinate an individual the more likely she is to retreat. Clearly then, each bonnet macaque female has knowledge of some of her own individual attributes as well.

Although all of these must obviously call for some form of fairly sophisticated mental representation of particular individuals associated with their specific properties, including themselves, what remains unclear is how exactly such information is categorised and coded for in the non-verbal cognitive architecture of the macaque mind. It is also important to note that the bonnet macaque's knowledge system is integrative in nature – each female takes into consideration attributes of the two individuals that she is simultaneously interacting with and behaves appropriately given the relative strengths of these properties. A female is thus more likely to retreat during a triadic interaction if the approaching female is increasingly dominant and her own allogrooming companion increasingly subordinate (Sinha 1998). Whatever, therefore, may be the stored imagery of the individual attributes of the two females she is interacting with, it is possible for her to access both these sources and integrate them when making a decision.

Attribution of motives

During allogrooming supplants, when a dominant individual approaches the two members of a grooming dyad, the more subordinate of the two females is most likely to retreat, even before the approaching female actually reaches them (Sinha 1998). The dominant member of the dyad, however, sometimes retreats if her grooming partner is very socially attractive on absolute terms – these females, therefore, behave as if they 'believe' that the approaching individual is targeting their subordinate, but usually more socially attractive, companion (Sinha 1998).

The hypothesis that these particular females acted on the basis of a valid belief system comes from supporting observations of other triadic interactions when a grooming supplant did not actually occur. During certain such incidents, the approaching individuals were most likely to display aggression and chase away the more subordinate of the two individuals, while on other occasions, if they did not demonstrate any aggression, they almost invariably preferred to groom the more dominant member of the dyad (Sinha 1998). Why then occasionally did the more dominant member of the allogrooming dyad retreat?

It would appear that this decision was taken on the belief that a highly socially attractive individual is more likely, in general, to be the preferred target for affiliative interactions, even if she holds a relatively low position in the dominance hierarchy. The nature of this belief and the attribution of a corresponding motive to the approaching individual also seem to be rather natural since bonnet macaque females evaluate social attractiveness of an individual on the basis of the levels of allogrooming received and the consistency with which such grooming is received from other females in the troop (Sinha 1998).

Projection of experience?

It should be noted that this particular belief system is, in some sense, erroneous – given the actual choices that the troop females made in their display of aggression and grooming preferences. Thus, since in the instances when an actual grooming supplant did not occur and the approaching female preferred the dominant member of the allogrooming dyad as a grooming companion, why, in other instances, did the latter occasionally retreat when she was with a socially attractive subordinate?

One possible solution to this apparent contradiction may lie in the relative frequencies with which dyadic and triadic interactions occurred in the study troop. Triadic allogrooming sessions, where an approaching dominant individual groomed the dominant member of a grooming dyad in preference to the subordinate one, were relatively rare (Sinha 1998). In contrast, dyadic grooming was much more frequent, and females in the study troop were also much more likely to groom relatively more subordinate individuals during these dyadic sessions (Sinha 1996). In addition, subordinate females also tended to be more social attractive than their dominant counterparts. It is therefore possible that most females never received an opportunity to learn that they might be preferred as grooming companions by more dominant individuals during triadic supplants, and were, therefore, more likely to be guided by the belief system described above in their responses to the approaches made by these females. Interestingly, it is possible that the origin of this particular belief system could lie in their past experience with dyadic grooming sessions when these females could have observed a preferential grooming of relatively more subordinate individuals.

What is noteworthy here is that individual females seem to exhibit this erroneous behaviour during triadic allogrooming supplants even though on several occasions they themselves had preferentially allogroomed the dominant member of a grooming pair after approaching such dyads. Could this be considered a failure, in some sense, to project their own past experiences, and thus to adopt different, but suitable, behavioural strategies under changing situations? In other words, is it possible that a bonnet macaque female, as the dominant member of a grooming pair, is unable to attribute the correct motive to an approaching individual although she herself has experienced that particular motive earlier as an approaching individual? If this is indeed true, bonnet macaques are similar to rhesus macaques, which were unable to empathise with and understand the motivations of their partners in a laboratory cooperative task although they themselves had taken up similar roles earlier (Povinelli *et al* 1992b); successful role reversal in these experiments was necessarily accompanied by fresh trial-and-error learning.

Tactical deception

Human-like deception requires that an individual who signals information create a false belief in another individual, the audience. The signaler thus needs to recognise that the audience's mind can be in a state of knowledge that is different from one's own and that it is possible to alter and hence, control others' mental states without necessarily changing one's own. Such manipulations are usually tactical in that they involve the use of acts from the normal repertoire of the actor in situations where they are likely to be misinterpreted by the audience – leading to some tangible benefit for the actor with or without some corresponding cost to the audience (Whiten and Byrne 1988; Byrne and Whiten 1990).

All such acts of tactical deception are thus functional, and most cases of deception documented in primates can be included in this category. But is primate deception truly intentional, attributable to a theory of mind (see Byrne and Whiten 1991 for a succinct discussion)? Does the deceiver actually attempt to alter the beliefs of another individual when it actively suppresses some information or signals false information to the other? Or, has experience simply taught the deceiver the use of certain behavioural strategies in particular situations, leading to predictable responses from the audience and thus allowing the actor to achieve a desired goal?

Mind-reading or behaviour-reading?

The overwhelming majority of records of social interactions that could be potentially considered deceptive, obtained from the three study troops of bonnet macaques provide clear evidence for tactical deception over other competing explanations (Sinha 1999; Sinha and Datta-Roy, in press; see also Byrne and Whiten 1990). It is also noteworthy that individuals in all the troops exhibited comparable levels of deception although the three troops differed widely with regard to the social situations in which tactical deception was displayed as well as in the categories of deceptive acts commonly used by the resident individuals.

A striking feature of the deception displayed by bonnet macaques is the remarkable individual variation in the performance of these acts (Sinha 1999). Certain individuals thus exhibited deceptive acts with very high frequency and at levels significantly greater than that shown by other individuals within the troop; moreover, such deceptive abilities appeared to be independent of age categories and dominance ranks (Sinha and Datta-Roy, in press). The fact that certain individuals are more adept at deception than are others and that the ability to deceive is independent of other individual attributes is an indication that many of these acts could involve mentalism on the part of the actor rather than simple behaviour analysis. An alternative explanation could, of course, be that these particular individuals are good social learners and, therefore, more efficient behaviour analysts. This seems unlikely since it would require complex behavioural contingencies (of the kind displayed during tactical deception) to occur with high probabilities for individuals to learn their associations successfully; such contingencies, however, appear to be relatively rare (Sinha and Datta-Roy, in press).

If macaques are indeed better social learners than mentalists while complex social situations where deceptive behaviour could be learnt are rare, it might be predicted that individuals who exhibit high levels of deception should perform the same acts repeatedly. However, in all the troops, there was a significant positive correlation between the frequency of deceptive acts and the functional categories to which these acts belonged (Sinha and Datta-Roy, in press); in other words, individuals who deceived more did so in many more different ways! Surely, it is more parsimonious to assume that these individuals are better cheaters who perhaps have greater insights into the power of manipulative behaviour than do other individuals.

Moreover, certain rare acts of tactical deception displayed by the study individuals were extremely complex and involved several categories of deceptive acts juxtaposed together and performed in rapid succession to achieve one particular desired goal (Sinha 1999; Sinha and Datta-Roy, in press). It is extremely improbable that these individuals had experienced an earlier identical behavioural contingency for them to learn all the constituent deceptive acts.

If the argument put forward regarding the involvement of the mind in at least some of the acts of tactical deception practised by bonnet macaques can be accepted, it would seem logical that such manipulation must necessarily involve at least second-order intentionality. This would mean, in simple terms, that an individual performs a deceptive act in order to change the belief system of the audience – and then takes advantage of the false belief that has been generated to achieve a particular personal goal.

Visual perspective-taking

Several events of deception by three individuals in two different troops involved acts of physical concealment in which the actor either simply hid from the target behind some physical object or performed a behaviour surreptitiously behind a barrier, occasionally leaning out to inspect whether the target individual was still present (Sinha and Datta-Roy, in press). Since all these individuals repeatedly performed this exercise – in different contexts and using different objects or barriers to hide behind – these acts would appear to represent a genuine tactic and were possibly not simply events coincident by chance.

This kind of visual perspective-taking, estimating what would be visible from another individual's point of view, has earlier been seen in other primates, notably chimpanzees and baboons (Whiten and Byrne 1988). Although such an ability to recognise and utilise the geometric perspective of another individual has been equated to being able to represent correctly another individual's mental representation, there have also been dissenting views on such an identity (for a detailed discussion, see Whiten 1991).

'Intention to deceive' as an intervening variable?

Another characteristic feature of the tactical deception exhibited by bonnet macaques was that individuals did not invariably use deceptive strategies in apparently identical situations, a result not expected if these acts were being performed in response to certain behavioural contingencies (Sinha and Datta-Roy, in press). What could not be easily ruled out, of course, is that there were subtle differences in these apparently identical situations – and these may have triggered off the deceptive acts in some of them but not in others.

A related finding to this form of volitional control of deception was that of some individual adult males who changed their repertoire of deceptive acts following changes in the social environment. This happened when two particular males emigrated out of one troop and joined a neighbouring one; following this movement, they exhibited very different categories of deceptive acts. A major difference that these individuals faced in the two situations was that of their dominance ranks, which fell drastically once they had joined the new troop. It is, therefore, entirely possible that the perception of their specific positions in the rank hierarchy in the respective troops as well as the changing demands of the new social milieu may have triggered on a completely different repertoire of deceptive acts in the two males.

It is perhaps possible to model a complex set of stimulus–response links in the different social situations outlined above, leading to differential responses in terms of the deceptive acts displayed by specific individuals. It might, however, be more parsimonious to consider 'intention to deceive' as an intervening variable in these different situations, as outlined by Whiten (1996). This would mean that a variety of perceptual changes under different social conditions would be translated into either the presence or absence of potentially deceptive acts or into different forms of deceptive acts, all of these mediated by an intention or lack thereof to deceive. In addition to simplifying a possibly complex web of conditional stimulus–response chains, such an intervening variable would also be compatible with the notion of second-order intentionality underlying deception, outlined above.

An incomplete theory of mind?

Subordinate adult bonnet macaque males often give out loud predator alarm calls when they are chased by more dominant males – even if there are no predators in the immediate vicinity. An extremely intriguing variant of this deceptive act was observed in one of the study troops. A victim of aggression emitted a false predator alarm call on being chased, but continued to give this call even as he descended from the tree and continued to walk peacefully on the ground – behaviour that would never have been performed if there was truly a predator around (see also Cheney and Seyfarth 1990 for a comparable incident).

Deceiving individuals thus occasionally exhibit behavioural components that are not compatible with their own apparent 'belief' system, as communicated to others. An important point here is that notwithstanding its incompleteness, such a belief system must have been generated to alter the belief state of the audience – a return to second-order intentionality. What is also noteworthy is that the aggressor did not appear to have read the internal inconsistency of the deceptive act; this may have been due to his own theory of mind – or perhaps, a hypothesis of mind – being similarly incomplete (Cheney and Seyfarth 1990).

Summary

Cercopithecine or Old World monkey societies are typically characterised by social relationships established between individuals belonging to different age cohorts, dominance ranks and kinship groups. Given the unique nature of each and every relationship that individuals need to develop and maintain, it is perhaps not surprising that bonnet macaques may be inherently capable of solving many complex social problems. These monkeys may, for example, observe the social interactions of other individuals in the troop and acquire knowledge of different attributes of these individuals, thus aiding their own decision-making during complex social interactions. Many individuals are also potentially capable of developing strategies of tactical deception; these strategies not only encompass different categories of deceptive acts but are also employed in a variety of social situations, including agonistic interactions and competition over food, allogrooming companions and sexual partners.

Underlying these complex social strategies may be the ability of individual macaques to form rudimentary mental representations of their social interactants and their various attributes, including their relative dominance ranks and social attractiveness. Interestingly, an earlier study that documented an elaborate example of tool manufacture and use by a bonnet macaque, indicated the possibility that the individual was able to perceive the underlying causality of its actions and also form a mental model of the tool to which it could repeatedly refer (Sinha 1997). The cognitive ability to form mental representations could thus underlie the bonnet macaque's interactions with both the mechanical as well as the social components of its immediate environment.

Analyses of the decision-making processes that bonnet macaques employ during social interactions indicate that individuals appear to attribute distinct motives to other individuals, a clear example of second-order intentionality. Moreover, several acts of tactical deception provide evidence that the macaques are capable of attributing visual perspectives to another individual, thus being able to perceive what would be visible from that particular individual's point of view. This arguably constitutes another way in which a monkey is able to comprehend another monkey's mental representation of the world – again a prime cognitive candidate for second-order intentionality.

Bonnet macaques, it can be argued, may thus have some degree of comprehension of the mental world of other individuals and are able to attribute distinct individuality to each other, including themselves. But does this imply that they have a theory of mind? It has been discussed above that, during social interactions, individuals may fail to project their own experiences onto others and are thus often unable to correctly predict the true motives of other individuals. Moreover, even in instances of tactical deception where the macaques communicate their apparent 'beliefs' to others, they exhibit behavioural components incompatible with their own beliefs. Extensive observational studies on the study troops have also so far failed to turn up any clear evidence for unambiguous third-order intentionality, which could be considered evidence for a true theory of mind. In conclusion, therefore, even if bonnet macaques do have a rudimentary hypothesis of mind, it is a construct incomplete in many ways, some of which have been outlined here and some that still remain to be uncovered.

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Becoming self-conscious: A psychological perspective

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Abstract

*The paper deals with the issue of **Self-Consciousness** and how it grows in a child from birth, reaching the adult level at the age of five years.*

New research has shown that Self-Consciouness and Other-Consciousness develop together. One cannot develop without the other. A rudimentary awareness of Self, and its similarity with the Self of others, is in fact present from birth. This may have a basis in the mirror neurones present in the premotor cortex which fire similarly when a particular action is executed by the individual or is observed, when performed by others. By the age of one, the baby and the adults around her can point to things and get each other to act on them. This way the baby and the adults develop some joint attitudes to the world. In another six months the baby learns that besides having joint attitudes she and the adults may in fact have different attitudes also. The adults may not want the baby to do certain things she likes, while they may

want her to do certain things she does not like. By the age of two, the baby becomes truly empathic, caring for the pain experienced by others and trying to alleviate it in ways she is capable of. By the age of three, she learns that what she sees may not in fact be visible to others. By the age of four she learns that she and others may have different thoughts and beliefs about the same thing. It is at this age that she becomes capable of deception. By the age of five, she understands that some events not only happened in the past but actually happened to her and might not have happened to others. Now she can be truly autobiographical when telling stories about events. Now she is truly Self-Conscious.

1. Introduction

Study of the phenomenon of consciousness is becoming increasingly popular amongst psychologists these days. This was not always so; for a long time the field was dominated by behavioural psychologists who, following the fashions in the natural sciences, believed that what could not be directly observed and measured could not be 'scientific'. Therefore, in their opinion, what happened within the black box – the brain, could not be the subject of scientific inquiry. They concentrated on 'objective' measurement of the behavioural expressions of mental phenomena. The recent interest in consciousness also appears to be influenced by the advances in the natural sciences. The inspiration comes from the physicists, who having tested the success of the counter-intuitive principles of quantum mechanics have started invading the field of consciousness studies (Penrose and Stuart 1995). New developments in the fields of neuroanatomy and neurophysiology have also been a source of inspiration.

Psychologists look at Consciousness functionally. They study what on commonsense basis are taken to be the attributes of a conscious person, for example (a) awareness of the outside world, (b) reflective thought, (c) conscious feelings, (d) memory and recall, (e) self-awareness, and (f) intentionality . They are not greatly bothered by the *hard* problem posed by Chalmers (1995) and consider consciousness and awareness to be synonymous .

2. The science of developmental psychology

It does not require too much sophistication to understand that awareness grows or evolves, as the newborn becomes an adult human being. There are a variety of folk views about the level of awareness a newborn has and how it grows into the awareness in an adult. Some believe that the baby's mind is a *tabula rasa* (Locke 1959) on which inscription of life experiences is necessary to lead towards the formation of a fully conscious adult. Others have the romantic notion that babies are intuitive and not rational. Freud believed that they are driven by passions. Others like the romantic poet Wordworth (Williams 1943) think that they have some special kind of knowledge just because they are so ignorant.

The new science of developmental psychology has for the first time given us an understanding of how babies' minds work and how consciousness grows in the next few years to make them think, feel and behave as adults. Jean Piaget who systematically observed his own children as they grew, may be considered to be the father of developmental psychology but most advances have occurred in the last 30 years. This has been made possible by two new technological developments. One technology which has helped is the video camera which faithfully records what babies do, records which can be seen again and again by scientists other than the original observer thus removing the bias from the observation. Ingenious techniques have been developed to find out what babies think, feel and believe. For example, babies are shown two pictures and the camera records which picture they look at longer. Do they look longer at lines or dots, at familiar faces or unfamiliar ones, happy or sad faces and so on. Pacifiers have been used to start off the video cameras so that we can find out what the babies actually prefer to see!

The other technology is the computer. Computers not only help in analysing massive amounts of data but also provide for understanding mental functions. Research (Gopnik *et al* 2001) has shown the following:

1. Unlike what Locke said, babies come equipped with sophisticated programmes to understand the world.

2. The programmes are not static. Babies have the capacity to rewrite old programmes and *evolve* new programmes as they grow. *In this they are totally different from computers.*

3. The brain hardware passes through a long period of immaturity before reaching its adult structure and functions and it is this immaturity which allows the human brain to be flexible, sensitive and plastic, deeply influenced by events in the outer world. The brain has the capacity to absorb culture and adapt to its mores.

4. In their efforts to learn, babies think, draw conclusions, make predictions, look for explanations and even do experiments. Adult scientists take advantage of this natural human capacity. As the above mentioned authors say, "It is not children who are little scientists but scientists who are big children".

The science of developmental psychology has given us rich and breathtaking information about how the various consciousness functions grow but for our discussion here we shall examine the growth of just one of these functions, perhaps the most human of them all. We shall see how the babies become self-conscious and conscious about other human beings.

The growth of self- and other-consciousness

What has come out of so many sophisticated observations and experiments is that the two, self-consciousness and other-consciousness grow together, as if hand in hand. This is what we have learnt:

1. At birth the babies can decipher human faces and sounds as different from other visual and auditory stimuli. Within a few days of birth, they can distinguish a familiar face from a non-familiar one, their mother's voice from that of others. They can recognize even smells; they turn towards a pad kept close to their mother's body and away from that kept near someone else (Mcfarlane 1975; Field *et al* 1984)! Very early they can distinguish a human movement from a random one. Before the baby is nine months old, before she can walk or talk, she can distinguish facial expressions of emotions, an

angry face or a sad face. She can also attach the right sound to the right picture. If you play a recording of a happy or a sad song, the baby will look and laugh at the appropriate face.

2. Do babies have a conception of what being human means? It appears that they do. Meltzoff and Moore (1994) showed that if you stick out your tongue at a one-month old baby it sticks out its tongue at you. Later they showed that this was an innate ability and that a very newborn baby would do the same.

   It may appear to be an insignificant finding but on deeper thought it is indeed quite an amazing phenomenon. Babies have never seen their own face but they can be aware of their tongues kinesthetically. However, what they are seeing (the experimenter sticking out his tongue) is visual! Sticking out its own tongue in response means that the baby is aware of the similarity between others and itself - that the red thing coming out of a round face in front is the same as a similar organ in its own mouth. This goes against the conclusion reached by the philosopher Merleau Ponty (1962) who believed that the sensori-motor equivalence between one's kinesthetic sensations and the visual sensations has to be established first and then between self and others. The research also shows that right from the beginning there is an embryonic sense of Self and its separation from the Self of others. Otherwise, imitation would not occur. This exciting finding is made even more exciting by the findings of the neuro-physiologists that in the premotor area of the cortex of the higher primates including human beings, there are what are known as mirror neurones (Gallese and Goldman 1998) which bombard in the same fashion when they execute a goal directed action or observe it being performed by another person. This means that right from the beginning, mechanisms are available, which help one recognise the intentional meaning of other's actions. Further, this happens by direct matching and not through an inferential route. One does not have to watch someone else's action, then make a comparable gesture and then infer that the two are similar.

To summarise, a sense of Self and a sense of others is present right from birth. A sense of similarity of the two is also present. A sense of separateness of the two is also present. This understanding is the basis of empathy though still at a rudimentary stage. This has led many phenomenologists to believe that human individual consciousness is formed in a dynamic interaction of the self and others and is therefore inherently intersubjective. This intersubjectivity is the basis of empathy and empathy is the precondition for the science of consciousness (Thompson 2001).

3. At about the age of one year, this diad of baby–adult imitating each other expands to include *things* and becomes a triad. As babies are able to reach out and crawl, objects – toys, keys, rattles, telephones, which were so far subjects of fascinated gaze become objects of desire and danger. But other people form an interesting part of the relationship between the baby and these objects.

   Babies start pointing at things as well as looking at things pointed out by adults. Pointing, like imitation, implies a deep understating of Self and others. Pointing at things repeatedly and then repeatedly looking at Mummy's face implies that at some level the baby thinks that the other person should look at the something she is looking at. The opposite is also true. Looking at things pointed out by the adults indicates the same kind of communion.

   One-year olds not only look at things but also start noticing the mother's expression. If she smiles, baby keeps moving towards the object; if she shows horror, the baby stops. The baby now knows that not only do adults show different emotions but also that they show different emotions for different things. By watching the adults, babies can figure out what to do with the objects. They copy with toy telephones what adults do with the real ones, not very well but they understand the principle (Gopnik *et al* 2001).

   To summarise, one year old babies discover that they and the adults have joint attitudes to the world. Babies start using other people to figure out the world. In a simple way, they are already participating in culture.

4. However, as they learn that they and the adults have some attitudes towards things, they also learn that they may have different altitudes. What about china plates, electrical gadgets and so on. Baby wants them, others do not want the baby to have them. What about foods? Baby does not want to eat vegetables, adults want the baby to eat them. By the age of one and a half babies know that everything is not wonderful; there are often differences between their desires and dislikes and the desires and dislikes of the adults.

   Interestingly, instead of being depressed by this discovery, the babies set out to experimentally determine what they share with adults and what they do not. This is at the age which is commonly referred to as the "terrible twos". Babies deliberately start doing things which annoy you, just to find out the limits to which they can go.

   There is a positive side to their game. Imagine a situation when the mother is crying after a quarrel with the father. Baby is distressed by the mother's crying and tries to put band-aid to mother's lips, remembering that this is what she does when the baby cries. This is the start of real *empathy*. It demands knowing how people can feel distressed even when the baby itself is not so and *caring* enough to want to make them feel better.

5. By the age of three the baby starts learning that what it sees and what others see may not be the same. If you play a game with a two-year old, putting a screen between you and the baby and ask her to hide a toy, invariably she will put the toy on your side of the screen, believing that if she cannot see it, you will also not see it. But a three-year old will not put it on your side of the screen, because she knows that you might see what she cannot, and vice versa that she and you might have different perspectives about the same thing. By the age of three, the baby is already going beyond an egocentric understanding of other people.

6. So, by the age of three, children understand desire, perception and emotion but all these states are transparent states. There are other mental states like thoughts and beliefs which are different. Thoughts and beliefs are opaque; philosophers call

them *representational*. They occur inside the mind and are not visible to others. Further, these can be correct on incorrect representations. Three-year olds cannot understand this, while a four year old can.

In a classic experiment, Wimmer and Perner (1983) showed a candy box to a 3-year old child and asked what it contained. "Candy", she said. The investigators had however tricked the child and had put pencils in the candy box. Now the box was opened and the child was allowed to see what it contained. "What does the box have?" asked the investigator. "Pencils", said the child correctly. "What will your friend (who does not know about the trick) think it has?" asked the investigators. "Pencils" said the three-year old. A three-year old does not know that the others may not know what she knows and hence can have a false belief. Four-year olds understand this and this is a profound difference. It is this which allows a four-year old to understand that others can be deceived. Two- or three-year olds can tell lies but they are transparent lies. Four-year old can lie intelligently. This is the age when the children start showing character. Four- and five-year olds understand that it is good to say `nice' for a present they do not like!

7. The story of Self-Consciousness is complete by the age of 5 years, when another profound change occurs. Children start understanding that not only have some events happened in the past but also that they occurred to *them*; that they may not have happened to others. Also, that other things may happen to others, which might not happen to themselves. That there is an internal 'I' which is different from the internal 'I' of some one else and the memories of the two 'I's can be different. Only now can they tell stories in an autobiographical fashion. Only now do they start understanding that they have a mind and it is different from the minds of others.

   Now the child has the Self-Consciousness of an adult.

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Section 6

Neuroscience, consciousness and emergence: A supervenience theory of mind

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Abstract

Two extreme positions would, if true, block any significant dialogue between the neurosciences and many religious accounts of the self. Strong forms of dualism – at least those that make the mind a separate substance – remove mental phenomena forever from the realm of scientific study. On the other hand, eliminative materialism "explains" mental phenomena by making them nothing other than the underlying physical processes of which they are the product; it also resolves the debate with most of the metaphysical traditions by removing them altogether from the realm of plausible theories. For this reason, the present talk challenges the "Sufficiency Thesis," according to which neuroscientific explanations will finally be sufficient to fully explain human behaviour.

Once these two views have been dismissed, a wide range of interesting possibilities remains. The article explores the various ways in which neuroscientific results and metaphysical interpretations contribute to an overall theory of the person. Structural couplings of subjective *experience and thought to physical inputs are major determinants of mental experience; at the same time, the phenomena of reference and meaning, and the individual experience of qualia (the subjective side of conscious experience) remain irreducible.*

The paper advocates a supervenience theory, which holds that mental events are dependent on their physical substrata but not reducible to them. Challenging the determinism of "strong" supervenience, I defend a version of "soft" supervenience that allows for genuine mental causation; not all causes of human behaviour are purely neuronal causes. This view gives rise in turn to an emergentist theory of the person: mental phenomena result from an incredibly complex physical system, the brain, but represent a genuinely new causal and explanatory level within the world. Still, I remain a monist: there are many types of properties encountered in the world, although it is only the one nature which bears all these properties. The final position, emergentist monism, thus allows for diversity within the context of the one world. This view is open at the top for metaphysical applications and interpretations, while retaining the close link to neuroscientific study and its results. Many religious traditions offer an interpretation of the whole world based on a yet higher order of emergence, although the notion of God would clearly move beyond the natural order as a whole. Theism can therefore in principle supplement the natural scientific study of the world without negating it.

Two extreme positions would, if true, block any significant dialogue between the neurosciences and many religious accounts of the self. Strong forms of dualism – at least those that make the mind a separate substance – remove mental phenomena forever from the realm of scientific study. On the other hand, eliminative materialism "explains" mental phenomena by making them nothing other than the underlying physical processes of which they are the product; it also resolves the debate with most of the metaphysical traditions by removing them altogether from the realm of plausible theories. For this reason, the present talk challenges the "Sufficiency Thesis," according to which neuroscientific explanations will finally be sufficient to fully explain human behaviour.

Once these two views have been dismissed, a wide range of interesting possibilities remains. In what follows I would like to explore some of the ways in which neuroscientific results and metaphysical interpretations might contribute to an overall theory of the person. Structural couplings of subjective experience and thought to physical inputs are major determinants of mental experience; at the same time, the phenomena of reference and meaning, and the individual experience of qualia (the subjective side of conscious experience) remain irreducible.

The paper advocates a supervenience theory, which holds that mental events are dependent on their physical substrata but not reducible to them. Challenging the determinism of "strong" supervenience, I defend a version of "soft" supervenience that allows for genuine mental causation; not all causes of human behaviour are purely neuronal causes. This view gives rise in turn to an *emergentist* theory of the person: mental phenomena result from an incredibly complex physical system, the brain, but represent a genuinely new causal and explanatory level within the world. Still, I remain a *monist*: there are many types of properties encountered in the world, although it is only the one nature which bears all these properties. The final position, *emergentist monism*, thus allows for diversity within the context of the one world. This view is open at the top for metaphysical applications and interpretations, while retaining the close link to neuroscientific study and its results. Many religious traditions offer an interpretation of the whole world based on a yet higher order of emergence, although the notion of an ultimate reality would clearly move beyond the natural order as a whole.

The debate about neuroscience, psychology and mind presents one with a confusing clutter of possibilities. And yet in one sense one finds herself returning again and again to one basic choice. Many neuroscientists, but not all, maintain *the Sufficiency Thesis*. It is the view that in the future neuroscience will be sufficient to explain all that we know about the human person. This view contrasts with *the Insufficiency Thesis*, which predicts that neuroscience will *not* be sufficient to explain all we come to know about the human person. I defend *the Insufficiency Thesis* in what follows not because of blindness to the power of the neurosciences (far from it!), but because there are parts of what it is to be a person that lie in principle beyond their reach. This "something more" has been called variously *consciousness* (Chalmers, Nagel, Jackson, McGinn), *original intentionality* (Searle), or perhaps *caring* (Haugeland). What is intentionality, and why should it play an important role?

Emergentist non-reductionism and mind

Study of the human person involves not only all the knowledge we can glean about the brain and its workings, but also study of the emergent level of thought, *described and explained not only in terms of its physical inputs and nature, but also in terms intrinsic to itself*. But how are we to integrate these two levels, and what framework should we use? I suggest beginning with the notion of the human person as *psycho-somatic unity*. Humans are both *body and mind,* and both in an interconnected manner. How does this work?

It is not difficult to describe what is normally connoted by the word "person." A person is one who is able to enter into human social interaction: praising your work colleague, planning your dinner party, carrying out your intention to graduate from university by next year, and being aware of (at least some) other humans as moral agents who have value and rights equal to your own. These are concepts of personhood that are basic to research in the social sciences (psychology, sociology, and cultural anthropology); they are reflected in the literature of all the world's cultures as well as in multiple religious traditions. Of course, there are many questions that still leave us unsure: when does personhood start? Does it demand a metaphysical basis, such as the introduction of the soul or person-substance? Does it develop and end gradually? Can it be effaced within a human being? Is it a legal or social fiction, or a metaphysical reality? Such broader philosophical questions are crucial to the complete definition of personhood and hence part of the discussion that neuroscientists and religious persons must have if they are to find any common ground at all.

Personhood is therefore a level of analysis that has no complete translation into a state of the body or brain – no matter how complete our neuroscience might be. Of course, it presupposes such states; yet personhood represents an explanatory level that is distinct from explanations at the level of our "hardware." As Brian Cantwell Smith writes:

First, you and I do not exist in [physical explanations] – *qua people*. We may be material, divine, social, embodied, whatever – but we don't figure *as people* in any physicist's equation. What we are – or rather what our lives are, in this picture – is a group of roughly aligned, not-terribly-well delineated, very slightly wiggling four-dimensional worms or noodles: massively longer temporally than spatially. We care tremendously about these noodles. But physics does not: it does nothing to identify them, either as personal, or as unitary, or as distinct from the boundless number of other worms that could be inscribed on the physical plenum... (Cantwell Smith unpublished, p. 3).

The languages of physics and of personhood only partly overlap; one cannot do justice to the one using only the tools of the other. To give a purely physics-based account of the person is like saying that, because an academic society cannot survive without being financially viable (e.g., receiving income from some source), it *just is* the economic unit which economists describe in terms of income and expenditures. The confusion, one might say, is a confusion of necessary and sufficient conditions. A living body and a functioning brain are *necessary* conditions for personhood, yet the wide discrepancy in the "logic" of the vocabularies suggests that they are not *sufficient* conditions. Personhood is not fully translatable into "lower-level" terms; persons experience causal and phenomenological properties (*qualia*) that are uniquely personal.

Emergentist supervenience

I will argue that the philosophical notion of supervenience is especially attractive as a bridge framework when discussing neuroscience and the person. Simply put, supervenience grants the dependence of mental phenomena on physical phenomena while at the same time denying the reducibility of the mental to the physical. Note that supervenience is about properties or groups of phenomena, and not about relations between substances (and the ontology that supports them).

> Supervenience might be defined as follows:
>
> B-properties *supervene* on A-properties if no two possible situations are identical with respect to their A-properties while differing in their B-properties.

Early uses of the concept of supervenience described the way in which ethical judgments are dependent upon certain physical states and yet are not reducible to them. The notion made its major entrance into the mind/body debate in the early article "Mental Causation" by Donald Davidson. Davidson writes,

Although the position I describe denies there are psychophysical laws, it is consistent with the view that mental characteristics are in some sense dependent, or supervenient, on physical characteristics. Such supervenience might be taken to mean that there cannot be two events alike in all physical respects but differing in some mental respects, or that an object cannot alter in some mental respects without altering in some physical respects. Dependence or supervenience of this kind does not entail reductibility [*sic*] through law or definition: if it did, we could reduce moral properties to descriptive [ones], and this there is good reason to *believe* cannot be done (Davidson 1980, p. 214).

What about the relationship of dependence between the mental and the physical? We might call those views *strong supervenience* in which the physical determines the mental in its emergence and in all its subsequent behaviour. Bruntrup writes of the strong supervenience relation, "Micro-properties determine completely the macro-properties (micro-determinism). ... If mental properties are macro-properties in this sense, they care causally inefficacious qua mental properties" (Bruntrup 1998). In this construal of the physical/mental relationship, for example, one might hold that there are general physical laws such that, if they were known, the occurrence of any given mental event could be predicted from a thorough enough knowledge of the brain, its structure, and its past and present inputs.

There is a certain inherent tension in strong supervenience, however. As Jaegwon Kim, one of its best known (former) advocates, admits, "nonreductive materialism is not a stable position. There are pressures of various sorts that push it either in the direction of an outright eliminativism or in the direction of an explicit form of dualism" (Kim 1994; cf. the more recent treatment in Kim 2000). One of the reasons for this instability is that such a position appears to leave no room for genuine mental causes; all the determination of outcomes seems to flow from the bottom (the physical substratum), leaving no "room for play" for the mental actually to do anything. At worst, mental phenomena become mere epiphenomena; their reality is bought at the cost of causal impotence.

So the question becomes: Can any framework that is consistent with what we know today about the brain, and with what we may reasonably be expected to *come* to know, also be consistent with a real causal influence of mental phenomena? Not only folk psychology, the common-sense way of speaking of human persons, depends on a successful theory of mental causation, but the viability of key beliefs in many of the world's religious traditions does as well. Strong supervenience theories might suggest how religious beliefs and experiences could arise. But however much the *function* of religious beliefs might be incorporated in such accounts, their *truth* could not be. There would be no place for religious insights *as correct* to alter behaviour, and definitely no role for any influence of a disembodied divine force on the world. The supervenience concept seemed to offer the sort of framework required for drawing the links between the brain sciences and the mental life that we experience. But strong supervenience conflicts both with folk psychology and with many religious truth claims.

Is it possible, then, to formulate a "weaker" version of the dependence relationship? Suppose we define *weak supervenience* as the view that, although physical structures and causes may determine the initial emergence of the mental, they do not fully or solely determine the outcome of the mental life subsequent to its emergence. This view amounts to a dependence on genesis, since it grants that the origins of mentality can be traced to the physical conditions without which there would be no mental phenomena. But it does not grant a full, bottom-up determination of the mental by the physical – hence the "Insufficiency Thesis" defended above – even though the degree of bottom-up influence will certainly far exceed our present knowledge. Weak supervenience thus retains the central tenet of supervenience theory: the mental is dependent on, yet not reducible to, the physical. One reason for choosing weak over strong supervenience is the belief in mental causation: there are genuine mental causes that are not themselves the product of physical causes. The causal history of the mental cannot be told in physical terms, and the outcome of mental events is not determined by phenomena at the physical level alone.

Weak supervenience is the stepping-off point for an emergentist theory of supervenience, and thus an emergentist theory of human personhood. The background for emergentist supervenience comes from the British Emergentists in the 1920s and '30s. As Jaegwon Kim notes, the early emergentists held "that the supervenient, or emergent, qualities necessarily manifest themselves when, and only when, appropriate conditions obtain at the more basic level; and some emergentists took great pains to emphasize that the phenomenon of emergence is consistent with determinism. But in spite of that, the emergents are not reducible, *or reductively explainable,* in terms of their 'basal' conditions" (Kim 1993, p. 138).

A property is thus emergent only if laws cannot be formulated at the lower level that predict its occurrence and behaviour, say as a boundary condition of other well-established laws at that level. If for example we can relate the levels with the same bottom-up precision with which we can formulate the necessary physical conditions for the existence of conductivity or elasticity, then we do not have emergentist supervenience. A set of phenomena is designated as emergentist only when an exhaustive description of the underlying physical state of affairs, although necessary, is not sufficient for explaining the emergent properties. Thus an emergent condition seems to be implied in Leslie Brothers' (1997) explanation of human social behaviour in terms of "the representation of the generalized other" and the irreducible nature of first-person language – assuming that she means these terms to refer to a genuinely psychological reality that is something more than, and not just a different manifestation of, the underlying physical realities. One would also need to use the language of emergence if qualia (human subjective experiences, such as seeing red or being in love) are, at least in part, self-explaining.

I believe that emergentist supervenience offers the philosophically most adequate framework for conceptualizing mental properties in human persons. Does emergentist supervenience also offer a view of the person that is more compatible with the religious traditions than strong supervenience as defined above? Could it offer a better bridge principle? Clearly the answer is yes. Presumably the religious traditions would have many more things to say about emergent properties and their source and ultimate purpose. They might also attempt to offer religiously based explanations of why the biological world could or would give rise to such emergent properties. Two caveats, however:

when speaking in this way, the scholars of religion do not speak as scientists, and the status of such language *vis-à-vis* any presently available empirical verification should be made fully clear. Also, there is nothing in emergentist supervenience that *requires* a religious interpretation; it is not a form of natural theology. Emergentism is, in my view, a necessary condition for an adequate interpretation of the human person, but it is emphatically not a sufficient condition for a religious anthropology.

Coming from the viewpoint of science, one might worry that such a position closes off research and hence progress in neuroscience. Does it introduce a constraint on the work of empirical scientists? I would argue not. Emergentists may have an equally vivid interest in knowing more about actual brain functions and in seeing neural explanations extended as far as possible. It is just that they wager that the "as far as possible" does not extend as far as an exhaustive explanation of the mental – unless part of that explanation is given in irreducibly mental terms! Talk about the subjective experience of being in love or the sense of self-awareness is irreducibly mental; such phenomena exercise a type of causal influence of their own.

Three types of supervenience

By exploring supervenience approaches that eschew both dualism and strong reductionism, this paper has focused on that range of positions that seek to do justice both to neuroscience and to the human experience of personhood. Following contemporary usage, I have characterized these as the family of supervenience theories. We discovered, however, that some of the same tensions arise within this family as were present in the old *dualism versus reductionism* debate. Specifically, one either does or does not accept the Sufficiency Thesis, the view that the causal explanations of human behaviour will ultimately be given in neuroscientific terms.

Since both sides of this *new* debate accept the supervenience label, one might suppose that the ambiguity lies in the term itself. And indeed this is exactly right: one finds in the literature at least three different ways of characterizing the relation of the mental to the physical. All three presuppose that mental phenomena represent levels of complexification that depend on lower, more simple levels, yet that are in some sense not fully reducible to those lower levels:

(1) The more complex level could be related to the lower level by a clear set of laws (call it *nomological supervenience*). These are phenomena that are well understood scientifically in terms of the behaviour of the particles making up the physical system in question, although the supervenient properties cannot be fully expressed except at the level of the set of particles as a whole. Nomological supervenience is also visible in the work of R M Hare, who says explicitly that "supervenience brings with it the claim that there is some 'law' which binds what supervenes to what it supervenes upon." For Hare such laws are necessary conditions for supervenience: "what supervenience requires is that what supervenes is seen as an instance of some universal proposition linking it with what it supervenes upon" (Hare 1984, p. 3).

(2) The higher level could have all of the attributes listed in (1), yet without the condition just expressed by Hare, which we might call the "nomological condition." This second position is best known in the guise of what Donald Davidson calls "anomalous monism." Davidson holds that "mental entities (particular time-space and space-bound objects and events) are physical entities, but ... mental concepts are not reducible by definition or natural law to physical concepts" (Davidson 1995, p. 3; cf. Davidson 1980). Davidson disputes the law-likeness of mental events: mental events are of a type different from physical events, although there is a token identity of every mental event with a physical event. Still, in other respects, his view stands fairly close to (1). Certainly he does not speak of mental phenomena as genuinely emergent. He insists only that at least one portion of the physical world does not admit of the kinds of causal explanation by means of natural laws that science has been successful in formulating in so many other areas. Yet no emergentist conclusions should be derived from this particular failure of law-like explanation, Davidson seems to say; the mental simply obeys different constraints than physical laws, such as the unique constraint of rationality.

(3) The final type of supervenience is the one that I have been defending. It finds in mental phenomena and their dependence on the physical a supervenient relationship not unlike that accepted by the other positions. Yet it also finds grounds in the nature of this relationship to support the ontological hypothesis that mentality represents an emergent level. That is, without questioning the dependence on the physical, it understands mental properties to be different in kind from the properties that one observes at lower levels and to exercise a type of causal influence unique to this new emergent level.

Emergentist monism

In closing, one might ask, "What does it all mean? What kind of ontological position do these emergent properties entail? Is it monism or property dualism or panpsychism?"

The ontological view that I defend might be called *emergentist monism*. Monism asserts that only one kind of thing exists. There are not two substances in the world with essentially different natures, such as the *res cogitans* and *res extensa* (thinking and extended substance) propounded by Descartes and the Cartesians. But unlike dual-aspect monism, which argues that the mental and the physical are two different ways to characterize the one "stuff," emergentist monism conceives the relationship between them as temporal and hierarchical.

In one sense, monism is a necessary assumption for those who wish to do science. For instance, we can (and must) assume that the total physical energy of the universe as a whole is conserved. No action that you perform, no thought that you think, can add to the total energy of the system without invalidating calculations based on physical laws. Incidentally, this is the problem with dualism, and with direct interventions into the world by a God who breaks natural laws: if a spiritual cause gives rise to a physical effect, it has brought about physical change without a physical cause or the expenditure of physical energy, and this fractures the natural order in a way that would make science impossible. There could be no scientific study of a world where cups spontaneously fly across the room and objects released from your hand could go either up or down according to spiritual forces. Science does not need full determinism (see the next paragraph). But it does need the world to reflect at least patterns of probability over time.

(Note that monism is not only in the interests of science; one can *also* give metaphysical arguments in defence of monism. Monism makes the assertion that the world is one, that it constitutes a distinct order. Theistic metaphysicians, for example, speak of the universe as a whole as *finite*, in order to specify its single ontological status and to contrast it with a Creator whose nature is essentially infinite. Herein lies the importance of the phrase, "the unity of nature": in comparison to the Creator, all things in the universe share a common nature. Theologians have also argued that creatures can only exercise freedom within an ordered world that has an integrity and law-like structure of its own.)

I do not care if you want to think of this monism as a *sort* of materialism, but only if you mean by that that the "things" in the world-rocks and computers and persons – are all made out of *some material or other*. What is crucial is that you develop theories which do justice to the specific qualities that we actually find associated with the various "things" in the world. For example, after Newton we thought that physics presupposed at least the possibility of a fully determinate, and determined, account of the world. But when we found out that microphysical or quantum events simply do not work this way, we developed an essentially stochastic or probability-based science to deal with them. Likewise, when scientists began to research chaotic "systems," or systems far from thermodynamic equilibrium, they discovered that they were *essentially* unpredictable (for finite agents). But science did not end; instead, a fascinating new science of chaotic systems has developed. An equally complex story would have to be told about the convertibility of matter and energy.

Now we come to a *very* complex object in the world: humans. With 10^{14} neural connections, the brain is the most complex interconnected system we are aware of in the universe. This object has some *very* strange properties that we call "mental" properties–properties such as being afraid of a stock market crash, or wishing for universal peace, or believing in divine revelation. On the one hand, to suppose that these features will be fully understood in terms of physics as we now know it, is precisely that: a supposition, an assumption, a wager on a future outcome. A deep commitment to the study and understanding of the natural world (which I share with most of the contributors to this volume) does not necessitate taking a physicalist approach to the human person – if by that one means that the actions of persons must be explained through a series of explanatory sciences reaching down (finally) to physics, or, more simply, that all causes are ultimately physical causes. (note that under this definition there could be both reductionist and nonreductionist versions of physicalism.) On the other hand, *for both scientific and religious reasons*, I do not therefore advocate introducing an occult entity, such as Descartes' soul substance, in order to explain the person. To say that the human person is a *psycho-somatic unity* is to resist both positions. I instead say that the person is a complexly patterned entity within the world, one with diverse sets of naturally occurring properties, each of which needs to be understood *by a science appropriate to its own level of complexity*. We need multiple layers of explanatory accounts *because* the human person is a physical, biological, psychological and (I believe also) spiritual reality, and because these aspects of its reality, though interdependent, are not mutually reducible. Call the existence of these multiple layers *ontological pluralism*, and call the need for multiple layers of explanation *explanatory pluralism*, and my thesis becomes clear: ontological pluralism begets explanatory pluralism. (Or, to put it differently: the best explanation for explanatory pluralism is ontological pluralism.)

In her essay (Russell *et al* 1999), Nancey Murphy draws on the work of Ian Barbour and Arthur Peacocke (1993,1999) in chronicling the multiple meanings of "reductionism." Given her definitions, note that an emergentist position rejects causal reductionism, since it accepts mental causes. It therefore rejects explanatory (theoretical, epistemological) reductionism, insofar as mental properties need to be explained using a theoretical structure appropriate to them. At first blush, emergentist monism may *seem* like a version of ontological or metaphysical reductionism, since it breaks with dualism and refuses to postulate non-physical entities such as souls. But emergentists must finally declare themselves opposed to reductionism even with respect to ontological (metaphysical) questions. For their central assertion is that the history of the universe is one of development and process. The one order exists at each stage in its history, but *what it is* that exists is not identical through time. Genuinely new properties emerge which are not reducible to what came before, although they are continuous with it.

What *emerges* in the human case is a particular psycho-somatic unity, an organism that can do things both mentally and physically. Although mental functions supervene upon a physiological basis, the two sets of attributes are interconnected and exhibit causal influences in both directions. We therefore need a science or mode of study that begins (as a science should) with a theoretical structure adequate to this level of complexity. To defend an emergentist account of the self is not to turn science into metaphysics. Instead, it is to acknowledge that the one natural world is vastly more complicated and more subtle than physicalism can ever grasp. You can *wager* that the *real* things that exist in the world are physical processes within organisms, and that everything else – intentions, free will, ideas like justice or ultimate reality – are "constructs," complicated manifestations of neural processes. But I am wagering on the other side. I wager that no level of explanation short of irreducibly psychological explanations will finally do an adequate job of accounting for the human person. And this means, I have argued, the real existence and causal efficacy of the conscious or mental dimension of human personhood.

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Transcendences in physics and their implications to consciousness

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Abstract

The way science has developed in the past four hundred years, it has become the traditional role of physics to explain all natural phenomena at the most fundamental level. In this endeavour concepts like space, time, matter, mass, particle, radiation, wave, energy, causality drawn from everyday experience are suitably defined, quantified and incorporated into mathematical equations formulated to represent the underlying physical explanations. In these formulations, the guiding and restricting role of laws of nature discerned from varieties of experience are taken into account. Verification of the predictions and falsifications, the key factors in scientific methodology have been responsible for the successes achieved. It has happened in the history of science that many of these concepts originally derived from experience, have had to be radically modified and transformed and even transcended (going beyond limits of normal human experience) to explain newly discovered phenomena, as well as those that defied explanation in the old framework, in the domain of physical sciences themselves.

The concepts of four dimensional space-time continuum, equivalence of mass and energy, the dependence of the rate of flow of time on the velocity of the moving frame of reference, the equivalence of curvature of space and mass, and of force and acceleration which were all ushered in by the special and general theories of relativity and the concept of vacuum as the ultimate substratum that is the very source of all constituents and forces of nature as highlighted by quantum theory, are some of the typical examples of such transcendences in physics dictated by new experimental results. These aspects will be elaborated in this presentation with a view to emphasize that in the efforts to resolve the problems of Consciousness in terms of neuronal correlates and the associated physico-chemical processes, transcendences of some of the physical and biological concepts, may be required. In the same way as the 'spin' parameter of individual particles (integral or half-integral of h) controls the behaviour of large assemblies of these particles to obey either the Bose-Einstein or Fermi-Dirac Statistical distributions only, and also determine the very structure of elements in the periodic table and their properties, there may be very sensitive bio-parameters at the cell or sub-cell levels which may influence the group behaviour of bundles of neurons that could lead to emergence of consciousness and its many ramifications.

1. Introduction

The real and crucial problem of consciousness which has been outstanding and unexplained for several centuries, and which in recent years has been termed 'the hard problem of consciousness', is to explain the subjective experiences like cognition, recognition, feeling, sensation, thought, emotion etc. in terms of the physico-chemical activities of the brain. Recent developments in the field of neurosciences have provided elaborate and minute details of these processes in the various cortices of the brain, in the hundreds of billions of neurons that spread out from the brain to the various organs of the body, in the sensors that interface with the external world, in the glial and other cells in the brain, in the bloodstream, in the endocrinal and immunological systems and so on. While a variety of techniques have contributed to the vast store of knowledge that has accumulated over the centuries, in recent decades employment of newer non-invasive techniques, like CATSCAN, PET, fNMR, magnetic encephalograph, lasers, and computer-coupled micro-electrodes, have provided much higher spatial- and time-resolutions for mapping ongoing processes in different locations of the body. These processes themselves, being chemical, physical, electro-chemical, or electro-magnetic, fall well within the framework of science and therefore of proper interpretation.

It has to be emphasized that all physical processes in nature are, in the final analysis, quantum processes. However, not all require the use of sophisticated quantum mechanical analysis and can be treated in the classical framework. The general rule in this regard is that if the 'action' involved in the process under consideration is large compared to the action defined by the Planck constant h, then classical approximation is adequate and works. There is, however, need for caution. There are many instances in which subtle influences of a quantum nature influence gross phenomena in a major way, especially if the macro-processes are the combined results of large assemblies of micro-quantum units.

In the history of life sciences, it has become clear that the detailed mode of functioning of many of the organs of human and animal bodies, like the heart, liver, lung, kidney and so on, can be fully explained in terms of physics and chemistry and there is no need to go beyond them either in terms of concepts or forces. In most of these cases, even classical physics and chemistry are adequate. However, when it comes to explaining the processes that go on in the brain and its accessories leading to consciousness, as hoped for by most scientists, it soon becomes apparent that normal concepts and procedures of explanation are hopelessly inadequate and that some kind of transcendences of these are absolutely essential. Such Transcendences (going beyond the limits of normal experience) have taken place several times in the past in the field of the physical sciences itself. The following are a few typical illustrations of such happenings.

2. Space–time continuum

Space and Time are two important concepts drawn from our daily experience. These are very different kinds of experiences. In our minds, space is characterized by emptiness and as a plenum for matter to occupy. Time is something that flows independent of us. In Newtonian dynamics, space and time are independent of each other. Time is universal and the rate of flow of time is the same everywhere and is independent of motion. All these ideas underwent a radical change, when Einstein introduced his special theory of relativity to explain the experimental fact that the velocity of light is independent of the motion of the source or observer as dictated by the famous experiments of Michelson and Morley. Einstein stated "we can do away with the ether; the velocity of light may be regarded as a constant of nature independent of the motion of the source or observer. But, we have to give up our conventional ideas of space and time". According to him, "the Laws of Science should be the same for all freely moving observers no matter what their speed". Formulating the special theory of relativity he stated:

(i) There is no absolute time; space and time have to be fused into four-dimensional space–time continuum
(ii) Space contracts and time dilates in a moving medium – the extent depends on the velocity
(iii) Idea of simultaneity has no longer any meaning.

Einstein's theory led to the very important consequence that Mass and Energy, two distinctly different concepts till then, were equivalent and related by the equation $E=mc^2$.

Einstein went further and developed the general theory of relativity which had more drastic consequences. Space is no longer Euclidean, and space–time becomes increasingly curved in the presence of mass and energy. While in Newtonian theory, gravitation is a force, in Einstein's general theory the gravitational laws describe the relation between the mass of the gravitating body and the structure of the field around it. In fact mass itself can be looked upon as curvature of the space–time continuum.

3. Action at a distance

Let us consider the case of Newtonian dynamics ushered in by Newton more than three hundred years ago. On the basis of observations on the motion of bodies on earth, he framed his famous laws of motion and extended them to explain the laws of planetary motion that had been enunciated by Kepler. According to Newton, the force between the sun and the earth that kept the earth in its orbit was proportional to the product of their masses and inversely proportional to the square of the distance between them. However, he did not clarify how this gravitational force was transmitted between the two objects, which were so far away from each other. The basic concepts used in Newtonian dynamics, force, mass, and distance, were all familiar concepts and derived on the basis of everyday experience (anthropomorphic) of the common man in his daily transactions. There was a 'ring' of familiarity about them. However, there were aspects which created problems in fuller understanding. One, of course, was the source of this gravitational force and the other was the 'action at a distance'. Till then, the impression in the minds of common men was that for force to act, spatial contact between the two bodies involved was essential. Action at a distance meant, in this case, transmission of force without any physical matter between them. Newton was aware of this problem. He had no answer. He is reported to have said 'God only knows'!.

The same problem of action at a distance was encountered in the fields of electricity and magnetism, though in these cases the distances were of much smaller magnitude. Faraday introduced the idea of magnetic and electric fields, without specifying the physical contents of these fields. Subsequently, the vague concept of 'ether' was brought in to explain these various fields. Maxwell who developed the electro-magnetic theory tried hard to explain the propagation of electro-magnetic waves in terms of the elastic properties of the ether, but did not succeed. The concept of ether was later abandoned since it conflicted with experimental results on the velocity of propagation of light which had been identified as comprising electro-magnetic waves. It is interesting to point out here how sometimes the relation between cause and effect gets wrongly identified and misplaced. Maxwell thought that the elastic properties of the ether were somehow responsible for the propagation of electro-magnetic waves. Later theories showed that the elastic properties of any medium are the result of the electro-magnetic interactions of the constituents of the medium.

The action at a distance and the propagation of electro-magnetic waves could be tackled only in the framework of the new quantum field theories and relativity theories. These theories required a total transcendence in the old and familiar concepts of space, time, causality, force, particle, wave etc. This was much more radical and far-reaching in consequences than the paradigm shift that happened in just moving from a Geocentric to a Heliocentric system.

4. Quantum tunneling

In the discovery of radioactivity, almost towards the end of the 19th Century, something very strange had been observed – emission of α-particles from very heavy nuclei like uranium. To come out of the nucleus, the α-particle had to overcome a huge potential barrier. The particle did not have the energy to do this. Yet occasionally it did come out. There was no explanation in terms of the classical ideas. This is where the dualistic wave/ particle ideas of quantum mechanics which were just being developed came in handy. By treating the α-particle as a wave and solving the corresponding Schrödinger wave equation, the probability of finding the particle outside the nucleus was calculated and found to be finite. This meant essentially occasional penetration of the α-particle through the potential barrier. In this explanation one had to give up the conventional idea of the "trajectory" of the particle defining its precise location in space and time, at every instant.

What is interesting and intriguing is that the same physical entity, namely the α-particle is registered by the Geiger counter as a particle and it leaves the track of α particle in a cloud chamber. But for understanding its penetration through the potential barrier, it has to be regarded as a wave. This wave/ particle duality has to be built into the explanation of the phenomenon. This duality has other ramifications too. Light which we considered as an electromagnetic wave also has this dual character. Depending on the experimental set up it can be seen as a wave or as a particle (photon). In phenomena like interference, diffraction or polarization, light behaves like a wave. In phenomena like the photoelectric effect, or the Compton effect, light behaves like a particle. The particular mode of light to be seen depends on the choice of the observer. This raises the question, how can objective reality become subject dependent? How can the same entity be an extended object like a wave and an extremely compactified point-like object, a particle? Apart from the deep philosophical implications, such dual aspects as far as scientists are concerned, focus attention on the necessity of evolving a proper scientific framework in which such apparently contradictory features that go against common sense and experience are resolved.

5. The Dirac sea: (The quantum mechanical vacuum)

When Dirac formulated the quantum mechanical equation for a relativistic electron, and solved it, he was surprised to find solutions that corresponded to both positive and negative energy states of the electron. The normal practice was to treat the negative energy solutions as 'unphysical' and just ignore them and consider only the positive energy solutions. Dirac just did not do that. He transcended the normal practice and tried to interpret the negative energy states in a bold unconventional way. He assumed that all the negative energy states of the electron, an infinite number of them, are completely filled in 'empty space' in which we see the movement of the electrons which have positive energy states. If however one of the electrons in the negative energy states makes a spontaneous transition due to fluctuation to a positive energy state then a 'hole' is created in the sea of negative energy states and this 'hole' behaves like a particle of opposite charge, namely positive charge, and if the energy available due to fluctuation is sufficiently large, then there is manifestation of two particles – an electron and a positron (as the hole is called). This pair creation happens more easily if a quantum of energy in the form of a photon is deposited into this Dirac vacuum or empty space. The positron is regarded as the 'anti-particle' of the electron. Right in the beginning, Dirac thought that this positively charged particle may be the proton itself which however has a mass widely different from that of the electron. Soon it became clear that, even for theoretical reasons, the particle has to be the positive counterpart of the electron itself. Around the same period, without being aware of these theoretical developments in England, Carl Anderson in USA, discovered in cosmic rays a particle which had a positive charge and the same mass as the electron. This is undoubtedly Dirac's positron. This whole development brought about awareness of many new aspects of nature. One, of course, is the existence of the anti-particles, the other is the revolutionary idea of the Dirac vacuum as the plenum in which all the negative energy states are filled and with which we cannot normally interact, the third is that all other particles can have such seas of negative energy states with the possibility of anti-particles being produced under suitable conditions. Though many of these ideas of infinite negative energy states etc. have undergone transformation in later years, in terms of field theoretical concepts the substance of Dirac's idea of vacuum or empty space as the plenum from which all fundamental particles emerge under favourable conditions stands. Dirac says: "All matter is created out of some impereptible substratum – Nothingness, unimaginable, and undetectable. But it is a peculiar nothingness out of which matter is created".

This new insight on empty space, the quantum vacuum or Dirac Sea has very significantly influenced subsequent developments in the field of elementary particle physics, cosmology, solid state physics etc. The creation and annihilation of particle–antiparticle pairs due to fluctuations in the Dirac Sea, a process that continuously goes on, opened up several interesting ways of understanding hitherto unexplained phenomena. How is the electrostatic force between the proton and the electron (for example in the hydrogen atom), negotiated though the empty space in between? The action at a distance problem that we raised earlier. This is now explained in terms of the exchange of virtual particles (virtual in the sense that they cannot be observed directly in any particle detectors) – the pairs of electrons and positrons, and their annihilation products – photons, being exchanged between the proton and the electron. This new concept of "exchange forces" in a sense replaced the old ideas of force drawn from daily experience. Is there evidence for such a phenomenon? Yes. This too was established, though indirectly through the detection of the altered radiation from the hydrogen atom itself. The electrons from the virtual pairs would move towards the positively charged proton and the positrons towards the electron of the atom. This would result in a reduction in the effective force between the proton and the electron., and would change the frequency of radiation emitted. In the case of other much shorter range nuclear forces the particles and anti-particles that were exchanged, were not the photons, but various other types of mesons of much heavier mass. The essential point to note is that there was a transcendence again in the very notion of force; and how it was negotiated.

In the field of cosmic ray studies (cosmic rays are very high energy particles that come from the depths of space), a very spectacular phenomenon is encountered. Occasionally more than a billion particles are incident almost simultaneously over tens of square kilometres at mountain altitude or sea level. These showers contain all kinds of fundamental particles – electrons, positrons, photons, nucleons, anti-nucleons, hyperons etc. The most intriguing thing is that these billions of particles owe their origin to the incidence of just one kind of high energy particle at the top of the atmosphere. Where were these particles before they manifested? The answer is in the extended Dirac vacuum. The primary particle in its collision with an air nucleus, first produces a large number of secondaries which start moving down. The production of these mesons, nucleons etc. is essentially a mining out from the excited vacuum region of the collision, sufficient energy being put in by the collision process. Some of the secondaries spontaneously decay into other particles. The remaining suffer further collisions as they move down and repeat the same process and produce more secondaries and this cascade of nuclear interactions continues down the atmosphere. Among the decay products, there are high energy photons which create electron–positron pairs. These electrons and positrons radiate high energy photons which give rise to more pairs of electrons and positrons. It is this cascading in the atmosphere that results in the production of billions of particles, all culled out from their hide-out, the quantum mechanical vacuum. The phenomenon itself is a gross one with billions of particles that are sampled and recorded in instruments like scintillation counters, cloud chambers etc. But the entire process involving the creation of so many particles is quantum mechanical in nature. Such an outcome could never be explained in the classical framework. The phenomenon, when analysed in terms of high resolution timing devices, beautifully demonstrates some of the relativistic effects like time dilation, increase of mass with energy etc. The chief point to be noted is the dominant role of empty space or vacuum in the whole process, which would never have figured in any classical treatment of the problem.

6. The spin parameter and its large scale influence

In addition to the mass and charge of the elementary particles, another important parameter that was first discovered in the analysis of the hyperfine structure of spectral lines emitted by excited atoms of elements is the spin parameter which again is a quantized parameter. The spin angular momentum in terms of ($h/2\pi$) units can be half-integral, integral or 0 and not any other value. What is most interesting is that the particles with half-integral spin electrons, protons etc. obey in large assemblies one kind of statistical behaviour (Fermi–Dirac distribution) and the integral spin particles obey quite a different statistical behaviour (Bose–Einstein). These features have tremendous influence on certain gross phenomena involving these particles. In fact the structure and properties of elements in the periodic table depends on the half integral character of the spin of the electrons and the Pauli Exclusion Principle. The influence of such parameters on macroscopic effects can be seen from the following examples. It is known that 99.9% of all matter that we come across on the earth is just empty inside. You can ask the question then: If this is so, why does not my hand go through the table, for example? There is no classical way of understanding this. The explanation depends on the quantum mechanical exclusion principle. There is lot of excitement in astronomy nowadays regarding condensed objects like white dwarfs, neutron stars, black holes etc. The factors governing the very formation of these objects and their properties depend on the spin parameters of the electrons, the protons and the neutrons that constitute the hydrogen and other elements of the stars.

There is yet another principle, Heisenberg's uncertainty principle, of tremendous importance in the quantum world, with major consequences in the everyday world that we are familiar with. The principle states that 'one cannot measure an object's position and momentum precisely and simultaneously'. A further elaboration of this principle that turned out to be significant was that it is not only a question of inability to measure, but also that these parameters do not have very precise values themselves; they fluctuate within the limits of the uncertainty principle – $\Delta P \cdot \Delta x \geq h/_{4\pi}$ and $\Delta E \cdot \Delta t \geq h/_{4\pi}$ where ΔP, Δx, ΔE, Δt are the uncertainties in position, momentum, energy and time interval of action. This principle provides for departure in the sacrosanct principles of conservation of energy and of momentum. There could be a departure in energy conservation by ΔE in a process which proceeds in time less than $h/4\pi.\Delta E$. In nature such allowances are made use of, for example, in spontaneous decays of some of the fundamental particles.

7. Conclusions

From the few examples given above (and many more which we have not presented here), it becomes apparent that many of the simple concepts originally introduced into physical explanations like space, time, causality, force, energy etc. have had to undergo considerable modification in terms of their implications and some have even transcended into the realm beyond normal human experience. These changes were forced by the discovery of new experimental results. We may remind ourselves that in the framework of the special theory of relativity, space and time are fused into the space–time continuum; flow of time, spatial intervals and even mass became functions of velocity; mass and energy become equivalent. In the framework of general theory of relativity, space becomes non-Euclidean, curvature of space becomes equivalent of mass (one a geometrical property and the other a physical quantity). In the light of quantum mechanics, the wave–particle complimentarity has to be accepted and even vacuum, which was originally conceived in classical physics as empty space (absence of all matter and radiation) becomes the very source of all the fundamental particles – the ultimate constituents of all matter, radiation and force. The concept of force gave way to exchange of virtual particles and anti-particles. The example we have given of a very high energy particle cascading through nuclear and electromagnetic forces into more than a billion particles of different properties is a clear illustration of the very dominant role that this so-called vacuum can play in creation, and in the destruction of matter and antimatter in extremely short intervals of time.

Though all this is in the realm of inanimate matter, it is equally relevant to animate matter as well, since the ultimate composition of animate matter is not different and has its origin in inanimate matter. In the development of organisms from the unicellular amoeba to the multi-billion-celled man, evolution based on the cardinal principles of natural selection and survival of the fittest is a subsequent phase to cosmological evolution, perhaps, beginning with the Big Bang as most popularly believed in scientific circles. These cosmological and creation theories of the universe and its variety of constituents have brought about the recognition of one very fundamental fact that, in the ultimate analysis, all this has arisen out of one substratum, call it quantum mechanical vacuum or four-dimensional space–time continuum or something equivalent, and this substratum has come into existence endowed with very specific properties, now discerned by physicists. Not all the properties of this substratum are known yet. In addition, the laws of nature have to be what they are, and so also the constants of nature. This being the case at the most fundamental levels of explanation, the possibility opens up that a similar situation may prevail in the living world also and explanations of fundamental questions like life, consciousness may in some sense be hidden in the as-yet unrecognised aspects of vacuum. In as much as the nuclear constituents throw up from the vacuum the virtual particles that mediate nuclear forces and the charged particles throw up the particles that mediate electromagnetic forces, it is conceivable that something similar may be happening during neuronal excitations, electronic tunneling from synapses, release of neurotransmitters etc. Since the consequence we are expecting from such processes is the emergence of consciousness, clearly this has to be a kind of transcendence that leads to very different type of cause–effect relation. In this context one may point out the following example, in the familiar field of chemistry. The three elements Carbon, Nitrogen and Oxygen combine differently to produce alcohols, sugars and fatty acids whose properties are very different. What is different is only the physical spatial structure of each brought about by the electromagnetic forces mediated by the virtual particles created in the intermolecular spaces. While the individual molecules do not show distinct properties, in large assemblies these properties 'emerge'. The whole is more than its constituents!

It may also be appropriate to remind ourselves of the cascade phenomenon – emergence of a billion particles through nuclear and electromagnetic cascades by the incidence of just one particle of very high energy – creation, decay and annihilation of particles under the supreme role of the underlying vacuum.

Speculations on a unified theory of matter and mind

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Abstract

Is consciousness an accident caused by random evolutionary processes? Or is it a fundamental property that emerges as a natural consequence of laws of nature? Are these laws of nature different from the laws of physics? Does 'information' play a more fundamental role than matter and energy when it comes to mind-body synthesis? A modest attempt will be made to address these difficult questions from a physicist's point of view.

Introduction

Most of the physicists today believe that we are very close to a unified theory of matter (UTM) based on p-brane theory (a variant of String [0-brane] theory) (Sarkar 2001). This theory has been well-motivated by the successes (from micro-chips to satellites) and the difficulties (the presence of infinities) of Quantum Gauge Field Theories (QED, Electro-Weak theory, GUT and SUSY GUT etc.) most of which are based on solid experimental evidences (measuring Lande g-factor of electron up to 10 significant places, prediction of Z-boson etc.). This 'theory of everything' tells us that all carbon atoms (after they are born out of nucleo-synthesis in the core of stars) in this universe are the same in space and in time, and thus is unable to explain why the carbon atoms present in a lump of roughly three-pound of ordinary matter - the human brain – give rise to such ineffable qualities as feeling, thought, purpose, awareness and freewill that are taken to be evidence for 'consciousness'!

Is Consciousness an accident caused by random evolutionary processes in the sense that it would *not* evolve again had the present universe to undergo a 'big-crunch' to start with another 'big-bang'? NO! It is a fundamental property that emerges as a natural consequence of laws of nature. Are these laws of nature different from the laws of physics? Is there a way to expand the UTM to incorporate consciousness? In this paper I make an attempt to point out a possible direction for such an expansion to achieve a unified theory of matter and mind by considering *'information' to be more fundamental than matter and energy.*

Nature manifests itself not only at the gross level of phenomena (accessible to direct senses) but also at the subtle level of natural laws (accessible to 'refined' senses). *Consciousness is the ability to access nature at both these levels.* Hence everything in nature is conscious, but there is a hierarchy in the level of consciousness. Although animals, plants and few machines today can access the gross level of nature, access to the subtle level seems to be purely human. In this sense a layman is less conscious compared to a scientist or an artist. (Is it possible that a level of consciousness exists compared to which a scientist or an artist of today may appear a layman?) *Once everything (both matter and mind) is reduced to information it is possible to define consciousness as the capability to process information.* Because any form of our access to nature is based on processing information with varying degree of *complexity.* The words process and complexity will be defined in the following. Now I proceed to elaborate the claims (italicized above) but due to the constraint of printing-space I will be brief here and the details of this scheme will be given elsewhere.

Matter

A. Phenomena

Some animals like dogs (in listening to ultrasound) and bats (in sensing prey through echoes) are better equipped than humans when it comes to direct sense experiences. But unlike animals, humans have discovered methods to extend their sense experiences through *amplification devices* like telescopes, microscopes etc. The summary (Davies 1989) of such sense experiences (direct and extended) acquired over the last five hundred years (equivalent to one second in a time-scale where the age of the universe is equal to a year) is that our universe extends in size from that of an electron (10^{-17} cm as probed by LEP colliders at CERN, Geneva) to the size of galactic super-clusters (10^{30} cm as probed by high red-shift measurements). The theoretical possibility of Planck length (10^{-33} cm) allows for further extension.

Our grand universe extending over more than 60 orders of magnitude in space has been constantly *changing* over the last 12 billion years! Living systems seem to have evolved out of non-living systems, and Consciousness seems to have evolved out of living systems. Is the dramatic difference between animate and inanimate, conscious and unconscious simply a difference in their ability to process information? At the level of phenomena, nature is so vast and diverse compared to the size and comprehension of human beings that one wonders how the collective inquiring human minds over the centuries could at all fathom the unity behind this diversity. This simply testifies to the triumph of the human mind over the physical limitations of the body, and has been possible because the human mind is capable of reaching a synthesis (an advanced form of information processing) based on careful observations of diverse phenomena.

B. Inanimate

Manifold: Till Einstein, everybody thought 'absolute space' is the arena (mathematically, a manifold) on which things change with 'absolute time'. In his special theory of relativity (STR), Einstein redefined the manifold to be flat space–time (3 + 1) by making both space and time relative with respect to inertial observers but keeping space–time (SpT) absolute. In his general theory of relativity (GTR), he propounded this manifold to be curved space–time that can act on matter unlike the flat space–time. Then the Quantum Theory (QT, the standard version, not the Bohmian one) pointed out this manifold to be an abstract mathematical space called Hilbert space since the space–time description of quantum processes is not available. Quantum Field Theory (QFT) that originated in a successful merge of QT and STR requires this manifold to be the Quantum Vacuum (QV). Unlike the ordinary vacuum, QV contains an infinite number of 'virtual' particles that give rise to all matter and interactions (Sreekantan 2001). Every quantum field has its own QV and a successful amalgamation of QT and GTR (called Quantum Gravity, and yet to be achieved) may connect the curved space–time with the QV of gravitational field. Finally, String (or p-brane) theory demands all fundamental entities to be strings (or p-branes) in ten-dimensional space–time. This evolution in our understanding clearly shows the necessity and importance of a background manifold to formulate any scientific theory.

Basic constituents: Energy and matter were considered to be the two basic constituents of our universe till Einstein showed their equivalence through $E=mc^2$. All forms of energy are inter-convertible. Matter in all its forms (solid, liquid, gas and plasma) consists of atoms. The simplest of all atoms is the hydrogen atom that contains an electron and a proton. If one considers the (now outdated) Bohrian picture of the hydrogen atom being a miniature solar system where the electron revolves around the proton in circular orbits then one realizes that most of the hydrogen atom is empty space. This means that if one blows up the hydrogen atom in imagination such that both electron and proton acquire the size of a football each, they need to be separated by 100 km or more! Hence one would think that even if 99.99% of the hydrogen atom consists of vacuum, the point-like electron and proton are material particles. But this is not so.

Elementary particle physics tells us that all visible *matter* (composition of *dark matter* is not yet known for sure) in the universe is made of six leptons and six quarks along with their antiparticles. Although they are loosely called *particles* they are not like the ordinary particles we experience in daily life. A 'classical' particle is *localized* and *impenetrable* whereas a 'classical' wave can be extended from minus infinity to plus infinity in space and many wave modes can simultaneously occupy the same space (like inside the telephone cable). But with the advent of quantum mechanics this seemingly contradictory differences between particle and wave lost their sharpness in the quantum world. A quantum object can simultaneously 'be' a particle and a wave until a measurement is made on it. According to QFT all fundamental entities are quantum fields (not material in the conventional sense) that are neither particle nor wave in the classical sense.

Evolution: Despite various specializations, all physical sciences share a common goal: given the complete specification of a physical system at an initial time (called the initial conditions) how can one predict what it will be at a later time? To predict this accurately one needs the exact initial conditions and the laws that govern the evolution of the system (called the dynamical laws). Either the lack of exact specifications of initial conditions or the intractability of the huge number of equations (that express dynamical laws) can lead to a probabilistic description rather than a deterministic one. However, there are chaotic systems that can be deterministic yet unpredictable because of their extreme sensitivity to initial conditions. Apart from dynamical laws there are other laws like $E=mc^2$ etc., which do not involve time explicitly. Could there be laws at the level of initial conditions that guide us to choose a particular set over another? A physical law is like the hidden thread (unity) of a garland with various flowers representing diverse natural phenomena. Its character seems to depend on characteristic scales (denoted by *fundamental constants* like Planck length, Planck's constant, and speed of light etc). Why should there be different set of laws at different scales? Most physicists believe that quantum mechanics is universal in the applicability of its laws such as Schrödinger's equation, and that the classicality of the everyday world is a *limiting case*. But there exists no consensus at present regarding the *emergence* of this limiting case.

Guiding principles: How does one formulate these physical laws? The principle of relativistic causality helps. Do physical laws change? Is there a unity behind the diversity of laws? Is it possible to understand nature without laws? The concept of symmetry (invariance) with its rigorous mathematical formulation and generalization has guided us in understanding the most fundamental of physical laws. Symmetry as a concept has helped mankind not only to define 'beauty' but also to express 'truth'. Physical laws try to quantify the truth that appears to be 'transient' at the level of phenomena but symmetry promotes that truth to the level of 'eternity'.

Interactions: The myriad mosaic of natural phenomena is possible because, not only does each fundamental entity evolve with time, but can also interact with the other basic constituents. All the physical interactions (known so far) can be put into four categories: (i) gravitational interaction (the force that holds the universe together), (ii) electromagnetic interaction (the force that holds the atom, and hence all of us), (iii) strong nuclear interaction (the force that holds the nucleus), and (iv) weak nuclear interaction (the force that causes radioactive decay). At present (ii) and (iv) are known (observationally) to be unified to a single force called Electro-Weak. Grand unified theories (GUT) and their extensions (SUSY GUT) for (ii), (iii) and (iv) do exist. Ongoing research aims to unify (i) with such theories.

According to QFT, the basic matter fields interact by exchanging messenger fields (technically called *gauge fields*) that define the most fundamental level of *communication* in nature. Both matter fields and gauge fields originate in the fluctuations of QV and in this sense everything in universe including consciousness is, in principle, reducible to QV and its fluctuations (Sreekantan 1999). Communication in nature can happen either via the *local* channel mediated by gauge fields or by the *non-local* EPR (Einstein *et al* 1935) type channels (through entanglement) as was demonstrated by recent *quantum teleportation* experiments.

Composite Systems: Till the importance of quantum entanglement was realized in recent times the whole was believed to be just the sum of parts. But the whole seems to be much more than just the sum of parts in the 'quantum' world as well as in complex classical systems. It makes quantum entanglement a very powerful resource that has been utilized in recent times for practical schemes like quantum teleportation, quantum cryptography and quantum computation. Quantum non-locality indicates that the universe may very well be holographic in the sense that the whole is reflected in each part.

C. Animate

Manifold: Space–time (3 + 1) is the manifold for all biological functions at the phenomenal level that can be explained by classical physics. If one aims to have a quantum physical explanation of certain biological functions then the manifold has to be the Hilbert Space.

Basic constituent: Cells are the basic constituent of life although the relevant information seems to be coded at the sub-cell (genetic) level. Neurons (or micro-tubules and cyto-skeletons) could be the physical substratum of the brain depending on the classical (or quantum) viewpoint.

Evolution: Does biological evolution occur with respect to physical time? If yes, will physical laws suffice to study biological evolution in the sense they do in chemistry? If no, is the biological arrow of time different from the various arrows of physical time (say, cosmological or thermodynamical arrows of time)? Is there a need for biological laws apart from physical laws to understand the functioning of biological systems?

Guiding principles: Survivability is the guiding principle in biological systems. Organisms constantly adapt to one another through evolution, thus organizing themselves into a delicately tuned ecosystem. Intentionality may also play a very important role in the case of more complex bio-systems.

Interactions: Interactions occur by exchange of chemicals, electric signals, gestures, and language etc. at various levels depending upon the levels of complexity involved.

Composite systems: Composite systems are built out of the basic constituents retaining the relevant information in a holographic manner. The genetic information in the zygote is believed to contain all the details of the biology that comes up later when the individual grows up. The genes in a developing embryo organize themselves in one way to make a liver cell and in another way to make a muscle cell.

D. Discussions

How 'material' is physical?: Anything that is *physical* need not be 'material', in the sense we experience material things in everyday life. The concept of energy is physical but not material. Because nobody can experience energy directly, one can only experience the manifestations of energy through matter. Similarly the concept of a 'classical field' in physics is very abstract and can only be understood in terms of analogies. Still more abstract is the concept of a 'quantum field' because it cannot be understood in terms of any classical analogies. But at the same time it is a well-known fact in modern physics that all *fundamental entities* in the universe are *quantum fields*. Hence one has to abandon the prejudice that anything `physical' has to be 'material'.

Is reductionism enough?: The reductionist approach: Observing a system with an increased resolution in search of its basic constituents has helped modern science to be tremendously successful. The success of modern science is the success of the experimental method that has reached extreme accuracy and reproducibility. But the inadequacy of reductionism in physical sciences becomes apparent in two cases: *Emergent phenomena* and *quantum non-locality*. Quantum non-locality implies a holographic universe that necessitates a *holistic* approach (Bohm and Hiley 1993).

Though it is gratifying to discover that everything can be traced back to a small number of quantum fields and dynamical laws, it does not mean that we now understand the origin of earthquakes, weather variations, the growing of trees, the fluctuations of the stock-market, the population growth and the evolution of life. Because each of these processes refers to a system that is *complex*, in the sense that a great many independent agents are interacting with one another in a great many ways. These complex systems are *adaptive* and undergo *spontaneous self-organization* (essentially nonlinear) that makes them *dynamic* in a qualitatively different sense from *static* objects such as computer chips or snowflakes, which are merely complicated. Complexity deals with *emergent phenomena*. The concept of complexity is closely related to that of *understanding*, in so far as the latter is based upon the accuracy of *model* descriptions of the system obtained using condensed information about it (Badii and Politi 1997).

In this sense there are three ultimate frontiers of modern physics: The very small, the very large and the very complex. Complex systems cease to be merely complicated when they display coherent behaviour involving *collective organization* of vast number of degrees of freedom. Wetness of water is a collective phenomenon because individual water molecules cannot be said to possess wetness. *Lasers, superfluidity and superconductivity* are a few of the spectacular examples of *complexity* in macroscopic systems, which cannot be understood in terms of the microscopic constituents alone. In every case, groups of entities seeking mutual accommodation and self-organization somehow manage to transcend their individuality in the sense that they acquire collective properties that they might never have possessed individually. In contrast to the linear, reductionist thinking, complexity involves *nonlinearity* and *chaos* and we are at present far from understanding complexity in inanimate processes, let alone that in living systems.

Emergence of Life: Is life nothing more than a particularly complicated kind of carbon chemistry? Or is it something subtler than just putting together the chemical components? Do computer viruses have life in some fundamental sense or are they just pesky imitations of life? How does life emerge from the quadrillions of chemically reacting proteins, lipids, and nucleic acids that make up a living cell? Is it similar to the emergence of thought out of the billions of interconnected neurons that make up the brain? One hopes to find the answers to these questions once the dynamics of *complexity* in inanimate systems is well understood.

Mind

A. Phenomena

The mind has three states: Awake, dreaming and dreamless sleep. The mind is capable of freewill, self-perception (reflective) and universal perception (perceptual) in its 'awake' state. Can it be trained to have all these three attributes in the states of dreaming and dreamless sleep? Can there be a fourth state of mind that transcends all the above three states? Where does the brain end and the mind begin? Due to its *global* nature, the mind cannot lie in any particular portion of the brain. Does it lie everywhere in the brain? This would require non-local interactions among various components of the brain. If there were no such non-local communication, how does the mind emerge from the brain?

Can anybody think of anything that transcends space–time? Is the mind capable of thinking of something absolutely new that has not been experienced (directly or indirectly) by the body? Nobody can think of anything *absolutely* new. One can only think of new ways of arranging and/or connecting things that one has learnt. In this sense, intellect is constrained by reason whereas imagination is not. But imagination is not acceptable to intellect unless it is logically consistent with what is already known. Imagination helps to see a new connection but intellect makes sure that the new connection is consistent with the old structure of knowledge. This is the way new structure in knowledge is born and this process of acquiring larger and larger structures (hence meaning or synthesis) is the *learning* process. Science is considered so reliable because it has a stringent methodology to check this consistency of imagination with old knowledge.

Can one aspire to study the mind using the methodology of (physical) sciences? Seeing the tremendous success of physical sciences in the external world, one would think its methodology would work for understanding the inner world. It is not obvious *a priori* why the QT should not work in this third ontology when it has worked so successfully with two different ontologies. We aim to understand nature at a level that transcends the inner and the outer worlds by synthesizing them into a more fundamental world of quantum information.

Manifold: A physical space–time description of mind is not possible because thoughts that constitute the mind are acausal: It does not take 8 minutes for me to think of the sun although when I look at the sun I see how it was 8 minutes ago. We will assume that it is possible to define an abstract manifold for the space of thoughts (say, T-space). An element of T-space is a thought-state (T-state) and the manifold allows for a continuous change from one T-state to another. I presume that T-space is identical with the mind but it need not be so if mind can exist in a thoughtless but awake state, often called *turiya*.

Basic constituent: How does one define a T-state? This requires one to understand what is a 'thought'. A thought always begins as an idea (that could be based on self and universal perception) and then undergoes successive changes in the idea but roughly remains focused on a theme. Change from one theme to another is triggered by a new idea. Hence I would suggest that the basic constituent of a T-state is an idea. An idea is like a 'snapshot' of experience, complete with all sense data, whereas a thought (T-state) is like an ensemble (where each element is not an exact replica of the other but has to be very close copy to retain the focus on the theme) of such snapshots.

Evolution: There are two types of evolution in T-space. First, the way an ensemble of ideas evolves retaining a common theme to produce a thought. To concentrate means to linger the focus on that theme. This evolution seems to be nonlinear and non-deterministic. Hence the linear unitary evolution of QT may not suffice to quantify this and will be perhaps best described in terms of the mathematics of self-organization and far-from-equilibrium phenomena. (On the practical side the time-tested techniques of Yoga teach us how to linger the focus on a theme through the practice of *dharana*, *dhyana* and *samadhi*.) The second type involves a change from one particular thought to another and this evolution could be linear and perhaps can be calculated through a probability-amplitude description in the line of QT. Given the complete description of a thought at any initial time, the refutability of any theory of mind amounts to checking how correctly it can predict the evolution of that thought at a later time.

Guiding principles: If the guiding principle for evolution in the biological world is survivability, in T-space it is happiness-ability. A constant pursuit of happiness (although its definition may vary from person to person) guides the change in a person's thoughts. Each and every activity (begins as mental but may or may not materialize) is directed to procure more and more happiness in terms of sensual pleasures of the body, emotional joys of the imagination and rational delights of the intellect.

Interactions: Can a thought (mind) interact with another thought (mind)? Can this interaction be similar to that between quantum fields? Perhaps yes, only if both thought and quantum fields can be reduced to the same basic entity. It will then be possible for thought (mind) to interact with matter. What will be the messenger that has to be exchanged between interacting minds or between interacting mind and matter? This ultimate level of communication has to be at the level of QV and hence it may amount to silence in terms of conventional languages. But can any receiver (either the human or any other mind or equipment) be made so sensitive as to work with this ultimate level of communication? Interaction with the environment is believed to decohere a quantum system that causes the emergence of classicality in the physical world. A completely isolated system remains quantum mechanical. Can a completely isolated mind exhibit quantum mechanical behaviour in the sense of superposition and entanglement?

Composite Systems: In the T-space, a thought is an ensemble of ideas and a mind-state is composed of thoughts. Behaviour, feeling and knowledge of self and universe are in principle reducible to composite subsets in the T-space.

B. Discussions

Working definition of consciousness

Consciousness (at the first level) is related to one's response to one's environment. This response consists of two parts: habit and learning. Once something is learnt and becomes a habit it seems to drop out of consciousness. Once riding a bicycle is learnt one can think of something else while riding the bicycle. But if the habit changes with time then it requires conscious attention. We have defined learning earlier as a process to determine the commensurability of a new experience with old knowledge. One has to learn anew each time there is a change in the environment. Hence consciousness is not the response to the environment but is the time of rate of change of the response i.e. $C = \mathrm{d}R/\mathrm{d}t$, where $R = H + L$.

The hierarchy in consciousness depends on the magnitude of this time derivative. Everything in the universe can be fit into a scale of consciousness with unconscious and super-conscious as the limit points. It is obvious that all animals show response to their environment, so do some refrigerators, but there is a hierarchy in their response. Through the use of 'cresco-graph' and 'resonant cardiograph' of J C Bose one can observe the response of botanical as well as the inanimate world. We cannot conclude that a stone is unconscious just because we cannot communicate with it using our known means of communication. As technology progresses, we may be able to measure both its response function R and its time derivative. If this is the right definition, what can it tell us about the future evolution of humans? My guess is that we would evolve from conscious to superconscious in the sense that genes will evolve to store the cumulative learning of the human race.

Emergence of consciousness

The first step in understanding consciousness consists of using the reductionist method to various attributes of consciousness. A major part of the studies done by psychologists (and their counterparts doing studies on animals) and neuro-biologists falls under this category. Such studies can provide knowledge about mind states (say M1, M2,...) but cannot explain the connection between these mind states and the corresponding brain states (say B1, B2, ...). Because this kind of dualistic model of Descartes would require to answer (a) where is the mind located in the brain, and (b) if my mind wants me to raise my finger, how does it manage to trigger the appropriate nerves and so on in order for that to happen without exerting any known forces of nature?

To find out how the mind actually works one needs to have a theory of mind, one that will relate the sequence of mental states M1, M2, M3,... by providing laws of change (dynamical laws for the two types of evolution discussed above) that encompass the mental realm, after the fashion of the theory of matter that applies to the physical realm, with its specific laws. Such a theory of mind is possible if we synthesize the results of studies on attributes of consciousness to define the exact nature of the manifold and the basic entities of the T-space (or Mind–Space). Once this is achieved, one can attempt to explain the emergence of consciousness taking clues from the complexity theory in physical sciences. But such an extrapolation will only make sense provided both M-states and B-states can be reduced to something fundamental that obeys the laws of complexity theory. We propose in the next section that information is the right candidate for such a reduction.

Role of Indian philosophy (IP)

(1) Unlike the Cartesian dichotomy of mind and body some schools of IP like *Vaisheshika* and *Yoga* treat both mind and body in a unified manner. Since (Western) science is based on the Cartesian paradigm it cannot synthesize mind and body unless it takes the clue from oriental philosophies and then blends it with its own rigorous methodology.

(2) In terms of sense awareness, awake, dreaming and dreamless sleep states are often called conscious, sub-conscious and unconscious states. A great conceptual step taken by IP in this regard is to introduce a *fourth state* of mind called *turiya* that is defined to be none of the above but a combination of all of the above states. This state is claimed to be the superconscious state where one transcends the limitations of perceptions constrained by space–time (3 + 1). Patanjali has provided very scientific and step-by-step instructions to reach this fourth state through *samyama* (*dharana*, *dhyana* and *samadhi* are different levels of *samyama*). The scientific validity of this prescription can be easily checked by controlled experiments. Nobody can understand modern physics without going through the prerequisite mathematical training. It would be foolish for any intelligent layperson to doubt the truth of modern physics without first undergoing the necessary training. Similarly one should draw conclusions about yogic methods only after disciplined practice of the eight steps of yoga.

(3) IP can provide insights regarding the role of mind in obtaining happiness and thus a better understanding of mind itself. Happiness lies in what the mind perceives as pleasurable and hence the true essence of happiness lies in the mind and not in anything external. Once the body has experienced something, the mind is capable of recreating that experience in the absence of the actual conditions that gave rise to the experience in the first place. One can use this capacity of mind to create *misery* or *ecstasy* depending on one's ability to guide one's mind.

(4) There is a concept of *anahata nada* (the primordial sound) in IP. Sometimes the possibility of having a universal language (like *Sandhya bhasa* etc.) to communicate with everything in the universe is also mentioned. Modern physics tells us that the only universal language is at the level of gauge bosons and QV. Is there any connection between these two? Can a (human) mind be trained to transmit and receive at the level of QV?

(5) It is said that whole body is in the mind whereas the whole mind is not in the body. How does the mind affect the body? If one believes in the answer given by IP then the results obtained in this regard by western psychology appear to be the tip of the iceberg only. Can science verify these oriental claims through stringently controlled experiments?

Unification

Information

Information seems to be abstract and *not real,* in the sense that it lies inside our heads. But information cannot only *exist* outside the human brain (i.e. in a library, a CD, internet etc.) but can also be *processed* outside the human brain (i.e. by other animals, computers etc.). Imagine a book written in a dead language, which nobody today can decipher. Does it contain information? Yes. Information exists. It does not need to be *perceived* or *understood* to exist. It requires no intelligence to interpret it. In this sense information is as real as matter and energy when it comes to the internal structure of the universe (Stonier 1990). But what we assume here is that *information is more fundamental than matter and energy* because everything in the universe can ultimately be reduced to information.

Information is neither material nor non-material. Both quantum fields and thoughts can be reduced to information. If the human mind is not capable (by the methods known at present) of understanding this ultimate information, it is its own limitation. This may not remain so as time progresses. The whole of the physical world can be reduced to information (Roy Frieden 1999). Is information classical or quantum? There are enough indications from modern physics that although it can be classical at the everyday world level it is quantum at the most fundamental level. Quantum information may have the advantage of describing the *fuzziness* of our experiences.

Manifold: The manifold is an information field (I-field) for classical information (like that of Shannon or Fisher etc.). Hilbert space of QT is the manifold for studying quantum information. But if quantum information has to be given an ontological reality, it may be necessary for the manifold to be an extended Hilbert space.

Basic constituent: A bit or a qubit is the basic entity of information depending on whether it is treated as classical or quantum respectively. Information can be of two types: kinetic and structural, but they are interconvertible (Stonier 1990).

Evolution: All organized systems contain information and addition of information to a system manifests itself by causing the system to become more organized or reorganized. The laws for evolution of information are essentially laws of organization. Are these laws different from the physical laws? Is there an equivalent in the world of information of fundamental principles like the principle of least action in the physical world?

Guiding principles: Optimization seems to be the guiding principle in the world of information. What gives rise to structure in the information such that we acquire an understanding or meaning out of it? Is there a principle of least information to be satisfied by all feasible structures?

Interactions: Interaction at the level of information has to be the ultimate universal language. What could be that language? The only fundamental language known to us is that of the gauge fields that communicate at the level of QV. Could the gauge fields serve as quanta of information? How different is this language from conventional language? Can this help us to communicate with not only other creatures incapable of our conventional language but also the inanimate world? The time is not yet ripe to answer these questions.

Composite systems: How can every composite system of information (like a gene or a galaxy) be expressed in terms of bits or qubits? Does the holographic principle also apply to information?

Discussion: Consciousness and information

There is no doubt that sooner or later all attributes of consciousness can be reduced to information. This is just a matter of time and progress in technology, and will complete the understanding of consciousness at the gross level of phenomena. It will also harbinger the understanding of consciousness at the subtle level of laws. The synthesis of the phenomenological studies of consciousness will be possible by treating information as the most basic ontological entity, which can unify mind and matter. The emergence of consciousness will be understood in terms of nonlinear, far-from-equilibrium complex processes that lead to spontaneous self-organization and adaptation of structures in the manifold of quantum information.

Consciousness will be seen as the ability to process quantum information in an effective way. Depending on the degree of complexity involved, processing will encompass activities starting from the way a planet knows which is the path of least action, to the way modern super-computers do simulations of reality, to the way a scientist makes a discovery or an artist traps beauty on a canvass through the nuances of truth. The limit points of unconscious and superconscious will correspond to the limiting cases of no-information processing and infinite-information processing respectively. Sub-conscious will be interpreted as partial information processing. Every entity in the universe has to take a decision at every moment of time for its existence although the word existence may mean different things to different entities. The chance for continuation of existence is enhanced if the best decision on the basis of available information is taken. This is a process of optimization and the more conscious an entity is, the greater its ability to optimize.

Limitations of understanding

Is there any fundamental principle (or theorem) that places a limit on the understanding of both mind and matter by reducing them to information and then applying methodology of physical sciences to understand life and consciousness as emergent phenomena? Since this approach heavily relies on mathematics, the limitations of deductive logic as pointed out by Godel in his famous incompleteness theorem may indicate the first limit. The second constraint may come from QT if it turns out (after having rigorous information theoretic formulation of both matter and mind) that the information related to mind is complementary to the information found in matter. I personally feel that this is quite unlikely because I believe that information at the fundamental level cannot be dualistic.

Conclusions

Unlike the Cartesian duality between mind and body, understanding consciousness requires us to first to understand matter and mind in a unified way. This can be achieved by giving "information" the most primary status in the universe. Then a generalized theory of quantum information dynamics has to be formulated (see the table: The World Matrix, for a summary). The line of attack involves three steps: (1) understanding emergent phenomena and complexity in inanimate systems, (2) understanding life as emergent phenomena, and (3) understanding consciousness as an emergent phenomenon. The attributes of consciousness can be understood only by a prudent application of both reductionism and holism. The emergence of consciousness can be understood as an emergent phenomenon in the sense of structural organizations in the manifold of information to yield feasible structures through which we attribute meaning and understanding to the world.

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Table: The World Matrix (Summary of various Worlds)

Character	Physical	Biological	Mental	Information
Manifold	SpT (3 + 1), Hilbert space, QV, SpT (10)	SpT (3 + 1), Hilbert space	T-Space (Abstract mathematical Space)	I-Field, Extended Hilbert space
Basic constituents	Wavefunction, Quantum fields, Strings, p-Branes	Cell, Neuron, Micro-tubule, Cyto-skeleton	Idea (based on self- or universal-perception)	Bit (classical), Qubit (quantum)
Evolution	Phys. Laws (mostly diff. equations)	Phys. Laws, and / or Bio-Laws	Laws for evolution of thought	Laws for evolution of organization
Guiding principles	Symmetry (Group, Theoretical)	Survivability and Intentionality	Happiness-ability	Optimization
Interactions	Gravity, ElectroWeak, Strong nuclear interaction	Chemicals, Electrical signals, Gestures, Language	Primordial Sound or Vibrations, Quantum fluctuations	Local, and Non-local (EPR type) channels
Composite systems	Many-body systems with or without interactions	Plants, Animals	Thought (ensemble of ideas with ordering)	Complex systems with hierarchy in organization

Panel Discussion

Metaphysical implications of modern science

Extracts and summary

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The panel was chaired by Prof. Wesley Wildman and the panelists were Professors N Kumar, M K Chandrashekaran, Srinivasa Rao, Jean Staune and Purushottama Bilimoria. The coordinator for the panel was Dr M G Narasimhan.

After the panelists were introduced by the coordinator, in his opening remarks Dr Wildman pointed out that the topic 'Science and Metaphysics' was very complicated and that it was important to know certain things. First, the two terms have been used to describe features of intellectual activity in the history of humanity, in very different ways in South Asian, West Asian, and East Asian traditions. This has contributed to confusion which could have been avoided. Second, there are many allegations that science and metaphysics are ill-suited for decent humans. The charge against science is that science's attempt to be objective is futile because scientific objectivity involves moral abandonment for the products of science. On the other hand, thex charge against metaphysics is that metaphysics is futile because it is incoherent, impossible and deranged. The metaphysical charge is the one that sticks hardest and longest in the Western tradition giving rise to a number of disputes. It is a conflict of opinions, which have become unresolvable. This being the case, it is stated that it is better to stick to more tractable things like the sciences.

But, despite these problems, Prof Wildman expressed the view that in our time there is a possibility of a closer relationship between science and metaphysics. This can be in two ways. Metaphysics is capable of representing a world of values and perspectives on scientific activity that inhibits the tendency in scientific cultures to reduce reality to that which science can manage. Conversely, science produces boundary questions that cannot be answered within Science itself but demands reflection by careful intellectuals. He observed that this can be taken as the meaning of metaphysics here and pointed out that the panel would be looking at the second kind of implication, i.e., the implication from science to metaphysics, trying to learn from science what constrains speculative metaphysical construction which for itself aims at a wider and deeper understanding than science can produce on its own terms. Prof Wildman concluded his remarks by saying that the task of the panel would be to explore the deeper aspects of science and metaphysics so that they could be brought closer to each other.

N Kumar*

Prof N Kumar, speaking on the topic, 'Self-consciousness: The First-Person Singularity', argued that free-willed self-consciousness, being a 'private' phenomenon, may not interact with the will-free neuronal brain (which belonged to public domain) as this would violate the rules of procedure and behaviour that are valid in their own respective domains. Thus articulating the 'hard' problem, Prof Kumar, stated that this could be resolved only through 'reduction' of the two domains to the subliminal levels of detection through the agency of extreme sensitivity as is done in the case of determinable chaos.

Elaborating both the problems which he locates at the intersection of physics and metaphysics and possible solutions for it in his paper, Prof Kumar observes that the two domains of self-consciousness and brain do interact with each other, despite the fact that there can be no pre-fixed 'Interaction' theorem between them. Presenting his arguments as a physicist, Prof Kumar observed that of the three ideas (which he regards as attractive) Reduction, Emergence and Intermediate Concepts, Reductionism is a reasonable principle as it is based on the experience of past centuries. He observes that even the property of Emergence is related to reduction as the emergent properties of self-consciousness or consciousness must be consistent with the laws of physics.

M K Chandrashekaran*

Prof M K Chandrashekaran in his presentation dealt with the experiments he had conducted with human subjects (mainly his students in the Department of Behaviour and Physiology, School of Biological Sciences, Madurai Kamaraj University) concerning their response to various aspects of time consciousness under controlled conditions.

One of his most important findings was that under conditions of prolonged social isolation there would be expansion and contraction of the human consciousness of time.

Srinivasa Rao*

Following the two presentations made by a physicist and a biologist, Prof Srinivasa Rao, a philosopher, presented his viewpoint stating that in any discussion of the metaphysical implications of modern science, it is necessary to have clear understanding of the meaning of the term "metaphysics". After describing metaphysics as conceptual structure constructed on the basis of reason alone, Prof Rao emphasized the role of reason in science as well. Although this scientific reason is speculative in nature, it has to be combined with experiments, observation and experience in order to produce scientific knowledge.

Given the fact of this interaction, Prof Rao said that in recent times a situation has arisen when scientists (physicists, in particular) have been compelled to study consciousness (hither to neglected as a metaphysical, unobservable entity) with as much seriousness any other physical phenomena.

Jean Staune

In continuation with Prof Srinivasa Rao's presentation, Prof Jean Staune, a philosopher from France, stated that in his talk he would deal with scientific discoveries of the previous century (the 20th Century, that is) specially those which are relevant for metaphysical questions. He began with a reference to quantum physics, as it was the most important development in 20th Century science. He said that in this connection he would refer to particle duality. In terms of its foundational character, a quantum entity exists in the kind of reality that is different from ordinary reality. So elementary particles are not as real as the thing (i.e., the object) that they form. This aspect of elementary particles is a very new and important aspect of the metaphysical view of discovery. To put it more provocatively, matter is not real matter, or completely material viewed from the common sense view of the term 'material'. Next, there is the phenomenon of non-locality, a very important aspect of quantum theory. It can be said that (in this context) the particle is only one single object, but the fact is that it has a completely separated level of reality, which means that one particle could be here and the other could be at a distance of 10 km. In view of this, it would make no sense to claim that there is no separation between the two particles in our level of reality. But at the other level of reality, at the quantum level, there is no meaning to the claim about the separation of the two particles. So, while one can speak about this experiment (in quantum theory) in many ways, the conclusion remains the same about the existence of another level of reality outside space, time and energy and matter. In addition, there are metaphysical questions, which arise from general relativity in astrophysics. General relativity shows that there is the activity of space and time, which, in turn, indicates the possibility of the beginning of space and the beginning of time.

In astrophysics the big bang theory indicates the need for another reality outside space and time. In addition to this, there is the anthropic principle which raises a huge metaphysical question which implies the existence of parallel universes and indicates that only by chance are we in a humdrum universe. Now, about the question of the existence of God or a Creator: the answer is not scientific. One can choose a universe with God or one can choose an infinite number of universes without any meaning or God. But presently this question of the meaning of the universe is a scientific question and shows that from a metaphysical point of view, it is a very novel question. Jacques Monod, for example, a Nobel Prize winner, who was also a deep atheist, argued that this question of meaning, the question of finality is absolutely outside science and that it had nothing to do with science. As it happens, ten years after the publication of Monod's "Chance and Necessity", science has in fact discovered (re-discovered, one might say) this question again but the answer, even if it is a personal answer, is yet to be discovered. The fact remains that the question of meaning (of these developments) is now a scientific question and that is something new. Again in the study of the evolution of life, the new paradigm is to challenge the Darwinian theory, i.e., not to challenge evolutionary theory *per se*, but to challenge the Darwinian explanation of evolution according to which evolution is just a matter of chance and a humdrum affair. Added to this, there are arguments to the effect that there is no meaning and purpose at all in evolution, that it is in fact a story of selfishness, that we are genetically controlled machines and that competition resulting in the elimination of the opponent is the main mechanism of achieving success in evolution. In order to challenge (and change this paradigm) Prof Staune said that there are three ways of thinking – one could use the complexity theory, the idea of emergence of self-organisation, and the ideas of Michael Denton.

Prof Staune also stated that there is a paradox related to the existence of these new paradigms and that this paradox indicates that there is a connection between the mind of a human and the structure of the universe. When for example, Einstein said that the most amazing thing about the universe was that we could understand it, he was referring exactly to this idea. In a way, when Einstein referred to the existence of God, he was referring to the fact that we can understand the universe. On the other hand, according to Prof Staune, one could say God exists and that there is a place for God because one cannot say that one can completely understand the universe and that herein lay the paradox. In view of this, he stated that the right task for metaphysics in the next century is to integrate, and to synthesize the two schools of thinking and only through this metaphysics can scientific progress be made.

Concluding his presentation, Prof Staune observed that we have achieved enough understanding of the universe to show that there is a connection between us and the origin of the universe. But, on the other hand, we also know that we do not know everything and this gives rise to the idea of incompleteness which Prof Staune has tried to develop. There is this idea given by the Vedas, the Bible, and the Quran, indicating that there is another level of reality, which is given to us (only) in revelation. This is an idea, Prof Staune observed which could be considered with more credibility. Quoting Arthur Eddington an astrophysicist, who says that "concerning the progress of science after 1927, after the rise of quantum mechanics a clever man can again believe in God", Prof Staune said that although this was meant to be a joke, it presented good news.

Purushottama Bilimoria

In the final presentation of the panel, Prof Bilimoria, a philosopher, stated that he would restrict his presentation to three remarks and two illustrations. First, he referred to the fact that in the past metaphysics was considered to be the queen of sciences, especially as it had developed in medieval times. But later metaphysics became discontinuous with science and on the whole philosophy also did so. Second, metaphysics, while thought to be speculative (taken in a broader sense of speculative reason inclusive of the mystical, the faith-based and so on), has the critical function of providing what William Grace calls (in Science, Religion, and Naturalism) the "limit questions", questions which may not have been asked before, questions pushing perhaps boundaries in some directions. The third point is that metaphysics encompasses the teleological trajectories of the goal of organising, forging links, cross-threading, stitching parts to wholes between and across disparate disciplines and knowledge traditions. According to Prof Bilimoria, Immanuel Kant, the 18th century German Philosopher is said to have thrown a wet towel over metaphysics by grounding it in empirical synthetic *a posteriori* investigations as distinct from the *a priori* where the role of pure reason of scientific enquiry to be found. So, metaphysics from that point on become marginalised if not found to be destructive with regard to pure and practical science. Even though in modern philosophy Kan would not dispense with these tropes his critique would still not be considered science as physics or Newtonian mechanics are thought to be. Prof Bilimoria observing that this is a discontinuous argument said that two consequences are entailed by it. As a result of this argument, one could say that either metaphysics has no relevance in the domain of science or its preserve is that of a discourse of critique as people like Habermas called it. In other words, it is as though metaphysics provides a second order language to supply questions for guiding distinctive enquiry within a scientific discipline and drawing them together into logical wholes and within this net raise non-reductive questions about the limitations as well as the possibilities in respect of what has emerged in that enquiry. So metaphysics is in a broader sense a meta language or a meta conceptual task providing certain questions that may not have been possible within that discipline itself. Prof Bilimoria referred to this as the limit question in his Sutra 2 as indicated by William Grace.

The example in this case is basically related to the suggestion that physics leads us to cosmology which is based in naturalistic presuppositions or naturalistic world view. Now it is possible, according to Prof Bilimoria, that the kinds of questions that one could ask in this context could come from not only physics itself but also from biology, or from religion or metaphysics and by that a certain kind of deconstruction could follow from naturalism. Two types of questions may arise from this situation. One of them could be called the last desk question – questions which are passed on to the very last desk as in the case of bureaucracy, – well, if you are not able to answer it goes on to somebody else one such question that would arise here is about the very fact of existence and wholeness, perhaps even the persistence of the world or as Heidegger, drawing out limit question in Kant, put it brilliantly in one of his very influential works, *What is metaphysics*?, this way – *"why is there existence and not non-existence"*? There may well be non-existence within existence where we have considered the extremities of the universe, of what lies beyond that if we have exhausted that existence by the way, we know that 30 percent of the physical universe is made up of matter of observable entities. Now as to what comprises the rest and what comprises the beyond, well the Buddhists had a very good answer – nothingness, obviously. A further question – whether existence sits in non-existence is an important metaphysical one. He said that he does not know how scientists would deal with questions of this kind because most physicists presuppose the question even before they have asked the question about the structure of things in this organization and so on the question whether non-existence exists would not make sense but it may be a question which may need to be asked at some point.

Second, transcendental deductions pushing theological boundaries through leaps of mystical faith or perhaps in the sense of speculative reason that was referred to earlier, raise questions which are related to the limits or end points of naturalism or even realism of certain kinds of descriptions. More because of certain discrepancies and inconsistencies, which have arisen in those world views, we may need to ask questions such as what there is not rather than what there is or questions such as what is possible further within the limits of reason so far as they are available. By asking these questions one is not necessarily pandering to the so-called ultimate questions in philosophical theology as the constraints are obvious. In addition to this, there is a question of meaning and questions about what is significant which we can derive from our investigation from our understanding of things as they are.

After presenting his observations on the role of metaphysics in providing the limit questions, Prof Bilimoria offered two illustrations, one related to consciousness and the other related to discussion about realism. One fact about consciousness generally overlooked is that consciousness does not present itself as an observable object, that is in the form of electrons, quartz, superstrings, or quantum and so on. It does not present itself even as a mathematical entity about which people have expressed a sense of mystery but which does not necessarily refer to anything mystical for that reason. So the first thing we have to acknowledge about consciousness is that it is present in our experience and that it is a subjective thing. The second point which needs to be stressed, is that consciousness exists in history which is presented as a loosely constituted continuum in the world. This history is the one shaped by human beings through various experiences, conscious, unconscious, individual and so on. Prof Chandel talked about Marx in this context but perhaps

Hegel might have been a more appropriate candidate to talk about the history of consciousness as also the consciousness of history. In this regard, Kant, Hegel and Marx are considered to be the big boys of German philosophy and of course Hegel had a lot of influence on Marx and one could say that consciousness is not a piece of happening inside a hunk of meat or in a computer as some of the analogical models present. Consciousness in its relation to time becomes vertical when it is synchronic and horizontal when it is diachronic. History of consciousness is a very important aspect of the work of people like Duhem, Cassirer and certainly Heidegger and this attests to the transcendentality of consciousness, which does not mean that the transcendent is going beyond/outside the empirical but something which is constitutive of the world. Transcendentality of consciousness, in terms of its prioricity and constitutedness, that is, it being there before we arrive, is like language and it forms us in a way, that is, it also determines what we are and who we are (even after we have gone), after biology, genetics and neuroscience have completed their enquiries and so on. Consciousness grows in a way and does not remain the same, a 100 years later people might have a different sense of consciousness in terms of their experience, in terms of history – this being the case how does one capture this sense of change or explain this in terms of an ideology – transcendentality is a limit question here. Scientists are weak on history but they are worse on the historicity of consciousness – some people locate consciousness outside the world and some inside the world. Both Prof Bilimoria thinks are wrong. Consciousness is neither inside nor outside – rather it is a correlation between the noetic that we have experience of inside and noemic meanings, which are grounded in social life. The two forms of consciousness taken together in the world constitute transcendental subjectivity and this accounts for the unity of perception that classical phenomenology indicates in the thesis that consciousness constitutes. Whereas naturalism has insisted on the fact that the world produces consciousness, this is too one-sided as consciousness has a quality of intentionality and there is no consciousness object without intentionality – hence I would repeat the phenomenological thesis that consciousness constitutes the world as well. There is a correlative between the two and the Buddhists have a different way of putting it, dependent origination or Prathithya Samuthpada and so on.

Concluding his presentation, Prof Bilimoria referred to the act of getting meaning, that is, obtaining coherence out of explanations that Prof Clayton had called insufficient, as the second example of his critique. The descriptions and explanations of phenomena require at times concepts, categories, binding structures and critiques that do not belong to the vocabulary, say of fundamental physics, especially if such phenomena involve complex arrangement of constituents .... Scientific theories themselves are complex noematic structures and these are related to theories of time, theories of measurement, logical or mathematical techniques, which are all theories. These theories belong to philosophy and metaphysics where they are scrutinised, chiselled, fine-tuned and so on. These are, in short, higher level idealisations of the everyday perceptual world of achievement, of historically developing thoughts agreed upon by the community of investigators and confirmed by successful predictions for all intents. These may not lead to the establishment of ultimate principles but lead by inference to the best explanation until falsified. The picture of correspondence to reality no longer fits this account and hence realism has to be critiqued especially, the realism that comes out of science as scientific realism, phrased on the boundaries of science. Prof Bilimoria at the end of his presentation observed that as a philosopher he could only point to the limit questions and place some bets on what is yonder, and unlike Pascal, was not afraid of losing the wager, come what may.

Writeups by these speakers are included in this proceedings

Self-consciousness: The first-person singularity

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Abstract

It is argued that the free-willed self-consciousness, belonging in the private-limited domain, may not interact with the will-free neuronal brain (the physical world whose domain is public limited), without causing serious violations of the rules of procedure and behaviour that are valid in their respective domains. Resolution of this 'hard' problem seems possible wherein these otherwise sensible violations are effectively reduced to the sub-liminal levels of detection through the agency of extreme sensitivity, as in deterministic chaos. But, a deeper resolution may emerge through proper choice of an interaction mechanism that matches the two differently ruled motions smoothly, much as an idler meshes with two differently speeding toothed gears. This, however, calls for much deeper thought. Note that we are not concerned here with the problem of provenance – the origin of self-consciousness. The latter is simply taken as a given – irreducible and non-negotiable. Our real concern here is with the question of how it may possibly interact commensurably with the physical world, namely the neuronal brain.

1. The problem

Self-consciousness, with its indivisible integrity, belongs in the private domain. But, the neuronal brain, with all its divisible complexity, is physical, and belongs naturally in the public domain. Different rules of behaviour and procedure operate in the two domains, e.g., self-consciousness is free-willed while the neuronal brain is will-free. Therefore, any interaction between the two will subtend violations that are inadmissible – physically as well as logically. And yet, interact they must as all evidence on hand suggests. This then is the problem – the 'hard' problem of self-consciousness that science (read physics) and metaphysics ultimately must address.

In order to see more clearly the nature of this problem, consider the following. Self-consciousness is a primary experience of my inner life that I can never ever begin to doubt. But, I know of this awareness-of-being-aware only introspectively, and self-referentially therefore. It is inalienable, indeed would have been incommunicable except for certain congruences of our behaviour and the commonality of our conditions. This act is responsible for the remarkable transference that I can attribute self-consciousness to others around me. In precise physics terminology, I should say that self-consciousness is not reducible to 'pointer readings'. Therefore, its domain is private-limited.

The brain, on the other hand, is a complex piece of physical hardware, or rather wetware – a neural network. It is subject to the usual laboratory measurements, e.g., to Positron Emission Tomography (or, PET). We say that it is reducible to the 'pointer readings', accessible equally well to all: It is in the public domain. True, physics can and often does deal with unobservables (the quantum-mechanical wavefunction, for example), but then these are unobservable to all alike. Nothing personal about them. Now, and this is the crucial point, these two domains seem mutually exclusive in the strict sense that they cannot interact. Why? Because, interaction implies affecting something and being affected by that something in return. Thus, imagine our brain (the physical world) somehow affecting our self-consciousness. This effect will be processed by the latter according to its own domain-specific rules of behaviour and procedure. Now, when this self-consciousness subsequently reacts back on the physical brain, the received effect will carry the tell-tale marks of having been processed differently, i.e., by the free-willed self-consciousness, which as seen now from within the domain of the physical brain, will be in violation of the rules resident and valid therein. Such violations are, of course, inadmissible – logically as well as physically. Hence the NO INTERACTION THEOREM, if you will! And yet, on all evidence present, interact they must (or why go through the bother of debating at all!). Hence the problem.

2. Towards a possible solution

One can, of course, resolve the whole problem by a clever trick of pre-established coincidences, namely that while the self-consciousness is indeed free-willed, somehow by its very nature it wills (in its own domain) what the physical laws would demand in the physical domain (of the brain). But then, this will make the free-willed self-consciousness a concomitant of the physical brain, and, therefore, quite irrelevant to me. (This kind of freedom will be like the pure gauge freedom of classical electromagnetism. One can, however, pursue this line of thought further in the hope of finding a non-trivial interaction mechanism). We do not, however, pursue this any further here.

Another reasonable way out would be to appeal to what some earlier thinkers had very imaginatively referred to as the 'critically poised atoms' (which in the modern context may refer to the 'sensitivity', characteristic of deterministic chaos) assumed to inhere in the complexity of the neuronal network of the brain. The idea would be that of (arbitrarily) small causes (originating in the self-willed self-consciousness) giving (arbitrarily) large effects (in the physical brain) quite out of proportion to the cause. These would then, because of the almost infinite sensitivity, be hardly traceable to the primary causes. Note that we are not talking here of deterministic chaos as somehow providing the free-will itself. It merely provides a mechanism for covering up the causal trace connecting the free-willed self-consciousness to the will-free brain, such that no sensible violations could be discerned.

And now, let us consider the subtle and the minute. The question fundamentally is whether or not we can have an interaction between two systems, with their own differently governing laws, without leading to inconsistencies, which are, of course, inadmissible. Similar question has been posed in a different context (of classical and quantum worlds in interaction) and solved by E.C.G. Sudarshan (1976) for a model. I think this line of thought needs to be pursued seriously.

3. Some general remarks

And finally, let me briefly comment on the relevant and the attractive ideas of Reduction, Emergence and the Intermediate Concepts. Reductionism is a reasonable principle, firmly based on the experience of past centuries. In its unlimited form, its domain of validity includes all matter, living or dead, on all scales, inclusive of all hardware, wetware and even the software and the 'a-ware'. Best expressed by Feynman as, "Everything is made of atoms. Everything that we do atoms do. There is nothing that living things do that cannot be understood from the point of view that they are made of atoms acting according to the laws of physics". It was, therefore, not so astonishing after all when Francis Crick hypothesized that "Your joys and your sorrows ... your sense of personal identity ... are nothing but a pack of neurons", and went on to give the coordinates of consciousness (or free will) in the anterior cingulated sulcus (and not in the pineal gland that housed Descartes' Theatre). Underlying this reductionist approach, however, is the belief that somehow beyond a sufficient degree of complexity of the will-free matter (the neuronal brain), the free-willed self-consciousness arises as an Emergent Property – that more is different! But, the point is that emergence and the emergent properties too must be consistent with the laws of physics (although not derivable from these laws, but so only in the sense that we may not even begin to think in that particular direction of all possible directions – it may involve exhaustive search).

I think, as a matter of principle, reductionism underlies all scientific explanation. But, having re-assured oneself thus, one should move on and use the Intermediate Concepts in one's professional researches – concepts like valency, viscosity, fitness, adaptation, emergent properties and so on. They have great value. But, at the fundamental level, the issue at hand, namely that of the interaction between the free-willed self-consciousness with the will-free brain, must be addressed through reduction .

Finally, experimental facts from brain research (neuroscience), and the experiences gained from introspection and the various yogic practices must be critically assimilated. Thus, for example, it is important to note the elementary fact that anaesthesia causes loss of consciousness (and presumably of self-consciousness), but without causing cessation of all cortical activities. And when it finally wears off, the Self-Consciousness 're-boots' itself. Also, the possibility that the split-brain experiments (with the corpus callosum severed) may be pointing to two separate personalities (two distinct self-consciousnesses, if I may), which get synchronized on neuronal re-connection of the two separated hemispheres. If really so, then one sees the possibility of using the theory of synchronization and entrainment (well-known from the chaos theory) of two individual self-consciousnesses! Indeed, the split-brain experiment is perhaps already a demonstration *in vivo* of this realization. Examples multiply. But the point, I think, has been made.

Reference

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Consciousness of passage of time in humans under prolonged social isolation

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Thirteen human subjects, four females and nine males of between 20 and 35 years age, were studied for the *timing* of their sleep/wake cycles, rectal temperature profiles, mean intake, blood pressure, short-interval time estimation and alertness, in fifteen experiments lasting variously 21 to 43 days in *social isolation* in a specially built 'human isolation facility' of 25` x 25` dimensions. This facility was built in the Department of Animal Behaviour and Physiology, School of Biological Sciences, Madurai Kamaraj University with financial support from the Department of Science and Technology, Government of India under their IRHPA scheme. The facility was without windows and was well-insulated with two shells of walls with sand packed between them, which kept out environmental noise caused by moving vehicles as well as bird songs. Cool air was pumped into the facility by means of ducts fitted with sound muffles and the ambient was around 27°. A kitchenette, well-stocked refrigerator, toilette and bathroom were available within. The subjects communicated by means of written slips of paper for their needs, and indicated the nature of activity (go to sleep, wake up, toilet, bath, breakfast, lunch, supper, presumed 2-hourly BP measurements etc) by pressing appropriate buttons on a panel. The buttons, when pressed, activated the writing stylus of a 20-channel Esterline Angus 620 X event recorder, which was placed in my office room. Each function was allotted a separate channel. The subjects carried on their body a compact 'Solicorder' with two channels, one monitoring the rectal temperature, and the other, wrist movements. The solicorder had an interface card which was replaced once a week and inserted into an Apple II computer and the two functions were printed out.

In common with findings made on humans in human isolation facilities in Germany, the USA, UK and Japan all our 13 human subjects *underestimated* the passage of time and sooner or later slid into a state called 'free-running'. They fell asleep later and later each subjective night (before which they switched lights off) and woke up later and later in their morning (when they switched lights on). In four of our marathon experiments which lasted between 39 and 43 days, the subjects underestimated time so markedly that they began to remain awake 28 to 32 hours and then slept soundly for close to 16 hours. Such pronounced sleep/wake cycles accounting for 48-hour cycles have been called *circabidian* cycles. The rectal temperature, on the other hand, as has been established, is more conservative and had 'circadian' periods of close to 24.5 hours. As a result *internal desynchronization* or dissociation resulted between the two physiological rhythms. I have reasons to believe that the time course of the rectal temperature is the expression of the biological clock to which, under natural conditions, the sleep/wake clock is coupled. Interestingly in all four experiments, a hitherto unreported *positive correlation* sleep and wakefulness could be established.

We also reported, for the first time, that the menstrual cycle in the human female is *not* coupled to the sleep/wake clock, for the two episodes of the menstrual cycle remained in all our female subjects 28 calendar days apart. Since the rectal temperature persisted with periods close to 24 hours it is difficult to rule out its involvement in timing the episodes of the menstrual cycle. One more interesting finding of Jurgen Aschoff, made in 1985, could be confirmed by us: that short-interval time estimation in humans in prolonged isolation is directly coupled to duration of wakefulness. The estimation of passage of 2-hour intervals contracted and expanded, like a *time systole* as a positive function of hours of wakefulness. The time interval sense was unrelated to rectal temperature cycle. Meal timing was also positively correlated to sleep/wake cycle and the subjects had only *three main meals* even in situations of circadian sleep/wakefulness. All these experiments were carried out by me mostly employing my students as my experimental subjects (who are also co-authors in research publications) between the years 1987 and 1996.

Metaphysical implications of modern science: How and why they arise

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I do not think that we can engage in any useful discussion of the metaphysical implications of modern science without first arriving at a clear understanding of what constitutes metaphysics. But the question "What is metaphysics?" is very hard to answer because it is itself a philosophical question to which there has never been a settled answer among the philosophers of any age or time. I think that this unsettled nature of the answer is due to interpreting the above question in a certain way. Nearly every philosopher who has asked and answered the question "What is metaphysics?" seems to have actually understood it as a slightly different question "What is metaphysics *about*?" That is, they all have tended to treat the question as one concerning the *subject matter* of metaphysics, as a question concerning the kinds of things or entities metaphysics deals with, and on this point of what metaphysics deals with there has been a very fundamental and also a deep divergence of views among the philosophers.

But, if we ask a slightly different question like "What kind of an enterprise is metaphysics?" it appears to me that the same degree of divergence does not prevail anymore. To this new question, there are two answers. The first answer can be found in what the philosophers themselves have been *saying* about what kind of an enterprise metaphysics is. The second answer can be found by closely looking at the kinds of things the philosophers themselves have been *doing* when they are doing metaphysics. Now, can we really abstract something common to most of their sayings and doings, and take that as typically characterizing most or all of metaphysics? I think we can.

The metaphysical systems advocated by hundreds of philosophers may be radically divergent in their styles, subject matter and contents, but all these systems are nothing but conceptual structures built on the basis of reason alone. Now, for the purpose of this exposition, I shall be treating all conceptual structures built on the basis of, and also justified by, reason and reason alone as metaphysical structures. I shall also be treating all metaphysical structures and concepts as purely speculative in character. Here I mean by speculation any activity of thinking that fundamentally relies on reason alone. Once this is accepted, it is easy to see why there is no logically necessary role played by sense experience, observation or experimentation in the construction and development of any metaphysical system. Every metaphysical system embodies a conceptual structure involving certain specific logical possibilities that are justified only by an employment of rational argumentation. Philosophers build such speculative conceptual structures to explain in full all aspects of the universe of our experience. Such explanation is always in extremely general terms. That is, metaphysics is a very general, and also a completely conceptual, explanatory structure built as well as justified solely by speculative reason.

But, then, is not science also a very similar kind of general explanatory conceptual structure constructed by what is called scientific reason? If so, what exactly is the difference, if any, between science and metaphysics? In answer to this question we have to say that science differs from metaphysics in being a structure that is ultimately based on experience, observation and experiments and not based on speculative reason alone. Science is also built on the basis of speculative reason, but not just on that basis alone.

Therefore I think that the point of contact between science and metaphysics is usually where speculative reason enters in a major way into the construction of a scientific conceptual structure. Although science is firmly based on experience, observation and experiments, it still sometimes has to resort to the kind of speculative reason that is characteristically employed in metaphysics. In many cases, the metaphysical aspects and implications of science seem to emerge at this point of the employment of speculative reason. The disagreements among scientists also arise at this point. It appears to me that there does not, and perhaps also cannot, exist any general or universal agreement among scientists as to the point at which speculative reason can be justifiably employed in the development of explanatory structures. Where exactly the line is to be drawn beyond which scientific reason may or may not be substituted by pure speculation has been a matter on which even very great scientists have had very firm, and often completely mutually opposed, views.

As far as my own understanding of the nature of scientific explanatory structures goes, the theoretical reasoning of a scientist reaches a stage where most things fall into place very neatly and elegantly if and only if a certain entity is available as part of the structure, but such an entity is also clearly known to be not available. Then the scientist is encouraged to suppose, purely on logical and rational grounds, that such an unknown entity exists. If this hypothesis about the existence of the unknown entity were not to be permissible and hence forbidden, the resulting explanatory structure would necessarily leave some crucial phenomena partially explained or even totally unexplained. At this point, there are two choices for a scientist: (a) allowing a purely speculative entity as part of a more satisfying explanatory structure, or (b) remaining content with a less satisfactory explanatory structure. Whether a scientist accepts (a) or (b) depends very much upon the extent to which he/she is receptive to allowing a role for pure speculation in developing explanatory structures.

Usually, metaphysical issues arise in science at its frontiers where reason based on experience, observation and experiment reaches its limit long before it is able to achieve a relatively complete or satisfactory explanatory structure. At this point, further progress is possible only through pure speculation. Since pure speculation involves thinking in terms of only logical possibilities, it can naturally happen that several scientists entertain radically different logical possibilities and thus arrive at several well-rounded explanations that may well be incompatible with one another. The debates in which such explanations are criticized and justified are clearly metaphysical in character. Modern science has given rise to a number of such debates.

To end this presentation with just one example, we can look at physics which has been acknowledged for centuries as the science that exclusively deals with the nature of physical reality or matter as such. It had also been acknowledged for centuries that consciousness is completely different from physical reality and no physicist was in doubt about the natural irrelevance of the study of consciousness to any investigations into the nature of physical phenomena. But in recent times situations have arisen within physics that have compelled a complete reversal of the earlier view. A significant amount of discussion in modern physics today involves topics and ideas that would have been unhesitatingly dismissed as too speculative or metaphysical not very long ago.

Science and religion

Extracts and summary

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The panel was chaired by Dr Raja Ramanna and the panelists were Prof G Padmanabhan, Dr Paul K Wason, Prof Philip Clayton and Dr J S Neki with Prof B V Subbarayappa as Coordinator.

At the outset Prof Subbarayappa introduced the chairman as well as the panelists and indicated that the main focus of this panel was whether science and religion would be complementary or contradictory in terms of scientific and religious attitudes. He also suggested that any reference to sensitive issues like the obscurantist or superstitious practices of religion or religions be avoided during discussions.

In his opening remarks, Dr Raja Ramanna stated that the participation of a number of intellectuals on a wide range of subjects at this conference during the three days was indeed inspiring. He desired that the question as to whether there was any contradiction between science and religion needed critical examination and hence the importance of this panel discussion. His introductory views were as follows.

India is a country of several religions. An important aspect of this milieu is an element of agnosticism, which has nevertheless found expression in an agreeable manner. The earliest compendium in Sanskrit, The Rigveda has expressed certain doubts about the origin of the universe in its *Nasadiya sukta,* which goes back to about 3500 years. Its translation in English rendered by A A Mac Donanel is as follows:

1. "There was not the non existent nor the existent then;
   There was not the air nor the heaven which is beyond.
   What did it contain? Where? In whose protection?
   Was there water, unfathomable, profound?"

2. "Whence this creation has arisen; whether he founded it or
   Did not; he who is in the highest heaven is its
   Surveyor, he only knows, or else he knows not".

As you will observe, this hymn ends with the question: who knows? and it is a good question. Among the ancient religions, the Buddhists evaded this question, and Jainism which is noted for its logic similar to quantum logic did not believe in the existence of god. There are six systems of orthodox Indian thought including the *Sankhya* and the *Vedanta*. In the *Sankhya* system of the evolution of *Prakruti, Purusa* is inert and *Prakruti* is ever active, while Sankara's *Advaita* deals with *Brahman,* a Cosmic Principle in rather a complex manner. The *Puranas* contain a plethora of gods in a mythological setting, with no god-head as a unitary principle and although some of the gods are grotesque, they may be symbolic of varied divine dispensation. The epics, the *Ramayana* and the *Mahabharata,* despite some of their incongruities, have had a tremendous impact on the Indian masses.

As for the Indian scientific tradition, it needs to be recognized that mathematical thinking was vibrant., Aryabhata I (5 century A.D.) was a celebrated mathematician and astronomer. He gave a scientific explanation of the occurrence of an eclipse in terms of shadows of the earth and the moon. However, the mythological approach to the eclipses in terms of *Rahu* and *Ketu* was preferred, then as now.

In recent times, there have been scientific studies on human consciousness as well as on the mental states of religious or yogic excitation or meditation, and photographs of the brain in such states have been taken and studied. The general conclusion appears to be that there is a certain type of causation in the brain through meditation, with a whole series of reactions in the brain, leading to a religious feeling, which is rather curious. It is well known that *sadhus* or mendicants take in *bhang* etc. to get a divine-like feeling. In other words, it seems that brain can be set in order to get a religious feeling of god. In India many god-forms or idols are worshipped in the matrix of mythology and, according to some exponents, mythology might be important even for the study of consciousness.

In this conference, there have been references to various ideas, but no reference to St. Paul who was incessantly persecuting the Jews. But something happened to him on his way to Jericho city and this suddenly transformed him into a dedicated Christian. That sudden shocks can produce religions feelings have been experimented upon, as revealed in a recent article. Even mathematicians seem to undergo sudden brain excitement.

While many scientists have been endeavouring towards the material enrichment of society in several ways, there are also scientists and technologists who have been involved in the production of weapons of mass destruction.

Dr Ramanna posed the questions: Do we have to live with both science and religion? Or Do we live without them? He then called upon the panelists to present their views.

Abstracts from the presentations of the panelists are given below.

G Padmanabhan

I was asked to speak on the human genome project in relation to its ethical values, and thought that this topic might not be out of place, and even be conceptually relevant to this panel discussion.

The genome project itself involves the sequence of four alphabets – ATGC – in the DNA sequence and this is supposed to tell us the arrangement of amino acids in it. Basically this is a reductionist concept of biochemical reactions and life-processes. The achievement of this sequence is no doubt a great landmark. However, certain ethical issues arise which deserve consideration. The knowledge of this sequence has several applications including diagnostics, development of new vaccines and gene therapy.

As for the diagnostic part, this tool is available to find out whether certain mutations cause certain types of diseases. The question is whether this knowledge should become private property, since, as an example, employers could demand a gene-map of an employee that would reveal his or her susceptibility towards a particular type of disease and the insurance company may also need this diagnosis to determine the quantum of premium etc.

For example, let us consider the case of breast cancer which is caused by a mutation in the gene BRCAI. If a young girl of 20 is told that she will get breast cancer at her age of forty, it would be a traumatic experience for her, although the gene that causes breast cancer has several other modifications about which we know very little at present. In any case the presence of the mutations would be hazardous but the absence of it can also be false assurance. In the West, it was earlier thought that a diagnosis of this type would be welcome, but it has not happened that way at all. The detection of mutations would no doubt help pre-natal diagnosis and the termination of pregnancy, if any abnormalities are detected. But this has a very deep religious undertone, namely, whether the abortion is to be allowed or not. Another example is that there is a disease called thalassemia, which requires repeated blood transfusion as the red cells break down. To remove the accumulated iron toxicants, a chelator molecule is to be administered. This treatment is not only painful but also expensive; children sometimes die in their teens. The main question is whether a mother should go through this trauma or seek abortion. In a country like India where we have consanguineous marriages, the husband and the wife may not have the disease, but the offspring could get the disease. And such a situation could have been averted, if the marriage was prevented as a result of proper diagnosis.

Let us take gene therapy. As a result of the human genome project, there will emerge a basket of new genes. Gene therapy involves the replacement of a defective gene by a normal one. Recently there have been successful clinical trials for rectifying genetic disorders at least in one or two cases. Let us hope that for the first time in human history, a permanent cure for genetic disorders has become available. However, several ethical issues raise their heads in this connection. There are two types of gene therapy: (i) somatic cells, and (ii) stem cells. A somatic cell is basically introduced into the liver, lung or kidney cell, whereas a stem cell is introduced into the zygote, that is, the first cell of the embryo produced by the combination of the sperm and the egg. The problem is that we do not yet know where the newly introduced gene will go and lodge itself. It is possible that the defective gene may continue to be present as such, while the introduced gene may lodge itself elsewhere. At the same time, it gets expressed and we get the protein which otherwise would be missing. But people are worried about the consequences of the gene lodging itself in a position which is not its normal place. The question is: Can this be done in an embryo? It is unethical and we should look into it in the light of the Dolly experiment. In this experiment both the donor and the recipient were female sheep, and the nucleus of an adult cell was taken out and placed in the egg cell of the other sheep. An embryo was formed and an infant sheep was born to a foster mother. As a biological event, scientists are excited about it. While any part of plant can give rise to new plant, any part of an animal cannot do so. But the Dolly experiment has demonstrated the possibility of an animal cell giving rise to another animal. Such a possibility shows that human beings can also be cloned, and it could become a new experiment in eugenics.

There is also talk of behavioral genes that can alter an individual's behaviour. The thought of combining this with the ability to clone animals and human beings, is viewed by some people as a deadly combination. However, the background ideas were simply to clone some useful portions in an animal, in the production of certain pharmaceuticals.

The present position is that one can clone one's own organs like the liver or kidney that can then be kept in a freezer and become available at the time of transplantation. The media, however, projects it in a different light, namely, a dead child could come back to life or a grandmother could clone herself. We should recognize that all of us have identical (99.9%) sequences with some minor difference called signatures. Genes are supposed to be transcribed or translated in the form of proteins; this is not an automatic process but is controlled by the environment. Some of the genes are either not expressed at all, or are over- or under-expressed. It is some complement of a gene that is the most important aspect while the sequence of the gene is only secondary, and each has a different mosaic of proteins. If a grandmother could clone herself, the child may look like her, but the behaviour may be completely different.

The relation between gene expression and consciousness - a command centre in which free will arises and millions of thought processes take place – is still not understood. Can gene expressions regulate these processes? We can generate music through an instrument like the *Veena* but if the wire snaps there will be no music. It is very difficult to say whether the musician generates the music or the instrument does. The genes and the elaborate neuronal network or the quantum physical principles may execute the commands. In any case, it is not clear how science can answer questions concerning the generation of free will or the way one can do whatever one likes. So far as consciousness or self-realization is concerned, it is not intractable at the personal level as evidenced by Shri Aurobindo, Vivekananda, Jesus Christ and the Buddha who had their own experiences. One can sit under a bodhi tree and still not have such an experience as the Buddha had.

Philosophy has an easy way of saying that consciousness does not die at all and once the body dies, consciousness merges with the cosmic one or transmigrates to another body. But, as a scientist I find it hard to understand the mode of this transmission. The genes, neural network and others can be conduits, but the question is: could they be the originators of consciousness and free will? It may be difficult for science to answer this question, and as a scientist I can say it cannot be established on the basis of our present knowledge.

Paul K Wason*

On of the reasons I am pleased to be here is the opportunity to learn how scholars in India approach the relationship between science and religion. In the network of people I usually work with, it is common to talk about the "dialogue between science and religion" or "the constructive engagement of science with religion." But these are shorthand terms, used for the purpose of quick summary. Many authors use the terms "religion" and "science" in a broad encompassing way and not as technical terms. However, sometimes this usage merely confuses things, for there really are various meanings for these words. Ulf Gorman, President of the European Society for the Study of Science and Theology explained to me, for example, that science and religion are not parallel concepts – theology is more accurate.

In any case, if we are to develop the fullest possible understanding of reality we should consider all these areas – how science relates to metaphysics, to theology, to spirituality and to religious institutions and practices. A scientist might be motivated to believe something by the persuasiveness of the empirical evidence, and we might be motivated to believe certain things theologically through our spiritual experience. And both these points might well be describing the same person. But in the current world (in North America, anyway), the intellectual culture and popular culture have both pushed for a separation between these two 'worlds' of scientific belief and religious or spiritual belief.

A very important motivation of the science – religion dialogue has been to overcome this separation, and to do away with the antagonism that often goes with it. For example, the Center for Theology and the Natural Sciences (CTNS) in California has popularized the metaphor of *bridge building*.

Much progress has been made in the science – religion – spirituality dialogue over the past twenty years by scholars like Ian Barbour, Arthur Peacocke, John Polkinghorne, Nancy Murphy, Phil Clayton and a great many others. And I think one reason we are seeing such a rapid growth in interest in science and religion is that persuasive answers are now being provided for the problems that have kept science and religion apart. Genuine progress is being made concerning how we might understand divine action in the world (in the world we know through science).

Yet as Wesley Wildman has pointed out, there needs to be more to it than this, and I think there is far more potential to come from bringing science and religion together than we yet realize. My hope is that many seemingly intractable intellectual questions can eventually be answered by making use of the fuller view of reality by bringing science and spirituality together. For example, what is the human sense of intentionality and purpose? Is it real or just a mental construct, and if real, does it imply that there would be value in looking into a teleolnomic approach to the living word generally?

Even when there are no conflicts – real or perceived – between religion and science, efforts to bring them together creatively can have a great positive effect. The value is not just in overcoming barriers, but more positively in the creation of deeper understanding.

Finally, just a few points that need our consideration: Creative interaction between science and religion requires that we think across disciplinary boundaries and learn new fields of study. This is not as easy as it sounds. We need to be patient with one another. I have seen scientists who think they can solve all questions without troubling themselves to learn anything about religion and theology. Stephen Jay Gould wrote a whole book, *Rocks of Ages,* without engaging the literature of the field. Someone with a little more patience and humility might pause to learn something about a field before dismissing it as trivial.

We also need to remember that religion and science must maintain their own integrity. When religion insists on what science can or cannot discover – as with the so-called creation science in the US – or vice versa, we lose an opportunity to learn more. It will not be possible for the whole to be greater than the parts, of when one part takes over the other.

Philip Clayton

At the outset, I wondered whether there was any common ground for all the discussions on science and religion that took place for the past three days or was there any way to present them in the form of a capsule. I think that while all the words were inadequate in one sense or the other, the word, complementarity, for science and religion would be significant. In physics, the complementarity of wave and particle, and Niel Bohr's principle are too complex. But the complementarity of science and religion perhaps means that both are necessary. In this respect, four aspects need to be considered:

The simple one is that science and religion are complementary in action and right actions are possible with the aid of both. For example, we are well aware of environmental degradation and we need right actions to have a pollution-free environment. For this purpose, we have to look into what may be called the "wisdom traction". As you are aware, we have the scientific capability to have genetics-based medicine, genetically modified food and the like. Science does not provide the wisdom to make the decision as to whether these are useful.

The second complementarity relates to the ways of knowing. There are multiple ways of knowing and to be tied to only one way of knowing is inadequate. There is the western view that all knowledge is scientific and sophisticated arguments have been advanced for this. In this respect the approaches of several names like Kant's Positivists and the like are mentioned. For the past three days there were talks on the involvement of the West in the non-scientific ways of knowing. The most disturbing talk was by Wesley Wildman who gave us reasons to worry about the non-scientific ways of knowing and these deserve careful consideration. In my opinion, the resources that this conference offered were the possibilities of the non-scientific ways of knowing, and to use them in our spiritual quest as well.

The third complementarity is ontological. There should be complementarity of science and religion in the realms of knowledge and this needs to be a type of both reality and ontological complementarity, of the finite world and the infinite ground, of the individual existence and the infinite sources. If we formulate thus the complementarity of reality, certain differences emerge. There are multiple interpretations of the *Vedanta*, between the East and the West. We need a simple way to understand it. There is a complementarity of science and meta–science or physics and metaphysics. Who knows whether the meta-physical system could be the best, even though some meta-physical disagreements cannot be resolved. Still there is ground for thinking of the complimentarity of science and religion, for the sake of ethical living, for humility in the wake of scientific knowledge and technical power, for the sake of beauty and harmony and humanity completeness.

Quoting Wordsworth: 'For more deeply whose dwelling is the lights of setting suns and the round ocean and the living air and blue sky and in the mind of man', I suggest that we should discuss the complementarity of science and religion as implying that scientific resource should be checked by the intuition available to us, and religious truth and claims checked by scientific facts.

J S Neki

I am a psychiatrist as well as a poet. My presentation would be a mixture of these two. In the Upanishadic story of Prince Svetaketu who after completing twelve years of study, narrated to his father that he had learnt several subjects including grammar, english, philosophy, mathematics, astronomy and astrology, geography etc., whereupon the father asked him whether he had learnt that by knowing which everything else could be known; but the prince replied to this in the negative. The prince was sent to *a Rushi* or a 'seer', one who does not pass through the stages of learning, but can directly 'see'; and that marks the difference between science and spirituality. In spirituality you **see** and in science you **learn**. It is often said that both science and religion seek truth, but it seems to me that science has access to factual data and we should distinguish between fact and truth. Facts can be valued through our senses but truth cannot always be and truth in religion is subjective for each person. A fact is emotionally cool but truth is emotionally warm and ethically pragmatic. One has to look at facts externally, but one has to look inwards for truth. One looks inside, looks into the consciousness, which is present in all living beings and everywhere. Can we draw a line between the living and nonliving beings? To me everything is life including earthquakes, cloud bursts, rain, dunes of a desert etc. Human consciousness arises through integration of trillions of molecules into a patterned weave of memories, a synthesis of innumerable threads into a mother rug of ultra-dimensional perception. Even the entire universe may be integrating itself into a mega-consciousness which we commonly attribute to God.

Let me give an example of an accident in which my legs had been fractured. When I was convalescing in the hospital, I thought that my osteocells would move in the entire body and pick up calcium particles wherever they were and deposit them at the fractured place continuously till the fracture was healed. This could be the consciousness of the osteocells. It is significant to note that the fusion or the union of the sperm and the ovum forms the zygote and some of the cells in it become an eye and some others a toe, and the process is very exact. We do not know how they assume these forms. There is a statement that such things are coded only in genes, and one could say that this coding has been done (as also the de-coding) by consciousness, and that consciousness directs the genes which are responsible for coding.

It needs to be recognized that science depends on sensory data. Let us consider what a frog's eye tells its brain. Let us suppose that a scientist has taken out the frog's eye along with the optic nerve and kept it alive by perfusion and encased this eye within a dark glove into which various kinds of stimuli can be introduced, small, big, coloured and so on, so that the connected optical nerve could write the types of messages received. The experimentalist would think that there would be as many messages as the number of stimuli. There were different type of messages and it was believed that the responses were for survival purposes, leading to the conclusion that the eye also has consciousness. Now the question is: is there any other type of survival, a spiritual survival for which we have to look inwards? I have had experience in which there was no 'I' or 'me', but a communion with the entire universe.

Religion has also predicaments with the social complexities, mythological explanation of the universe, rites and rituals, magical beliefs etc. However there is a spiritual aspect or mystical dimension of religion which it can offer to science. Science is now at its wit's end and it is at an edge where mysticism could provide answers to it. There is now a need for science and religion to come together and cross-fertilize each other. There is a view that mystical experiences do not tally with one another. A person or an object can be looked at from different angles and heights leading to different experiences, and be the same although they appear to be different. If in an aeroplane one goes up and looks through the window, the past, the present and the future will merge into the present. Likewise, if one goes up to a spiritual level beyond the different layers of consciousness, one experiences the transcendence level. Let me end my presentation with a poetic line: "Time past and time future allow but little consciousness, to be conscious is not to be in time."

**Writeups by these speakers are included in the proceedings*

Science and religion

PAUL K WASON
John Templeton Foundation, USA

One of the reasons I am pleased to be here is the opportunity to learn how scholars in India approach the relationship between science and religion. I have learned a great deal. Even more importantly I now have some connections to continue the process. I have been interested in how science and religion relate for more than 25 years (obviously I started very young). And I would like to share a few observations largely from a North American-UK context. This is not an overview but just some points to add.

1. How we use Words

In the network of people I usually work with, it is common to talk about the "dialogue between science and religion" or "the constructive engagement of science with religion." But these are shorthand terms. They are used for the purpose of quick summary. Many authors use the terms "religion" and "science" in a broad encompassing way and not as technical terms. However, sometimes this usage merely confuses things, for there really are varied meanings for these words.

I have the privilege of working full time in this field and my title is *Director of Science and Religion Programs*. This was meant to cover anything having to do with religion, including theology, spirituality, personal practice, institutional religion and so on. Science is also meant broadly to encompass the social and behavioral sciences and not just the natural sciences.

Naturally there is value in using these words in different, and particularly in more precise ways. Ulf Gorman, President of the European Society for the Study of Science and Theology explained to me, for example, that science and religion are not parallel concepts – theology is more accurate. They apparently had an extensive discussion about what to name the organization. (In fact, for sometime what I studied was science and theology, or even more specifically, biology and Christian theology.)

In any case, if we are to develop the fullest possible understanding of reality we should consider all these areas – how science relates to metaphysics, to theology, to spirituality and to religious institutions and practices. Dwelling on definitions might seem a little tedious for a 15-minute presentation on a broad topic but based on some informal conversations in the past couple of days, I realize there could be much unnecessary misunderstanding otherwise.

2. Motivations: Why care about science and religion?

My second point concerns motivations. I won't pretend to be a philosopher, especially not when there are so many trained philosophers listening to me, but I like the idea I have heard suggested that there is "no unmotivated belief" (and no unmotivated action either, for that matter).

A scientist might be motivated to believe something by the persuasiveness of the empirical evidence, and we might be motivated to believe certain things theologically through our spiritual experience. And these two points might well be describing the same person. But in the current world (well, in North America, anyway), the intellectual culture and popular culture have both pushed for a separation between these two 'worlds' of scientific belief and religious or spiritual belief.

A very important motivation for the science–religion dialogue has been to overcome this separation, and to do away with the antagonism that often goes with it. For example, the Center for Theology and the Natural Sciences (CTNS) in California has popularized the metaphor of *bridge building*.

I myself first became interested in order to overcome what I perceived as conflicts between biology and my Christian faith. I am often asked why we should care about bringing science and religion together, why such bridges are of any use. Here are a couple of reasons.

(i) There are people, even today, who still hold to the 19th Century idea that the world is a determined place, and that science has proven religion to be wrong or foolish. The field of science and religion seeks to overcome this notion.

(ii) I have conversations with people who will say, of course there are many areas where science and religion conflict, but when I ask "such as?" they can rarely give an example. And those who do come up with an answer, it is usually something like the Galileo affair that is far more complex than most people realize. In the case of Galileo, for example, there is good reason to believe it was not at all a matter of the Catholic Church against science. People who see this as a glaring example of conflict, are, to put it bluntly, simply ignorant of the debate.

Much progress has been made in the science–religion–spirituality dialogue over the past twenty years by scholars like Ian Barbour, Arthur Peacocke, John Polkinghorne, Nancey Murphy, Phil Clayton and a great many others. We have found time and again that when people claim there are conflicts; it really has more to do with their philosophical assumptions than with anything that deserves to be called science. Assumptions such as naturalism or materialism and not science itself are what conflict with most religious perspectives. Furthermore, science does not provide support for naturalism or materialism vs. such alternatives as theism. We need to unmask these damaging confusions.

And I think one reason we are seeing such a rapid growth in interest in science and religion is that persuasive answers are now being provided for the problems that have kept science and religion apart. Genuine progress is being made concerning how we might understand divine action in the world (in the world we know through science). Progress is being made in our understanding of historical episodes like that involving Galileo and what was really involved. And we have also identified some characteristic errors. (See the piece I wrote on this subject called "clearing the ground" at *http://abacus.bates.edu/~jsmedley/phys228/wason.html)*. When these errors are recognized a great many problems simply disappear.

Yet as Wesley Wildman has pointed out, there needs to be more to it than this, and I think there is far more potential to come from bringing science and religion together than we yet realize. My hope is that many seemingly intractable intellectual questions can eventually be answered by making use of the fuller view of reality we get by bringing science and spirituality together. For example, what of the human sense of intentionality and purpose? Is it real or a mental confusion, and if real does it imply that there would be value in looking into a teleolonomic approach to the living world generally?

Even when there are no conflicts – real or perceived – between religion and science, efforts to bring them together creatively can have a great positive effect. The value is not just in overcoming barriers, but more positively in the creation of deeper understanding. It is worth keeping in mind, all the same, how much of the literature in the science and religion dialogue in North America has been motivated by the desire to overcome obstacles – including the view that science and religion are separate worlds and one is running over the other.

You may find this uninteresting. But if approached with different questions from different religions and sciences, there is far more potential, particularly as we contemplate certain important topics like meaning and purpose, virtues and values, the fundamental nature of reality, the nature of love and the nature of other spiritual matters like forgiveness, hope, joy, the origin, source and nature of the cosmos, and what it means to be human.

3. Expanding the dialogue

If we are to take this expansive view, this idea of science and religion as going far beyond merely overcoming barriers (however important) I think we will benefit from a more world-wide network of scholarly interaction. Barriers and obstacles tend to be "local" to a specific context but a better understanding of love, of the nature of being human and many other questions are of universal importance.

4. Problems and needs

Finally, just a few simple and quick points about what are needed, in my view:

- Creative interaction between science and religion requires that we think across disciplinary boundaries. It requires that we learn new fields of study. This is not as easy as it sounds.

- We need to be patient with one another. I have seen scientists who think they can solve all questions without troubling themselves to learn anything about religion and theology. Stephen Jay Gould, wrote a whole book *Rocks of Ages* without engaging the literature of the field. This is a great problem. And someone with a little more patience and humility might pause to learn something about a field before dismissing it as trivial. On the other hand, we cannot be specialists, we cannot develop true expertise, in all the fields involved and I have seen people poorly treated because they didn't know all the details of the expert in every field. Patience and generosity.

- We also need to remember that religion and science must maintain their own integrity. When religion insists on what science can or cannot discover – as with the so-called creation science in the US, or vice versa, we lose an opportunity to learn more. It will not be possible for the whole to be greater than the parts or when one part takes over the other.

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The notion that science and metaphysics are two different themes which cannot have issues of common concern has changed with the new and different ways of understanding science, technology, philosophy and spiritual traditions. A rich literature exists on the philosophical understanding of the complexity of consciousness, especially in the Indian wisdom traditions. Scientists are also rather excited about the emergence of new insights into many outstanding issues in the life sciences. In recent years particularly, molecular genetics has caused waves through the Human Genome Project and raised, rightly or wrongly, great hopes as well as great fears.

A dialogue between scientific and metaphysical traditions has now not only become relevant but also imperative in the modern context where we are often confronted with dilemmas in defining values - whether they be scientific and technological developments and innovations, societal and communal health, or moral and spiritual explorations. This volume is a collection of invited papers on the frontiers of science and metaphysics, with special reference to the themes of consciousness and genetics.

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