

Science and Consciousness*

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When we want to discuss consciousness in the context of science, we should perhaps first define what the two terms science and consciousness stand for. One of the best and most succinct definitions of science has been given by the Nobel Laureate Charles Townes [1]:

"Science is the attempt to understand the structure of the universe and how it works including ourselves."

While science over the last four hundred years or so since the time of Galileo and Newton has been eminently successful in unraveling the structure of the universe both on the micro- and macro-scales and is trying to figure out the ultimate constituents, the forces that act on these constituents and the exact processes behind each manifestation and phenomenon using on the one hand the power of technology and on the other the most intricate and sophisticated mathematical tools, when it comes to the question of understanding 'ourselves' the progress is not as impressive. The essential reason for this is that when science has to deal with "ourselves" it straightaway faces two barriers – Life and Consciousness. There is no understanding in science yet as to what exactly life is and how it originates from inanimate matter and what exactly consciousness is and how it originates?

Perhaps, we should start with a working definition of consciousness – something that is consistent and based upon our own daily experience of activities: I see, I hear, I think, I exercise my will, I enjoy, I suffer, I imagine, I am aware of myself, I am aware of my dreams, and my sleep. All this I am able to do only when I am conscious and therefore I can formulate a working definition of consciousness as whatever it is behind all these activities of mine. Immediately the question arises – is consciousness a thing which is inside me? Is it a force? Or is it a process associated with something happening inside me? Is it possible to locate where this consciousness is centered? What is the connection between this "I" and consciousness.

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These questions have been deliberated upon by intellectuals belonging to different disciplines at different times in the past perhaps for several millennia. For a long time these questions were in the realm of philosophy only, since there was no way of scientifically identifying and accessing this "I" and consciousness was considered to be a "subjective phenomenon" that could not be dissociated from this I. However, there was a snag in this argument. Even though an individual is aware of only his own consciousness, he is also aware that there others around him in whom he recognizes the presence of consciousness from their behaviour and actions. Consciousness of the other persons therefore is objective and therefore should be amenable for scientific investigation, in as much as any other phenomenon he observes outside himself.

Thanks to the remarkable developments that have taken place in the field of neurosciences in recent decades by extensive and ingenuous use of a variety of new generation instruments like Positron Emission Tomographs (PET), Functional Nuclear Magnetic Resonance spectrometers (fNMR), Computer Aided Scanning instruments (CATSCAN), Magnetic Encephalographs, Laser and Micro Electrode probes coupled to computers, very systematic and though investigations of the brain, which is considered the main center for all cognitive activity, have been carried out on animals and also on human beings since these are non-invasive techniques. This has resulted in a detailed mapping of the relevant locations and layers of the cortices of the brain associated with different cognitions and identification of the physico-chemical and electrical, electronic, and electromagnetic processes in the neural networks and interestingly also in the associated blood streams. These efforts have been extremely rewarding in terms of establishing correlations in very minute details between these mental processes and the sensory functions of the brain like seeing, hearing, smelling etc, from the inputs received at the corresponding body centres sensors like the eyes, the ears, the nose etc. What is most exciting is the high resolution achieved in relating the structural and functional (physio-chemical) details with which the terminal areas of each neurons or each bundle of neurons responsible for specific individual acts of sensing, have been identified. However, despite these marvelous achievements, the nature of the integrating element, namely consciousness – the one responsible for feelings, sensations, emotions, thoughts, recall of memories, is not at all clear. Some are of the opinion that consciousness is an emergent phenomenon arising from the co-operative electro-physical-chemical activities in the neural networks and blood streams.

The Table 1 illustrates the two kinds of experiences generated in an individual when he looks at say a rose flower.



A (Physicalism)

B (Mentalism)

What happens in the Brain and its accessories

What happens in the mind

<ul style="list-style-type: none"> • Formation of 'image' of the flower on the retina. 	<ul style="list-style-type: none"> • Distinctive perception and recognition of the flower as a rose.
<ul style="list-style-type: none"> • Activation of rods and cones in the retina's various layers. 	<ul style="list-style-type: none"> • Evokes sense of beauty - Smell of the rose flower
<ul style="list-style-type: none"> • Generation of action potentials - electrical pulses. 	<ul style="list-style-type: none"> • The awareness and recognition colour of the flower.
<ul style="list-style-type: none"> • Transmission of pulses through axons in neurons. 	<ul style="list-style-type: none"> • The softness and smoothness of petals on touching the same.
<ul style="list-style-type: none"> • Happenings in Synapses and Dendrites 	<ul style="list-style-type: none"> • Appreciation of symmetry, beauty and aroma.
<ul style="list-style-type: none"> • Releases of Neuro-transmitter chemicals at various locations 	<ul style="list-style-type: none"> • Earlier happy associations flood the mind
<ul style="list-style-type: none"> • Activation of Cortices 	<ul style="list-style-type: none"> • Emotions triggered.
<p><u>Basically:-</u> Electrical Signals } in various oscillations chemicals } locations time sequence.</p>	<p>The mind is able to gauge the size, distance, shape and other physical characteristics as well.</p>

In Table 1, on the left hand side (A), there are terms like electrical signals, oscillations, chemicals etc. that have specific connotations which we learn in the process of schooling at various levels, and start attaching certain kinds of reality to them. It is to be pointed out that these are actually representations of something things which are more basic and physical. For example, the electrical signal represents the flow of a certain quantity of electrical charge in a certain period of time in a certain location. These parameters are again related to more subtler realities as we shall see later on. Similar is the situation with the neurochemicals which are made of various elements which in turn are made of fundamental particles like protons, neutrons and electrons. For certain purposes one can stop at the level of signals and

chemicals. The question is whether we can stop at these gross levels for understanding what consciousness is.

The terms on the right hand side of the Table, i.e. (B) fall into an entirely different category. There we come across terms like beauty, fragrance, softness, etc. which we learn in the process of everyday living and through interactions with others. They cannot be described in terms of more fundamental entities. They cannot be quantified. They have a certain intensely personal (subjective) character about them. Some of these like joy, happiness etc. are triggered by past associations and memories of events and individuals. More than anything else, we read a certain 'meaning' to these. They are not just quantifiable data as in the first case (A).

The crucial difference between (A) and (B) is that while (A) can happen even when one is unconscious, (B) can never happen when one is unconscious. Even if all the signals and chemicals are released in the brain and its accessories, (B) cannot happen if the person is in an unconscious state or when he is not paying attention - when the intentionality for registering the particular happening is not there. While for seeing a flower or registering its fragrance, (A) is necessary, (A) alone is not sufficient for (B) to happen. On the other hand (B) can happen in a different way - by thinking of the flower and recalling from memory, its fragrance.

Let us consider the reverse situation when the input is not from outside, but from within. If I "will" to get up, then the necessary instructions are sent to the relevant parts of my body and I stand up. What or Who is this I, that wills and how does the will get translated to all the mechanical actions of the body? Clearly I can "will" only when I am conscious.

In both these examples, the net result is some kind of 'action'. In the first case the source is physical and the action is mental and in the other the source is mental and the action is physical. In both cases, the action takes place in a certain space-time framework - the body and its surroundings and in a certain time sequence.

Is it possible at all to relate these two different kinds of experiences of the same event in any meaningful way? Clearly at the gross level they appear to be distinctly different and unconnected entities though the two experiences are the consequences of the same physical event, namely seeing and smelling a flower by the same individual. Can they be reconciled at a

deeper fundamental level? It is very instructive and illuminating to become familiar with what happens in physical sciences in similar situations, not involving directly the brain or mind.

Reality and levels of explanation in physical sciences

It has happened in the field of science, particularly in physics, that even the same event requires widely different concepts for explanation depending on the level and purpose for which the explanations are required. Let us examine a few typical examples of such cases.

Suppose I take a piece of stone and drop it from a certain height. It falls to the ground. Why? The standard school-boy's answer is that the gravitational force between the stone and the earth is responsible for this. The stone is a solid and therefore does not change its shape while falling down, while it may break into smaller pieces when it hits the ground. This same phenomenon is explained by a chemist in a more elaborate way. He will say that the stone is a compound made of several elements like silicon, oxygen and other impurities and the molecules of these elements are made of atoms held together by electromagnetic forces. So when the stone falls it is an assembly of atoms falling down held together by these forces. An atomic cum nuclear scientist goes one step further and will say that all these atoms are made of protons, neutrons and electrons bound together by nuclear forces and so what is happening when the stone is falling is that a bunch of protons, electrons and neutrons are all falling down together held by nuclear and electromagnetic forces. A fundamental particle physicist will go even further and say that the protons and neutrons are made of quarks held together by gluonic forces and it is the assembly of quarks, gluons and electrons that is falling.

What this shows is that though the gross phenomenon is just the falling of a stone, the realities are different at different levels of explanation. The reality goes on changing as we delve deeper and deeper into the structure of matter and nature of forces. Different levels of reality meet different purposes. An engineer designing a steel bridge does not have to go beyond the molecular structure of iron, while a pharmaceutical chemist designing a drug has to go to deeper levels. A nuclear engineer has to go to the nuclear levels for designing reactors and providing protection against radioactive emissions.

What we have considered so far is about the finer and finer constituents of matter. While we have made a reference to the various forces, we have not considered some of the intricacies involved. As the stone is falling, it is entering new regions of space. The

electromagnetic, the nuclear and gluonic forces are not rigid bodies like rods that are permanently attached and move down with the particles they connect. According to present concepts of forces, their action is through the creation and absorption of virtual pairs of particles and antiparticles. So strictly speaking, it is not only the bunch of quarks and electrons falling down, it is also the continuous creation and annihilation of virtual pairs of particles in the space between the falling particles. This highlights yet another intricate action that is going on which is very relevant to the act of the stone falling as one piece, but which is not apparent, at the gross levels. We normally treat the space as 'empty' of 'everything'. Actually this is not the case. Space is the repository of the ultimate constituents of all matter and forces, but existing in such a form that either by spontaneous fluctuation (which is one of the properties of this vacuum) or by the deposition of positive energy they can be made manifest. For example, in the case of a hydrogen atom, the electromagnetic force between the proton and electron is due to the continuous creation and annihilation of electrons and positrons created as virtual particle pairs by the mediating photons emitted by the charged particles. In the case of quark-quark forces the gluons are exchanged. Though the virtual pairs cannot be recorded by any instruments directly because of the extremely short time for their existence and the very short distance intervals in which they manifest, the effects of their production have been recorded (Lambshift, Casimir force etc.). What all this is telling us is that what meets the eye is very different from the plethora of many subtle phenomena taking place at deeper levels which are not only unseen, but unseeable.

In the above paragraphs, we have talked about force as due to exchange of virtual particles. This is a very different concept from the original ideas of force fields that were introduced in connection with gravitational, electric, magnetic and electromagnetic phenomena. The fields were introduced as mathematical concepts without defining what the physical contents of the field are. It was assumed that these are some vague properties of 'ether' which itself was supposed to be non-material something, not identifiable. For several centuries the ether concept held sway, but was finally replaced by the four dimensional space-time continuum by Einstein, as part of his special theory of relativity.

While quantum mechanics highlighted the properties of empty space in terms of its ultimate constituents (fundamental particles or fields representing them), the special and general theories of relativity brought out some other interesting aspects of space - connecting geometrical properties of space with matter and energy. The old common sense idea of time as

absolute and same everywhere got a new twist in the special theory. Rate of flow of time became dependent on the velocity of the frame of reference and dilated as the velocity of motion became higher. Space intervals contracted in the direction of motion. For certain purposes space and time could not be treated as separate characteristics, but had to be fused into a single concept of space-time continuum. The human experience of space is very different from the experience of time. Clearly they belong to different categories of experience. But according to the special theory they had to be merged. The special theory had more surprises in store. It combined energy and mass through the famous relation $E=mc^2$. Here again the concept of mass and the concept of energy, both anthropogenic in origin were certainly very different concepts and were introduced in different contexts. The most surprising of all was the equivalence of mass and curvature of space, established in the general theory of relativity. According to this, matter which is the most concrete of all our perceptions is just a geometrical property of space, in a sense topsyturvyng the old idea that empty space is there laid out for matter to occupy.

As is well known the special theory of relativity was proposed by Einstein to account for the experimentally observed fact that the velocity of light was independent of the motion of the observer. Several unusual consequences that followed from the theory have been subsequently very well established experimentally. The bending of light around a massive object like the Sun predicted by the general theory of relativity was later verified by the observation at the time of a solar eclipse. The explosion of the atom bomb was clear vindication of the equivalence of mass and energy.

It may be appropriate at this stage to state the revolutionary ideas that brought about a major change in the way of our thinking in science and also in philosophy, in the words of the masters themselves who brought about these revolutions.

Einstein: "Matter which we perceive is merely nothing but a great concentration of energy in very small regions, We may therefore regard matter as being constituted of space in which the field is intense. Field is the only reality".

Dirac: "All matter is created out of some imperceptible substratum. "Nothing", unimaginable and undetectable. But it is a peculiar form of nothingness out of which all matter is created".

What these developments in the field of physics demonstrate is that many of the fundamental concepts like space, time, matter, radiation, energy taken over from commonsense everyday ideas to science in its early days, have had to be radically transformed and even transcended (see Sreekantan [2]) to be able to explain many new phenomena discovered especially in the 20th century. These realizations of the fundamental connectivity of what appeared to be widely unconnected aspects of nature - electricity, magnetism, light, matter, gravitation - came about gradually and in different contexts, and with the application of more and more powerful tools for the exploration of nature - probing on the one hand extremely small intervals of space with high energy particles and with the ability to record happenings in extremely short intervals of time with sophisticated detector and electronic systems, and on the other, accessing the farthest reaches of the expanding universe and identifying entirely new kinds of celestial objects that revealed new features of the Universe. This new knowledge and the new physics is pointing towards a most important secret of nature as it were - that all this variety is a manifestation just of one substratum, a four dimensional space-time continuum according to theory of relativity and a quantum vacuum (Dirac vacuum) according to quantum mechanics, and theory of elementary particles and their interactions. How this substratum arose and how it was endowed with all the intrinsic properties necessary for these manifestations, science will, perhaps, never find answers. However, what science has been able to do is to specify the properties necessary from the point of being able to explain phenomena in the traditional scientific methodology of breaking down gross phenomena to finer and finer levels by the reductionistic method reinforced by experimental observations and theoretical constructions incorporating mathematical equations and their solutions and guided by conformity to laws and to constants of nature. However, several surprising features that unfolded in this endeavour are (i) occasional breakdown of laws was as, or more important on occasions to the emergence of new features (ii) these deviations were of a controlled nature (Heisenberg's principle of uncertainty) (iii) group behaviour was in some as yet inexplicable way depended on some individual parameters (spin dependent statistics) (iii) entirely new features emerged in assemblies (superconductivity, super fluidity, laser action etc) - (iv) 'Resonance' plays an extremely significant role in the explanation of many phenomena.

On the unification of space and time and the connection to gravity, Yu Vladimirov *et al* [3] write:

"Thus the curvature of space-time has a physical meaning. We have long got used to the fact that many things in this world are different aspects of the same entity. This was the case with mass and energy with inertial mass (resistance to force) and gravitational mass (gravitational charge) and now we see that the same is true of gravitational fields and geometrical properties of space time. Curvature is a geometrical entity whose components vary from point to point in any given system of co-ordinates. Thus curvature is a field in the mathematical sense of the word, and at the same time a manifestation of a physical gravitational field. The credit for this discovery goes to Einstein".

Further they continue

"..... is there any difference between physics and geometry? The only reason we regard geometry as an independent physical reality is because we were educated in the spirit of Euclidean axioms. Think how absurd this view point is: indeed our universe is whole and unique and its properties can all be learned only from experience. The geometry of the real world should be regarded as one of the experimental physical sciences and its assertions and predictions must always be verified through experience or practice. The axioms of geometry are, in fact, no more than a refined form of human experiences. To the question whether it is possible to construct a theory in which all the quantities have a geometrical interpretation the answer is "yes, the most elegant solution lies in the framework of higher dimension."

[Historically, it is interesting to note that William Clifford (1845-1879) had noted: (i) physical properties of matter and properties of curved spaces are related (ii) heat, light, electricity may be related to changes in the curvature of space (iii) the Electro-magnetic field may be related to geometry of space.]

Origin of the universe—creation of space, time and matter

The Big Bang Theory of Creation of the Universe is one possible and at the moment the most popular theory of creation of the Universe. It spells out the intricate connections between widely different physical parameters in the light of all the developments in physics and astronomy in the 20th century.

The Big Bang Scenario and the first moments of the physical evolution of the universe is beautifully narrated by John Boslough [4] as follows:

"Into a void, so absolute as to mock any human concept of emptiness, appeared a single point of raw potential. At the very instant of its creation, this point bearing all matter, all dimension, all energy, all time burst out spewing forth its contents.

At the instant of its origin, all matter and all forces were indistinguishable from each other. As the universe expanded and cooled, matter and forces split again. Still in the billionth of a second in its history, the universe continued to fragment. Soon all the constituents of matter - what we now call quarks and leptons, assumed separate identities, falling into separate classes that have been joined again. The single force propelling the cataclysm also became fragmented and the different particles became associated forever with the new forces that were being created. Three of the fragmented forces are still at work inside the atom. The most powerful of these is the strong force that binds the constituents of the nucleus together - the quarks that make up the protons and the neutrons. One thousand times weaker is the electromagnetic force that keeps the electrons, a type of leptons, orbiting around the nucleus. This force makes atoms appear solid and also is responsible for radio and light waves. Another hundred times less powerful is the weak force that causes radioactive decay."

While the above describes the act of creation of matter and force in the first moments of the universe, Boslough [4] has a more graphic description of the whole creation of the universe including space, time, matter, space, galaxies, earth, life and people as follows:

" at first there was nothing - no time, no space, not even emptiness only a void beyond voids, a place that was no place, without colour, without shape or substance, without passing a single moment or a prospect of eternity"

From this pure nothingness sprang a speck of chaos, a seed seething with such raw energy that the thought capable of contemplating it has not yet been formed.

Within this speck of vibrating energy still many times finer than an atom were the dimensions of time and space although these concepts were then meaningless. There was no now, then and will be ; no here, no there. The infinitesimal cosmos began to expand. As it

grew it cooled and its energy dissipated. Almost at once one of the forces ranging within it separated from the rest. Some pairs of particles capable of existing only in such extreme conditions flashed in and out of existence, colliding with each other in a shower of annihilation.

Suddenly the infant cosmos erupted from subatomic proportions to the size of a cantaloupe. Within a second, it was as big as solar system a crucible of matter and energy denser than a star. Pure energized light blazed throughout the young universe. As it grew and cooled, flying particles began coalescing into larger structures of hydrogen atoms, which eventually swirled into immense clouds of billowing gas.

Epochs passed. The universe expanded. Its blazing light faded into darkness. A million years, then a billion years came and went. All at once millions of stars began emerging from the swirling clouds of hydrogen gas. Galaxies appeared, then more stars, other worlds perhaps, Earth, Life and People".

This Big Bang theory is based on three critical experimental observations and a lot of information gathered from collision studies at high energy particle accelerators. The three crucial observations are (i) expansion of the universe, (ii) discovery of the universal 3°k Microwave radiation and (iii) percentage ratio of Helium to Hydrogen in the universe as a whole. The creation scenario as a function of time from 10^{-43} sec to 20 billion years in the life time of the universe is shown in the **figure 1** taken from Boslough's book.

Consciousness and quantum vacuum

While the advances in theoretical elementary particle and nuclear physics and theoretical astrophysics and cosmology have helped us in formulating this Big Bang scenario - the creation of space, time, radiation, elementary particles, elements, compounds, stars, galaxies etc., what is missing is any hint even, of how and when inanimate matter became animate matter and how and when consciousness emerged. What is established beyond any shadow of doubt by biologists is that the constituents of animate matter at all levels from amoeba to man are made of the same elements as encountered in inanimate matter. No particular new element has been found unique to living matter though the organic molecules are very long chain molecules. Though it is more difficult to be categorical about the absence of any new forces unique to organisms, the biologists continue to work on the hypothesis that

the same four physical forces operative in inanimate matter are the only ones in animate matter too.

It has to be pointed out in this context that the experience in the delineation and discovery of forces in the physical domain has depended on theoretical formulations and predictions followed by experimental effort costing enormous sums of money and involving construction of new facilities for carrying out these searches. In very recent years there is considerable excitement over the possibility of yet another new force in addition to the four known forces, attributable to the detection of the "dark energy" in

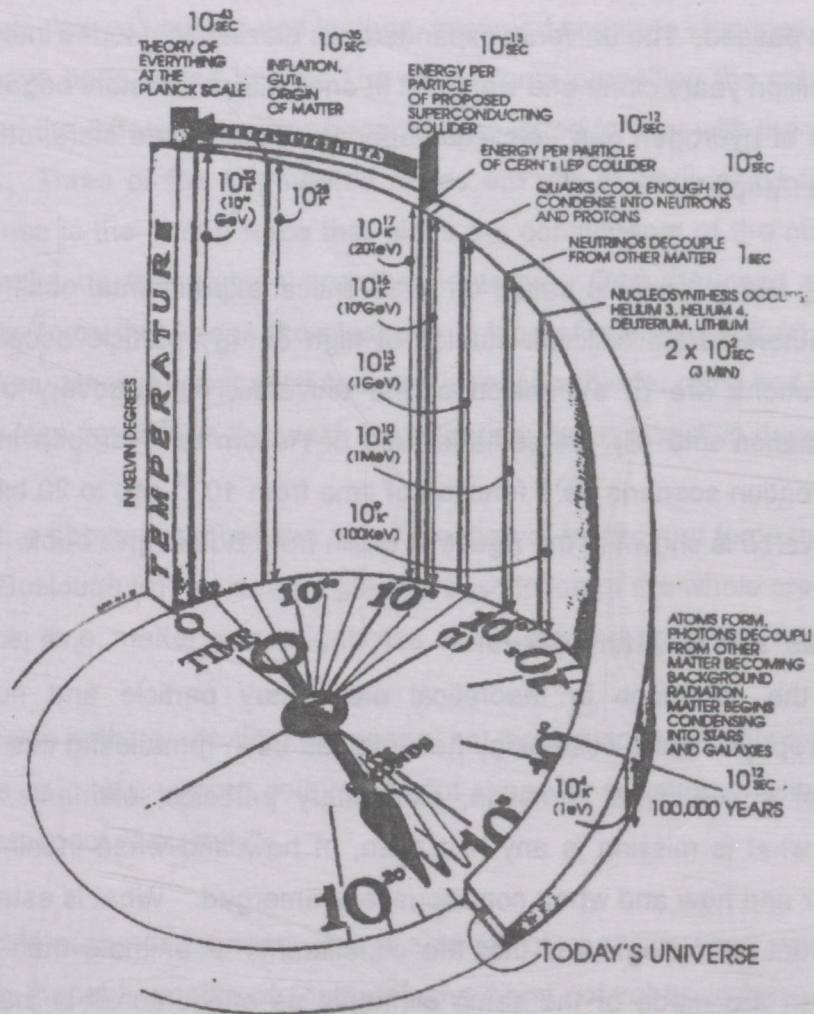


Figure 1. Thermal History of the Universe. Using even the biggest accelerators, physicists are unable to explore the terra incognita at the dawn of time. From: John Boslough Masters of Time (92) Pheonix

the universe that is behind the faster expansion of the universe (acceleration of the universe) established by astronomical observations. Unfortunately, despite suggestions by Shelldrake and others about the possibility of new kinds of forces in the animate systems no systematic efforts have been made in this direction, to confirm or deny them, may be because of the prejudice arising from the old concept of vitalism and vital forces. Since we do not know all the properties of quantum vacuum which is the reservoir of all forces, in principle it is not difficult to accommodate new forces. We have seen that the four known forces gravitational, electromagnetic, nuclear and weak forces serve entirely different purposes. Yet another approach that is being advocated to explain consciousness is the systems approach which incorporates ideas of chaos, coherence, non-equilibrium nonlinear processes which has become popular in connection with phenomena that require group effort. In this class are phenomena which show the 'emergence' of new features which are not there in any manifest way in their constituents. Typical examples in the field of physical are superconductivity, superfluidity, laser action. These are mostly due to long distance phase couplings established by quantum coherence. In this kind of scenario consciousness is considered to arise from the coherent firings of individual well separated neurons, the firing of individual neurons themselves being controlled by quantum coherence effects in the microtubules [5] of the neurons. In the ultimate analysis these again become processes in the universal substratum, in the quantum vacuum.

Finally, what this 'oneness' - the universal substratum, the space-time continuum, the quantum vacuum, has done is to point a way of resolving the trichotomy between the three entities involved in Consciousness, the experienced, the experience and the experiencer as just different manifestations of the same base level unity. What is interesting and perhaps significant is that similar insights of oneness (Urstoff, Brahman, Sunyata, Tao etc) have been emphasized in several ancient philosophies too (see Sreekantan [6,7]), of course following an entirely different line of approach - turning objectivity to subjectivity by exploring the inner halls of our experience. It may be relevant here to quote one of the famous statements of Einstein:

"All knowledge of reality starts from experience and ends in it. Experience remains, of course, the sole criterion of 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 ancients did".

The widely different views held by scientists and philosophers, which continues to be heterogenous with no hope of converging, are reflected in the following quotations, chosen randomly.

Francis Crick [8]:

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

John Stuart Mill [9] (quoted in neuronal Man, Jean-Pierre changeux p. 275) says:

"If it is materialistic to look for the material bases of mental operations, all theories about the mind must be materialistic or insufficient."

Max Delbrück [10], the physicist turned biologist and the winner of Nobel Prize in Biology says:

"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 with when we permit relativity theory to alter our intuitive concepts of space and quantum theory to alter our intuitive concepts of objects and causality"

Roger Penrose [11], the mathematician, cosmologist and the author of the books "Emperor's New Mind" and "Shadows of the Mind" has said in answer to the question whether physicists rather than biologists can help us to move forward with regard to consciousness problem asked by Nancy Wright, a Professor of Philosophy, answered ("The Large, the Small and Human Mind, Cambridge University Press, 1997, p. 179).

"I claim that we must search for structures in the brain with some clear-cut physical properties. They should be such as to enable well shielded spatially extended quantum states to exist, persisting atleast 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 the synaptic strengths. I do not see that the ordinary nerve transmission can be sufficient on its own because there 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 Cytoskeletal microtubules appear to have more of the relevant qualities. It may be there are many other structures on this sort of scale (such as a clathrins) which are needed for this full picture”.

Freeman Dyson [12] another famous theoretical physicist goes to the extreme of saying “I think our consciousness is not just epiphenomena carried along by chemical events, but is an action against forcing molecular complexes to make choice between one quantum state and another. In other words, mind is already inherent in every electron”.

In an evolutionary strain, William James the famous psychologist of the early part of the last century and the author of the book “Varieties of Religious Experiences” says

“Taking a purely naturalistic view of matter it seems to me reasonable to suppose that unless consciousness serve a useful purpose it would not have been superadded to life.”

The neuro-surgeon Sperry [13] says:

“Consciousness is a higher order emergent from holistic properties that will in turn exercise “downward” control over neural functions”.

The despondent situation of extreme reductionism, is well demonstrated by the following statement by the soviet physicist Daniel Danin [14] author of the book “Probabilities of the Quantum World” (Mir. Publication, Moscow, 1983):

“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”.

Arthur Eddington [15], mathematician, relativist, philosopher and author of popular science books has said

“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 the linkages to consciousness. We restore consciousness to a fundamental position”.

These are but a small cross-section of the views on the ability or the inability of science in tackling the problem of consciousness. Even the most optimistic scientist Francis Crick [8] who

is pursuing vigorously research on the mechanism of vision, concludes his book "Astonishing Hypothesis" by saying "the astonishing hypothesis may be proved correct. Alternately some views close to religious one may become more plausible. There is always a third possibility that facts support new way of looking at the mind-brain problem that is significantly different from the rather crude materialistic view many neuro-scientists hold to-day and also from the religious point of view. **Only time, and much further scientific work will enable us to decide**".

Clearly, the message is conveyed by the last sentence of the above quotation, which I have highlighted in bold letters.

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