Scientific and Philosophical Studies on Consciousness*

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Lao Tsu the Chinese Philosopher of 6th century BC is reported to have said "a journey of a thousand miles begins with a single step"!
The Big Question about consciousness is whether even one step has been taken so far in this journey!

To ramify the many facts of consciousness, the theme of this seminar, I would like first to list the types of people who are all interested in studies on Consciousness:

- Those interested in Disciplining of the Mind: Meditation, Yoga, Zen, …
- Philosophers: Western, Eastern
- Computer and Artificial Intelligence Scientists
- Scientists involved in SETI (Search for Extra-Terrestrial Intelligence)
- Physical Scientists: Physicists, Chemists, Mathematicians
- Instrumentalists: CT-Scan, and other Tomographic instruments like MRI, fMRI, PET, and LASER, EEG, Microelectrodes etc.
- Life Scientists: Neurobiologists, Neurosurgeons, Evolutionary Biologists, Psychologists, Psycho-linguists, Animal consciousness investigators, and those looking for paranormal phenomena
- Druggists, Anaesthetists
- Those who would like to make a Consciousness Meter
- Those who are holding the view that consciousness is a Non-entity does not exist as such

Clearly the interested people belong to widely different professionals; scientists medical men, philosophers, instrumentalists and so on, whose understanding of what consciousness is and the purpose for which they would like to understand what it is are itself quite different. Some are interested in individual consciousness and the other in universal or cosmic consciousness and the connection between the two. We have to bring into consideration the role of body, brain, mind and environment to explain consciousness.

In this article we will consider only the philosophical, eastern and western and the scientific approaches including the most important neuronal ones in this endeavour.

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Let us begin with a brief review of the philosophical approaches on consciousness which began much earlier than scientific studies.

In western philosophies the Mind is not different from Consciousness. Also most of the early western philosopher were also scientists. The two broad classifications in western philosophy are (a) Monism , (b) Dualism. Under these there are ~~the following~~ many subgroups. We will list only a few of them.

(a) Monism

- Idealism (Spiritualism): Everything is Mental (Berkely, Fichte, Hegel, Fechner, Mach, and W James (in the later period), Whitehead, Tielhard de Chardin and B Rensch)
- Neutral Monism: The mental and physical are so many manifestations of an unknowable neutral substance. (Spinoza, W. James, B Russel, R Carnap, Schlick, Fiegel)
- Eliminative Materialism : Nothing is Mental (J B Watson, B F Skinner, A Turing)
- Reductionstic Materialism: Mental Events are Physical or Physico-Chemical (Epicurus, Lucretius, Hobbes, La Mettrie, d Holbach, I P Pavlov, Lashley, Smart, Amstrong, Quine)
- Emergentist Materialism: Mental Events Constitute a subset of processes in the brains of higher Vertebrates (Diderot, Darwin, Ramony Cajal, Schneirla, Judson, Henrich, Hebb, Bindra, Mountcastle)

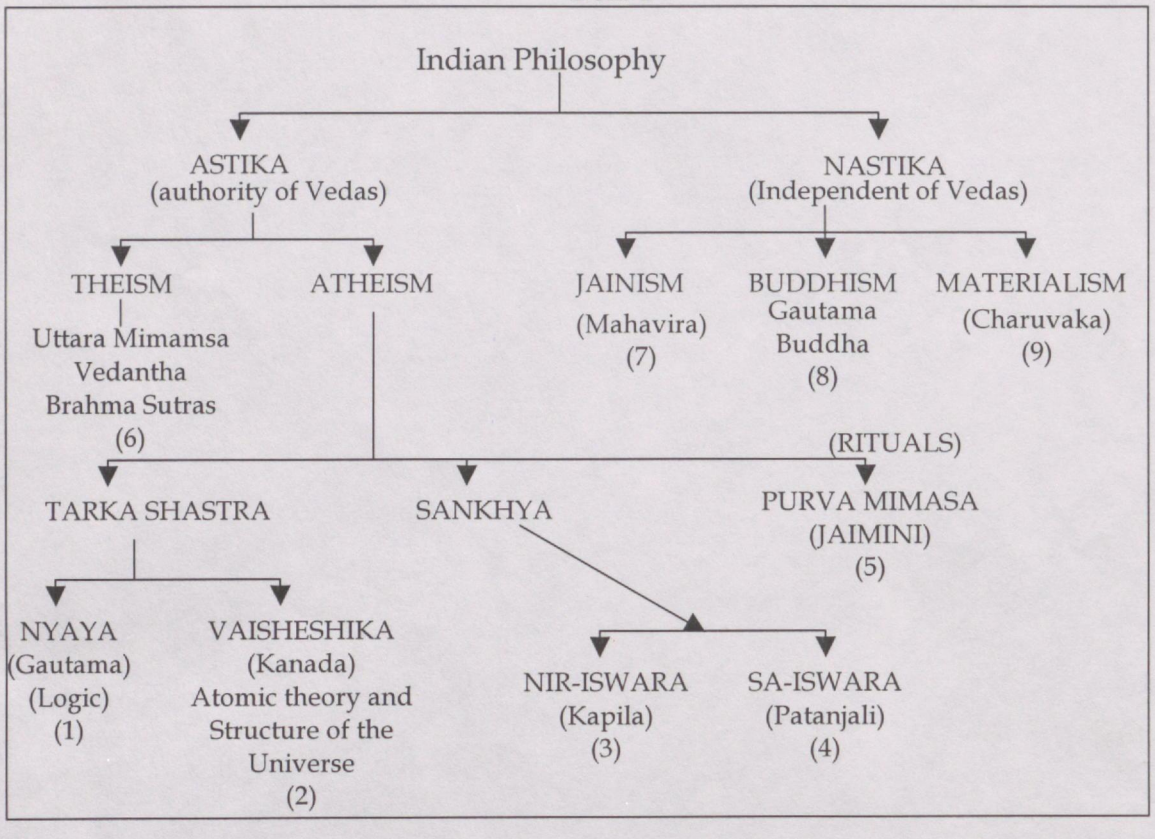
(b) Dualism

- Autonomism: The Mental and Neural are uncorrelated (Bradley, Wittgenstin)
- Psychophysical Parallelism: Every Mental Event is accompanied by a synchronous neural event (Leibniz, Lotze, Wundt, Jackson)
- Epiphenomenalism: Mental Events are caused by neural ones (T H Huxley, Vogt, Broad, Ayer, Puccetti)
- Animism: Mental Events cause neural and physical ones (Plato, Augustine, and computational cognition psychologists)
- Interactionism: Mental Events cause or are caused by neural or physical ones, the brain being only the tool or "material basis" of the *mind* (Descartes, McDougall, Freud, Penfield, Sperry, Eccles, Popper, Chomsky)

These views as we see have been held by scientists and philosophers across the last several centuries in the Western World.

The Box 1 shows the various systems of Indian philosophy, their dependence, independence of the scriptures (the Vedas), the status as theistic, atheistic.

Box. 1



Numbers 1 – 6 are orthodox systems owning allegiance to Vedas and Numbers 7-9 to Heterodox systems – no allegiance to Vedas. (Vedas: Rig, Yajur, Sama, Atharva (Samhitas -Mannasa; Brahmanas – Rituals; Aranyakas – contemplatives). Upanishads: End portions of Aranyakas of each veda.)

The accepted sources of knowledge (Pramanas) in Indian philosophies are Pratyaksha (Perception); Anumana (Inference); Apta Vakya (Testimony); Upamana (Comparison); Arthapatti (Postulation); Anupallabdhi (Non-cognition)

Vedanta accepts all 1-6; Nayyayikas only 1-4; Sankhyas only 1-3; Vaiseshikas only 1-2; Buddhas only 1-2; Charuvakas only the first.

The Charuvaka philosophy is extreme materialism perhaps the earliest. There is nothing other than matter. No karma and death is equal to nirvana. The concept of self is physiological. Consciousness is an epiphenomenon that subsists with the body and disappears on death.

The Nayaya – Vaisesika system insists on the reality of both material and immaterial substances, and consciousness is an evanescent product that emerges in the assemblage of happenings in suitable locations. It is an adventitious product of self that makes objects known, and cannot exist without, self. It is not a quality of the body. In this system the self is 'knower' 'Doer' and the 'Enjoyer'. The self's association with mind and body gives rise to consciousness.

In Sankhya Yoga (Plurality of Souls): Purusha is self; Prakriti is primary substance; Matter is predominantly thamasic part of prakriti; Psyche (mind) predominantly Satvic part of prakriti; Mind is always fleeting and consciousness co-ordinates the fleeting states and cognizes pleasure, pain etc.

Yoga accepts all this and maintains that practice and non-attachment lead to supernatural powers of the mind – control over body telekinesis, esp, etc.

There are many versions of the Vedanta philosophy. But the three main versions are – Advaita, Dvaita and Vishistadvaita. The essential difference between them is the relation between Brahman, Self and Reality. The relation between these is spelled out in the four Mahavakyas is as follows.

▸ Prajnanam Brahman (Consciousness is Brahman)	Rig Veda	Atreya Upanishad
▸ Aham Brahmasmi (I am Brahman)	Yajur	Brihadaranya Upanishad
▸ Ayam Atma Brahma (The Self is Brahma)	Atharva	Mandukya Upanishad
▸ Tat Tvam Asi (that thou art)	Sama	Chandogya Upanishad

According to Advaita philosophy of Shankara, we have essentially to consider two view points – Vyavaharika and Adhyatmika.

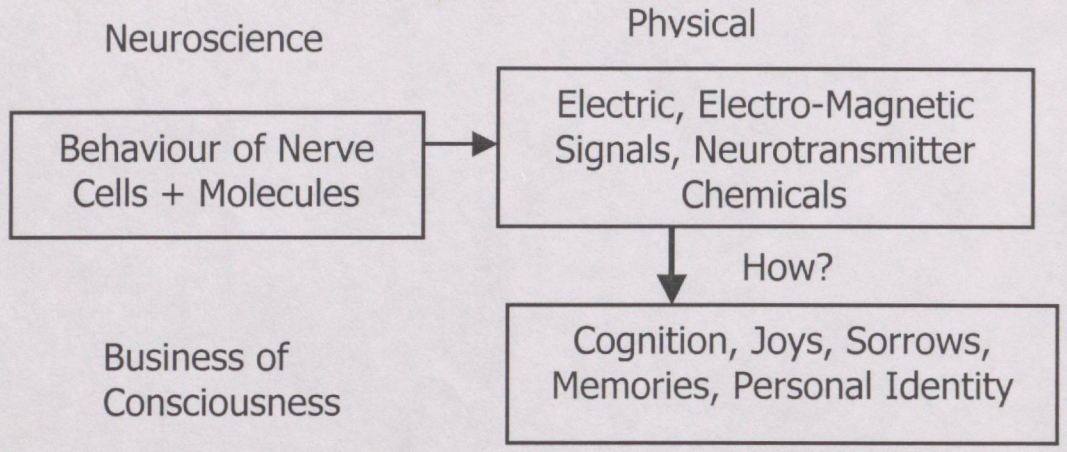
Vyaraharika is a transaction point of view – the world exists and is real for all of us. Adhyatmika is a Transcendental point of view – for the realized soul, there is only Brahman and no world. Brahman is Absolute Consciousness Individual Consciousness arises when this Absolute Consciousness interacts with the individual mind.

Clearly these are profound insights in both systems of philosophy on the ontological status of consciousness as the substratum from which everything has arisen. As we shall see modern

science has come to very similar conclusion on the ultimate substratum. Only some scientists have reservations about the type of connection between the substratum and consciousness. We will consider the significance of these parallelisms between insight in philosophy and science later.

Let us now move on to consider the current scientific views of consciousness. The way scientists look at the problem of consciousness is shown in Box 2 and Box 3.

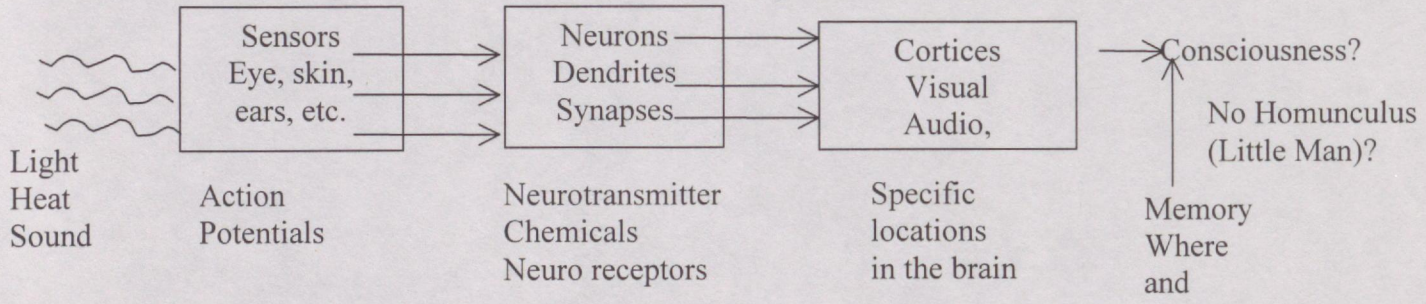
Box 2 . The paradigm of scientists looking at the problem of consciousness.



The Nobel Laureate Francis Crick[1] in his famous book "The Astonishing Hypothesis", states "Your joys, your sorrows, your memories and your ambitions, your sense of personal identity your free-will are all in fact no more than the behaviour of a vast assembly of nerve cells and their associated molecules".

But what is consciousness?. A working definition may be arrived at by our experience: I see, I hear, I smell, I taste, I feel hot, cold, I think, I decide, I control my acts, I enjoy, I get angry, I calculate, I remember, …….; Whatever is ultimately responsible for all these and any many more, I call consciousness. Why? Because none of these is possible when I am unconscious.

Box 3. The process of cognition according to scientists.



[1] F.C. Crick, The Astonishing Hypothesis, Charles Scribner's Sons, New York, 1994

In humans there are 10^{11}-10^{13} Neurons, each Neuron passes through 10^{3}-10^{4} synapses and releases 60-70 neurotransmitter chemicals which have been identified, Any single event involves the combined firings of hundreds of thousands of Neurons. The example of neuronal excitation of 80,000 synapses feeding into a Purkinje cell of the brain during a "Discuss Throw" is shown in figure 1.

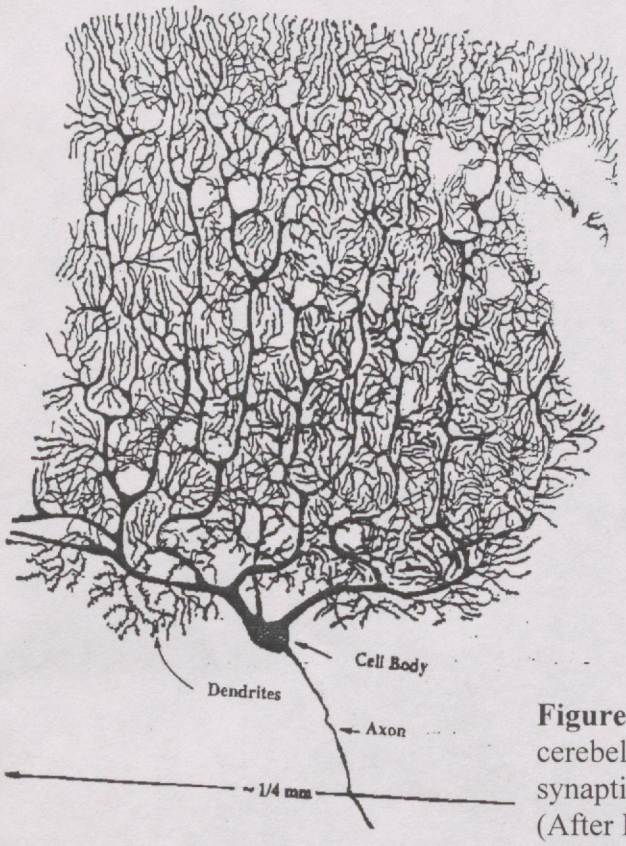


Figure 1. A Purkinje cell of the human cerebellum. This cell receives about 80,000 synaptic inputs during a Discuss Throw. (After Ramón y Cajal, 1952).

The table 1 illustrates the two kinds of experiences generated in an individual when he looks at say a rose flower. The real problem for the scientist is to figure out how these two different kinds of experiences one in the form of electrical signals and chemicals which he becomes familiar in his laboratory *generates* the feelings, sensations, emotions etc, which cannot be described in terms of physical parameters.

A (Physicalism) B (Mentalism)

What happens in the Brain and Its accessories

What happens in the mind

• Formation of `image' of the flower on the retina.	• Distinctive perception and recognition of the flower as a rose.
• Activation of rods and cones in the retina's various layers.	• Evokes sense of beauty - Smell of the rose flower
• Generation of action potentials - electrical pulses.	• The awareness and recognition of the colour of the flower.
• Transmission of pulses through axons in neurons.	• The softness and smoothness of petals on touching the same.
• Happenings in Synapses and Dendrites	• Appreciation of symmetry, beauty and aroma.
• Releases of Neuro-transmitter chemicals at various locations	• Earlier happy associations flood the mind
• Activation of Cortices	• Emotions triggered.
Basically:- Electrical Signals, Oscillations, chemicals, time sequence } in various locations	The mind is able to gauge the size, distance, shape and other physical characteristics as well.

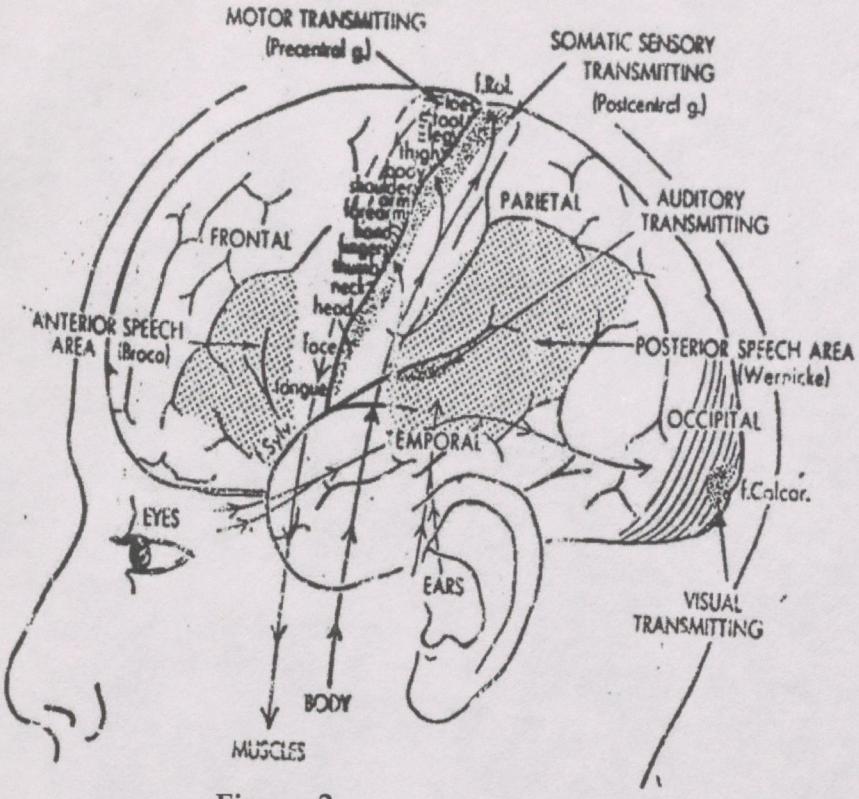


Figure 2.

The relation between specific mental functions and the anatomical parts of the human brain are illustrated by Figure 2. It is now established that the left brain puts things sequentially in a logical order, forms thoughts, into words, does speaking, reading, computing, quantitative skills. Is responsible for keeping our life sensible, organized and on schedule; and the right brain: Host to motor skills. Intuition, Emotion, Music Cadence, Ability to look at the Whole situation and leaps of imagination.

We all use the curvature of the contours of the lips to interpret whether the person we are looking at is series and unhappy or is smiling and happy. What is interesting is that the interpretation depends on the handedness of the observer as illustrated in Figure 3 taken from the book by Julian Jaynes, "The origin of consciousness in the Breakdown of the Bicameral Mind[2]", p.120.

Figure 3

	For RHS	For LHS
	Smiling Happy	Serious Unhappy

[2] Mariner, Boston, 1009

	Serious Unhappy	Smiling Happy

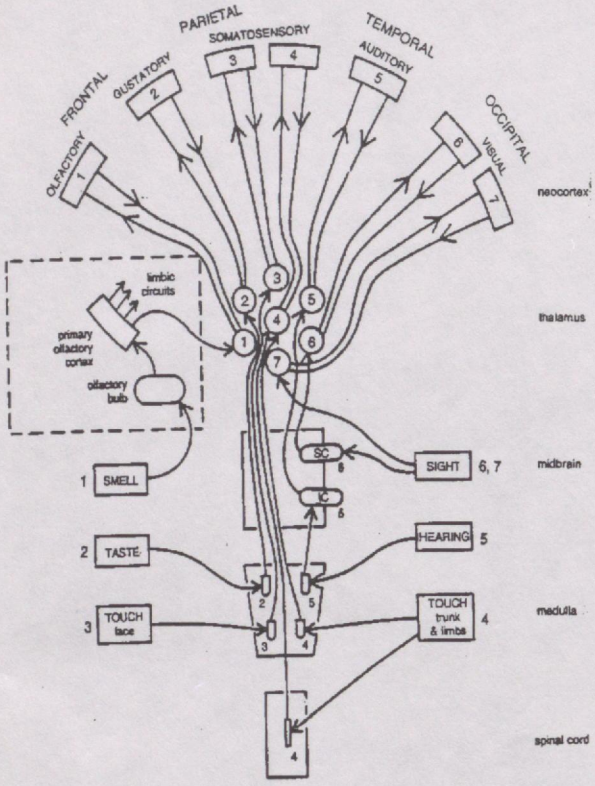


Figure 4.

Figure 4 illustrates further the Location Specificity of Functions (Still Plasticity Exists). Circuit diagram for some routes from sense organs to the brain. SC, superior colliculus, IC, inferior colliculus. Small circles represent nuclei of the thalamus as follows: (1) medial dorsal, (2) medial ventral, (3) ventral posterior medial, (4) ventral posterior lateral, (5) medial geniculate, (6) pulvinar, (7) lateral geniculate. In all this the chief concern is the binding problem: Who collates the information located in the different cortexes? Who recalls the memory? and How?

The spectacular advances made in neuroscience of vision and the extent of details to which modern technology with the scan instruments has enabled the scientists to unravel the intricate neuronal connections is illustrated by Figure 5. Till recently it was held that all the neuronal connections are made before the baby comes out of the womb. This view has changed recently. It has been found that new neuronal cells and connections continue to be made even at advanced ages.

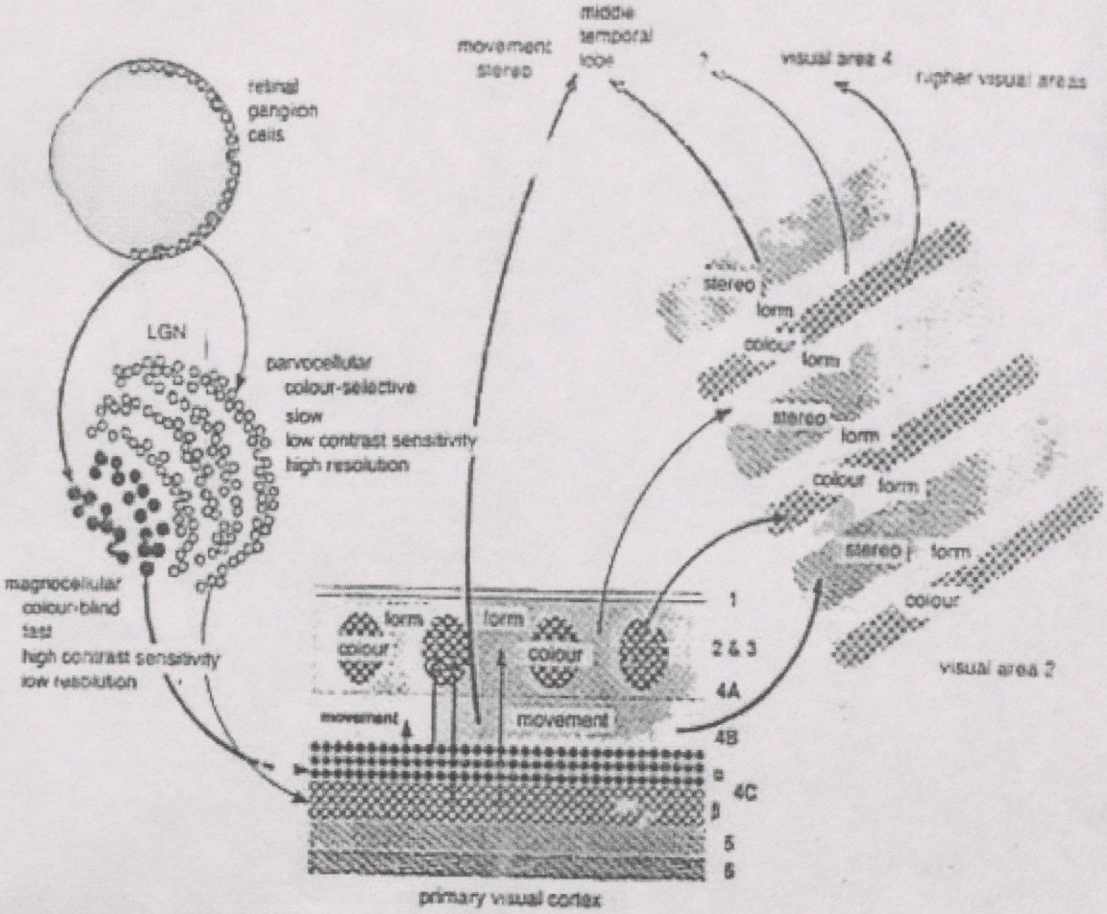
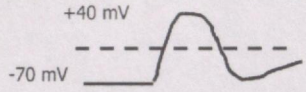


Figure 5. Diagram showing how different parts of the brain deal with different aspects of vision.

Over the past few decades the following features have been established by neuroscientists:

- The human brain comprises 10^{12} cells out of which 10^{11} of them are neurons linked to net works that give rise to perception, intelligence, creativity, emotions, memory etc.
- Large anatomic subdivisions of the brain offer a rough map of its activities.
- The brain is bilaterally symmetric, its left and right hemispheres are connected by the corpus callosum and other axonal bridges.
- *The Medulla*: regulates autonomic functions- respiration, circulation, digestion etc.
    - The Cerebellum*: co-ordinates movement*
    - The Limbic System: Emotional behaviour, long term memory
    - The Cortex (1.5 m^2 area, 0.2 cms thick) - The ancient evolutionary part of the cortex is part of the Limbic system.
    - The younger Neo-cortex: (i) Frontal (ii) temporal, (iii) parietal (iv)occipital → Thought, perception
    - Motor cortex, somatosensory cortex, visual cortex, ……

- The neurons which are connected to all parts of the body, carry the messages in the form of *action potential*



- A very interesting feature is that all the different sensors – retina, eardrum, skin, nose membranes – produce identical action potentials. The information is coded in the form of frequency modulation – bursts of action potentials, spacing within the bursts and between the bursts, and multiple neurons firing at the same time etc.
- The neuronal signals have to pass through a number of gates and check posts – the synapses – which regulate the passage or inhibition of the signal by the emission of neuro-transmitter chemicals.
- The synapses are connected to other neurons and dendrites.
- There is no electrical transmission of the signal through the synapse. It is chemical transmission by the neurotransmitter chemicals.
- Till recently it was held that there is no evidence for a central processor to which all the information is channeled. There is no Homunculus or Little Man inside the brain receiving, interpreting and sending out messages and triggering the necessary motor action. This view has undergone change recently, as will be discussed below.
- The information even about one event – seeing a picture – is distributed all over the visual cortex – There is no discernible order or sequence in the locations – the colour is in one place, the intensity in another, the angle of viewing in yet another place, the distance is in yet another location ….
- The information with-in a single cortex and from the different corteces has to be processed accessing the requisite memories, which again are distributed all over. **[This is the central role of consciousness.].**
- In his book "The Quest for Consciousness: A Neurobiological Approach[3]," Christof Koch Writes:

> "The intermediate theory of consciousness accounts well for a widely shared and persistent feeling: That there is a little person a homunculus, inside my head who perceives the world through the senses, who thinks, who plans and carries out voluntary actions. Frequently ridiculed in science and philosophy, the idea of a homunculus, is nevertheless profoundly appealing because it resonates with the everyday experience of who "I" am.

[3] Robert and Co-publishers, USA, 2004,

"Francis and I believe that somewhere in the confines of the frontal lobe are neural networks that act to all intents and purposes like a homunculus. This is a non-conscious homunculus who receives massive sensory input from the back of the cortex (Olfaction is an exception to this rule), makes decisions and feeds these to the relevant motor stages. .....

The homunculus is a real physical system ..... There is no infinite regress since the homunculus is not meant to explain qualia. It is more a computational entity.

The concept of non-conscious homunculus is not trivial. It is responsible for many complex operations such as thoughts, concept formation, intentions and so on ..... Supramental processes beyond conscious perception."

- In 1990, Crick and Koch had argued in favour of 45 Hz oscillations be responsible for synchronization (Binding Problem). In 2004 in the same book referred to above Koch says "We no longer believe that 40 Hz oscillation are necessary for consciousness to occur. What is needed is the record of simultaneous activity of ten thousand or one hundred thousand brain cells. However the exact mechanism by which this occurs is not spelled out.

The achievements and limitations of biological science on the anatomical aspects involved in consciousness and the molecular approaches to its explanation as of now can be summarized as follows:

Experiments have established considerable redundancy in the signal transmission channels and also *plasticity* in the *brain functions* – for example on special occasions the auditory cortex has taken over partially the functions of visual cortex.

The famous neurosurgeon Penfield has shown that by touching with microelectrodes specific points in the brain of the patients on the operating table, old memories of songs, places etc. have been revived indicating correlations between specific memories and specific locations. The mechanism of trigger and storage of memory are not known.

The power of molecular approach to mind functions has been illustrated through the effect of drugs that ameliorate hallucinations, delusions, disoriented thinking. (The puzzle is the *slowness* of the reaction.)

Max Delbrück states: "Human beings are organisms capable of manipulating internal representations of the World by means of concrete operations and *can transcend the bounds of their biologically given perception*. They can liberate themselves and construct a view of reality that conflicts with intuition, yet gives a truer, more encompassing view" (Figure 6).

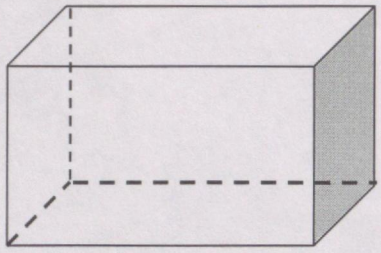


Figure 6.

The figure is a two dimensional drawing. However, the perception is that of a cube. The questions that arise are: What is the biological basis for this three dimensional perception? Is there a gross difference between this and the *four-dimensional intuition* of a professional *relativist*? Who talks in terms of 3+1 dimensions?

While constituents are important, the greater importance of structures is being realized in many fields, particularly from the point of view of emergence of new properties. Consider the example of the three compounds of three chemicals carbon, hydrogen, oxygen. They give rise to alcohols, sugars and fatty acids with very different properties. Same constituents but different structures. You can cannot deduce the properties from the constituents.

P.W. Anderson says: "I believe that at each level of organization or scale, types of behaviour open up which are entirely new and basically unpredictable from concentration on the more and more detailed analysis of the entities which make up the objects of these higher level studies".

Peter Medawar says: "Starting with atoms, building up through molecules, cells and organisms to conscious individuals and society, each level contains and enriches the one below, but can never be reduced to it".

In the context of the connection between neural correlates and consciousness, the well known quantum coherence phenomena illustrated in phenomena associated with – Lasers, Superconductivity …. *Downward causation* becomes relevant. Efforts are on to look for quantum coherence processes in the neurons.

William James: Taking a purely naturalistic view of the matter, it seems to me reasonable to suppose that unless *consciousness* served a *useful purpose* it would not have been superadded to life.

Miller: All motile creatures must be "conscious" in some form because their motility requires it for safe navigation and indicates it behaviourally – down to Protozoa which

have no separate nervous system – if this is unconscious functioning, then unconscious must evolve as much or more than consciousness.

Sperry (Neurosurgeon) says: Consciousness is a higher order emergent from holistic properties that will in turn exercise "downward" control over neural functions.

To the question whether physicists rather than biologists can help us to move forward with regard to consciousness problem asked by *Nancy Cartwright* (Professor of Philosophy) *Roger Pensore* (Astrophysicist) answers [p. 179, The Large, the Small and human mind, Cambridge University Press, 1997]:

- "I claim that we must search for structures in the brain with some very clear cut physical properties. They should be such as to enable well shielded spatially extended quantum states to exist, persisting at least for something of the general order of a second, where the entanglement in this state gives it a spread over fairly large areas of the brain, probably involving many thousands of neurons all at once. To support such a state, we need biological structures with very precise internal construction, probably with a crystal like structure and be able to have an important influence on synaptic strengths. "

- "I do not see that ordinary nerve transmission can be sufficient on its own because there is no real chance of obtaining the needed isolation. Things like pre-synaptic vesicular grids, as has been suggested by Beck and Eccles could be playing a role, but to my way of thinking, cyto-skeletal microtubules appear to have more of the relevant quantities. It may be that there are many other structures on this sort of scale (such as clathrins) which are needed for the full picture …."

As we have already stated

In his book "The Astonishing Hypothesis" the Nobel Laureate Francis Crick starts out with his astonishing hypothesis

"your joys and your sorrows and your ambitions, your sense of personal identity and your free-will are in fact no more than the behaviour of a vast assembly of nerve cells and their associated molecules"

Well, at the end of 262 pages in which he has elaborated in a masterly way how this hypothesis is supported by neurosciences, he remarks:

"The astonishing hypothesis may be proved correct. Alternatively some views close to religious one may become more plausible. There is always a third possibility that facts support a new way of looking at the mind-brain problem that is significantly

different from the rather crude materialistic view many neuroscientists hold to-day and also from the religious point of view. Only time and much more scientific work will enable us to decide"

Daniel Danin: Quantum physics by taking human mind deep into matter could never "touch the bottom". It is just looking for it and *will look for ever.*

Weinberg: If neuroscientists ever explain consciousness for example "they will explain it in terms of *the brain*" and the brain is what it is because of historical accidents and because of the *universal principles* of *physics* and *chemistry.*

Max Delbruck: The feeling of absurdity evoked by the question of *mind from matter* is perhaps similar to the feeling of absurdity with which we have learned to cope when we permit *relativity* theory to alter our *intuitive concepts of space and time* and *quantum theory* to alter our intuitive concepts of *objects* and *causality.*

Essentially these views are regarding *individual consciousness.*

Let us now consider the views of some of the other ~~physicists~~ scientists who take a much broader perspective on consciousness and its *ontological relation to the world*:

Max Planck: Consciousness, I regard as fundamental. I regard matter as derived from consciousness. Everything we talk about, everything we regard as existing postulates consciousness. We cannot get behind consciousness.

Wheeler: Reality might not be entirely physical. Our cosmos may be a participatory phenomenon, requiring observation and thus consciousness itself.

Heitler: What physics gives us is a 'sort of projection of the world on to a causal-quantitative plane just as a photograph is a projection of the 3-dimensional landscape on to a plane paper. Principles of Life, Will, Action, Perception, Memory, Purpose cannot be reduced to physico-chemical processes.

John Wheeler: Physical reality has thus moved from matter → molecules → atoms → protons, neurons, electrons → quarks and leptons → space or vacuum and geometry of space → matter. We have seen that matter and radiation are equivalent and transform to each other. So ultimately, the physical substratum of everything is just *one entity* - quantum mechanical vacuum. The question arises - does it help to reduce life consciousness, mind etc, to the motions of subatomic particles similar to matter? It looks that such a step even if realized is not likely to give any different insight to reality. All that again will be reduced to "empty space" . (*In what way is this insight different from . . . everything is Brahman?*)

Schrodinger (Physicist, Nobel Laureate): *Consciousness* is the very basis of all *creation*.

Eddington(Astrophysicist): The stuff of the world is mind-stuff. The mind-stuff is not spread in space and time. Recognizing the entire world is abstract and without 'actuality' apart from its linkage to consciousness. We restore consciousness to a fundamental position.

Von Weizacker (Physicist): Consciousness and matter ~~and~~ are different aspects of the same reality.

Dyson (Physicist): I think our consciousness is not just epiphenomenon carried along by chemical events, but is an action against forcing the molecular complexes to make choice between one quantum state and another. In other words, mind is already inherent in every electron.

Paul Davies (Physicist): "..... These and other considerations have convinced me that there are new processes, laws and principles which come into play at the threshold of mental activity. I do not believe that behaviour, let alone psychology can ultimately be reduced to particle physics.

I find it absurd to suppose that the migratory habit of birds, not to mention many personal sensations and emotions are all contained in the fundamental Largrangean of superstring or whatever.

Michael Polanyi (in "Life's irreducible structure" in Science, New Series, 160 (3834), Jun. 21, 1968, 1308-1312.): ....Life transcends physics and chemistry, there is no reason for suspending recognition of the fact that consciousness is a principle that fundamentally transcends not only physics and chemistry, but also the mechanistic principles of living beings.

David Hodgson (in Mind Matters): "Mind to some extent be said to be a function of brain, *but only if brain is understood* not as detectable macroscopic object, but *as the quantum reality underlying both this object and the mental events of consciousness*. Mind and brain are manifestations of and view points towards, a "single reality", but with important differences, in particular in relation to the development over time of this reality and (specifically) the causes and explanations of such developments".

Einstein: (physicist and NL) "All knowledge of reality starts from experience and ends in it". Experience remains, ofcourse, the sole criterion of the physical reality of mathematical construction. But the *Creative principle* resides in *mathematics*. In a certain sense therefore, I hold it true that *pure thought can grasp reality as the ancients dreamed*".

Erwin Schrodinger: "The world is a construct of our sensations, perceptions, memories. It is convenient to regard it as existing objectively on its own. But certainly does not become manifest by mere existence"

Conclusions

- Technological advances in the field of sophisticated instrumentation (micro-electrodes, lasers, EEG, fMRI, PET, etc.) and brain surgeries have led to remarkable developments in brain research - in mapping the different parts, in correlating their functions, in understanding the plasticity of the brain, in discernment of time sequences and location specific responses, likely sites of memory, the identification of the neurotransmitters and the neuroreceptors and analysis of the patterns of neuronal signals etc.

- There are some indications that some of the brain processes are quantum mechanical in nature. This opens up a new dimension to brain research, both in terms of further investigations and interpretations, and will necessarily require the active collaboration of scientists in the areas of life sciences and physical sciences. Again, new technological advances like the realization of single photon sources and supersensitive interferometer and recording techniques are enabling scientists to verify the intriguing predictions of quantum mechanics. These developments will necessarily find echoes and applications in Brain Research.
- Developments in the field of ultimate constituents of matter and radiations and the nature of physical forces lead to new fundamental ideas of quantum mechanical vacuum, multidimensional space etc., and have implications to the nature of mind and consciousness as been emphasized by some of the outstanding scientists. These become particularly important if the present attempts to understand mind and consciousness in terms of molecular activities alone fail and one has to go to deeper levels.

- It is fair to say, that from the scientific point of view, no clear cut understanding has been reached yet on what exactly is consciousness and at what stage of evolution it became a vital aspect of a living system.

- The establishment of the connection between emergence of language and consciousness may be a crucial line of approach - this brings in the whole question of animal consciousness and levels of consciousness.

- The idea that the brain may be a sophisticated parallel processing computer is being hotly pursued - particularly by A.I. scientists. It is difficult to see how they will succeed since there is no understanding of what sort of a machine is the brain.

- There is no evidence yet of any extraterrestrial intelligence.

- Further insights might emerge from more sophisticated studies on the different states of the mind – the waking, dreaming and sleeping and more importantly on higher level mental states that are reached through the practice of Yoga, Zen, Meditation etc.

- The domain of the unconscious - Is it different? What is the connection between the conscious, sub-conscious and unconscious states – these need to be investigated using the modern instruments and methods of analysis.

- On the philosophical front, what is interesting is the increasing recognition of certain over all parallelisms of modern findings and ancient insights which pursue entirely different approaches: the **oneness** of the substratum of all physical activity from the time of origin of the universe to the present day – the space-time continuum – the quantum mechanical vacuum - in comparison to the Urstoff – Brahman, Sunya, Tao, ... What is the meaning, significance of this parallelism?

Ideas You should carry home

Unity among diversity

- Whole is greater than sum of parts
- Epiphenomenona
- Emergence
- Coherence
- Synchronicity – acausal influences
- Downward causation

Unification in Science

- Reductionism to Holism
- Reality – Non-Local
- Participatory Universe
- Dirac Vacuum – Quantum Vacuum
- Space-Time continuum
- Something called NOTHING – source of EVERYTHING
- Grand unification

Ultimate Reality

ONENESS; SUBSTRATUM – URSTOFF' SHUNYATA; TAO; ZEN; BRAHMAN; QUANTUM VACUUM.

Sarvam khau Idam Brahma

PRAGNANAM BRAHMA – CONSCIOUSNESS IS BRAHMAN