



The DeepScience of NeuroCardiology

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Abstract

Heartless pursuance of science, religious rituals and politics are the cause of environmental, economic and human disasters. The remedy lies in entrainment followed by enactment of the heart and the brain of the *Homo sapiens* for their onward journey with compassion and empathy towards the spirit of consciousness. A scientific approach to this issue is felt essential and this article looks into such possibilities that could be nurtured in the discipline of cardiology, neurology, hybrid discipline of cardio-neurology or neuro-cardiology, psychology and sociology under the auspices of science of consciousness. In addition to neuro-centric consciousness, the possibility of co-existence of cardio-centric consciousness has been discussed. It is emphasized that instead of becoming neuro-centric or cardio-centric, we require to be consciousness-centric for achieving the state of heart-brain entrainment and enactment! Furthermore, we propose that both brain and heart synchronize and become consciousness-centric at the phase of nature between the ground state of matter and the ground state of consciousness during the mechanism of enactment.

Keywords: Cardioneurology; Cardiac consciousness; Zero-point-energy state of matter; Ground state of consciousness

Introduction

Contrary to present mainstream science which has accepted heart as a blood-pumping machine working under nervous system, the popular belief system reigns from time antiquity that the heart is the seat of feelings, which participates while making decisions! We feel all our emotions from love to sorrow, joy to despondence, intense feelings within to thrill of engagement with the Infinite bliss, inside the 'heart'. The heart feels. Brain cannot feel! The brain reasons it out! The story goes on from the ancient Egyptians, the Greeks, and the Indians from Upanishadic times, to the current modern age to Shakespeare in Macbeth, "Who could refrain that had a heart to love, and in that heart, courage, to make love known?"

There is a famous quote of Swami Vivekananda, "Like me or hate me, both are in my favor, if you like me I am in your heart, and if you hate me I am in your mind." Note that he is speaking from a plane where both heart and brain are at poise of equivalent importance.

In an individual going through a severe clash of ego and love, when the ego wins, the heart suffers the most! It may even stop, may suffer infarction! The heart cannot hide the truth, speaks its out! Therefore, the lie-detector machine focuses more on the variability in the pulse and blood pressure rather than on the recordings of the brain!

In education system, along with the brain, the heart and the hand also have specific roles. Education is the process to bring changes in the behavior of the learner in terms of knowledge, skill and attitude involving cognitive, psychomotor and affective brain, respectively. Education involves three 'H's; Head, Heart and Hand, i.e. behavioral expressional instrument of cognitive brain, affective brain and psychomotor brain, respectively. Also relevant, see reference [1]. In fact, it is said that sustainability in higher education will be observed when we all would think with our heart and feel with our brain [2].

"The release of atomic power has changed everything except our way of thinking", said Einstein, "the solution to this problem lies in the heart of mankind. If only I had known, I should have become a watchmaker" (1945). Einstein had taken a serious note of inadequate development of the affective brain in science education.

There is a popular analogy of heart-brain relationship in patient management system. "Doctors are the brain of the hospital, nurses are the heart. If brain fails, heart will manage, but if heart fails,

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nothing will manage” [3].

Certain stream of scientists [4] seeks explanation for such activity of the heart from the concentration of ganglionic nerve cells and nerve plexus within the heart. Ganglion is a collection of nerve cells outside the nervous system. There are 100 billion neurons in the brain. There are 100 million neurons in the gut, which is called the second brain! There is also a mini “brain” within the heart called, “heart-brain”, a collection of 40,000 neurons that is claimed to have the power to sense, feel, learn and remember. According to them, the ‘heart brain’ sends messages to the ‘head brain’ about how the body feels and more [5]. Unknowingly, the scientists get trapped in favor of the argument of neuro-centric consciousness, missing the point that consciousness is omnipresent and instead of becoming neuro-centric or cardio-centric, we require to be consciousness-centric for achieving the state of heart-brain entrainment and enactment!

Our thesis is that the source of consciousness is neither the brain of hundred billion neurons, nor the heart consisting of millions of cardiomyocytes! It is consciousness, which uses this brain and the heart for its manifestation. There are reasons for neuron-philia of consciousness and consciousness-philia of neurons [6] because neurons in the pathway of cellular specialization have achieved a reasonable degree of perfection to deal with consciousness. But does the cardiac myocyte have such proficiency or potential? Perhaps yes. Besides Ayurveda, and many other religious schools of thought, there exist a large number of consciousness scientists who believe heart is the seat of consciousness in terms of hope, deep feelings, episodic memory, decision-making behavior and socialization. This paper is to examine the scientific basis of such school of thought of cardio-centric consciousness. Finally, the authors take a position beyond both neuro-centric and cardio-centric consciousness and propose the mechanism of neurocardiac entrainment and enactment in the phase of nature between the ground state of matter and the ground state of consciousness.

Embryology of Three Neuron-Rich Organs

With folding of the embryonic plate, the endodermal celomic cavity is divided into three; that included in cranial fold becomes foregut, that included in caudal fold becomes hind gut and the joining one is destined to become mid gut. A mere 16 days after conception, ectoderm differentiates into neuroectoderm by signals from underlying mesodermal notochord and forms neural plate, a strip of neural stem cells, the foundation structure for the brain and spinal cord. The plate grows longer and folds onto itself, until that fold morphs into a groove, and that groove turns into a tube, called neural tube by 4th week. Neuronal differentiation, migration, organization take time although it begins by the end of 4th week or the beginning of 5th week.

Cardiac tube develops within the mesoderm of the folded embryonic plate and the heart starts beating on usually twenty second day of conception, verifiable by ultrasound examination by 5th week. This happens long before neural supervening on the heart takes place! Therefore, the embryonic sequence of organ independence is Gut, Heart and Head (brain), arising respectively from endoderm, mesoderm and neuroectoderm of the embryo. All three organs are neuron-rich and consume disproportionately higher percentage of cardiac output with respect to their mass. The gut-feeling, heart-feelings and brain’s rational thinking contribute in decision-making and leadership.

Like the Brain the Heart Works Mostly at Subconscious Level

In course of evolution, the heart as an organ and the cardiovascular circulation as a system in systems biology have achieved a desirable degree of perfection so that autonomy has been granted to the organ and the system, which generally works at the subconscious level of cognitive activity of the brain. We become conscious of our heart, its rhythm only when the heart adapts physiologically to meet the need of increased output, or something goes wrong in the functioning of the organ or the system, or we wish, rather ‘will’ (a function of consciousness) to be conscious of so!

When a love-bird misses his/her heartbeat in presence of the beloved, it is often said that the subconscious stupid heart which has been foolishly working without any rest since its embryological inception, now with a touch of love-consciousness has become conscious of its stupidity and pauses to rest at least for a beat or so!

Anatomical Similarities and Differences between the Brain and Heart

Heart constitutes only about 0.3% of body weight but consumes about 4% to 5% of cardiac output. Similarly, the brain constitutes about 2% of body weight but consumes about 20% of cardiac output. Both are ever-‘hungry’ but workhorses in their respective domain. However, at least a part of the brain sleeps regularly and rejuvenates itself. No evidence is available that the heart ever sleeps. Brain has lymphatics (periarterial and perivenular lymphatics), whose function to carry away ‘toxic’ products from the brain is enhanced during sleep, according to Plog and Nedergaard [7]. The heart too has lymphatics which have been relatively less studied. Heart, like brain, is also an endocrine organ [8]. Besides atrial natriuretic peptide family of hormones and other polypeptides such as proadrenomedullin, N-terminal peptide and endothelin-1, oxytocin (popularly called ‘bonding’ hormone) and catecholamines are also secreted by cells in the heart. Both brain and heart have their stem cell reserves and during dire necessity, use this reserve to regenerate!

Brain, heart and striated muscles are often kept on a spectrum with a say that the heart is neither a striated muscle nor brain but has many features, certainly not all, common to both!

Both brain and heart have pace-makers. The brainstem of brain has pacemaker neurons in its cardiac center, respiratory center, and vasomotor center. The heart also has specialized cells in SA Node, AV Node and the Bundle of His with pacemaking ability!

Morphologically, the brain is a networked organ of neurons while the heart is a large syncytium of cardiac myocytes. Therefore, both the organs constitute a community of millions of cells embodying a collective consciousness of the community. Heart, in addition, has about 40,000 ganglionic neurons and their plexus, which should be recognized as an addition to the armamentarium of cardiomyocytes favoring its consciousness-philic nature.

Is there any synapse between cardiac neuron and cardiac muscle? Not in the sense as we understand synapse in the nervous system. The interface between neurons and cardiomyocytes is, however, special because of the existence of a specific ‘neuro-cardiac junction’, where sympathetic neurotransmission occurs in a ‘quasi-synaptic’ way [9]. We know from the existing literature that for learning and memory an organ requires synaptic plasticity. Does cardiac nerve innervation

and synapse show plasticity? Perhaps yes! Evidence has started accumulating in favor of such plasticity [10].

Electrophysiological Similarities and Differences between the Brain and Heart

Both brain and heart have electromagnetic waves measured as Electroencephalogram (EEG) and Electrocardiogram (ECG), respectively. Have we ever tried to correlate the two ‘-grams’ in different clinical conditions in cardiology or neurology? No, not seriously! In addition, we have now become familiar with magneto-encephalographic recording of the brain, but we are yet to explore the magnetic mapping of the activities of the heart! As a step forward the recent studies of brain-heart interaction with fMRI have thrown a multitude of challenges and opportunities [11].

It has been observed that “Compared to the electromagnetic field produced by the brain, the electrical component of the heart’s field, which permeates every cell in the body, is about 60 times greater in amplitude while the magnetic component is approximately 5000 times stronger than the brain’s magnetic field and can be detected several feet away from the body with sensitive magnetometers” [12].

If heart is considered a signal fluctuation centre, then there is a “heart” inside the brain, observed as an orchestra of signal fluctuations and neural oscillations in the cerebral cortex that remains in the synchronized state with the heart rhythm. Examination of heartbeats as a reference point for synthesizing personal cognition in the context of visual perceptions by Park et al. [13] offers some support to this view, as also the publication of Chester Drum [14].

Enacted Brain and Heart

The heart-brain Inter-communication occurs in four major ways: through rhythmic hemodynamic pressure pulse; rapid communication through the transmission of nerve impulses; relatively slower communication *via* hormones and neurotransmitters for mutual adaptation and adjustment; and, finally biophysically through electromagnetic field interactions, which attempt to entrain their communication not only to each other but perhaps to environment and nature as well. The crucial question remains whether the heart has independent cardio-centric consciousness activity like the collection of neurons in the brain and what is the underlying mechanism of neurocardiac entrainment and enactment?

“Heart Rate Variability (HRV), the change in the time intervals between adjacent heartbeats, is an emergent property of interdependent regulatory systems that operate on different time scales to adapt to challenges and achieve optimal performance.” “The neural communication pathways interacting between the heart and the brain are responsible for the generation of HRV” [15,16]. Heart rate variability with different facial expressions has been reported [17]. Embodiment of feelings has corresponding variability of heart rhythm [18].

From brain-heart interaction we get window to the conscious state in many non-communicating patients [19]. Evidence has started accumulating that ‘HRV entropy’ can discriminate disorders in conscious states [20]!

Examining the Contributions of Cardio-Centric Consciousness in Behavior

Consciousness cognition and behavior are properties of any biological cell. So, what is the big deal about cardiac consciousness?

It shall be a big deal if cardiac consciousness covertly or overtly contributes to overall consciousness of the being!

Textbook functions of consciousness are three; cognition, emotions/feelings and volition/will. Besides these three, memory is a consequence of cognition. The process of learning is to retain and organize the experience. Attitude is the holistic immanence of consciousness in the personality of the individual. Decision-making ability and the leadership quality are influenced by deep feelings and episodic memory. Let us discuss these functions of consciousness in the context of heart, one by one.

Cognition

Unlike the brain, the heart cannot think! Cardiac neurons are mostly autonomic neurons. Neurons alone do not equal mind or consciousness. It requires the specialized organization of neurons as is present in the brain. The presence of astrocytes along with tripartite synapses in the brain enables the cognitive processes and is responsible for mind-like function. However, neither astrocyte-like cells, nor any tripartite synapses exist in the heart.

In spite of the above, the heart does have a very limited cognitive capacity. Cognition is the operation of acquisition of knowledge, of which sensing and learning clearly form a part. Synaptic plasticity, which is essential for offering structuration of learnt material as memory, and is abundant in the brain, has also been demonstrated in the heart, although to a limited extent [10]. Hence, owing to its presence, it can be inferred that heart does have cognitive capacity, albeit very limited.

Feelings/Emotion

When consciousness is recognized only by feelings, then common sense and the popular belief system dictates that the heart is the seat of feelings! At many occasions, this seems to be right and the mainstream science appears wrong! Of the emotion and the emotion-related feelings, which one is the initiator, and which one is a response to the other is an unsettled debate. Neurologists assert that neurophysiological emotional response generates feelings. Common sense says, feelings are generated first and emotional response originates from those feelings. When science and common sense contradict each other, it mandates an impartial probe to gather objective evidence. Otherwise, this may be considered as a scientific belief system or a popular belief system, neither of which is supported by any concrete evidence! Whether the part of the brain, the limbic brain with circuit of Papez, involved in emotional response, instantaneously enact heart for generation of feelings or the feelings in heart instantaneously enact the brain for generation of emotion is really an area which merits investigation. An attempt to explore and reveal the secret language of heart has been made by cardiologists [21]. However, even if the heart senses and “feels” or the feelings are instantaneously transferred to heart from brain’s emotional reaction, the heart is seriously handicapped in the linguistic area of expression and hence those feelings are not expressed in a language that we understand! The heart might have its own language!

Volition/Will

On this front, the heart is severely challenged and compromised. The heart has no language to express its volition/will, except by changing its rate, rhythm or synchrony. However, with its involvement in deep feelings and episodic memory, the heart might massively influence the neurological volition, generation of will and the decision-making ability of the person.

Memory

Memory is a content of consciousness. Dementia patients present with memory loss, "I do not remember"! There is a possibility that the heart independently can acquire vacuum memory, which is holographic! Because of robust brain-heart communications [15,16,19,20], there remains a possibility that some memories formed in the brain, especially episodic memory, existential memory and memory of intuitive perception are passed on to, and stored in the heart. This has been suggested by reports of some patients undergoing cardiac transplantation [22-24], who following transplantation developed psychological disorders and following psychoanalysis, the source of such memory could be traced to the donor. Since nothing else except the organ heart was transplanted, it was presumed that donor's heart is the source of such new memory. Counter arguments for such transfer of memory include unconventional route, i.e., a kind of out-of-body experience of the recipient during surgery or invoking vacuum memory while the heart is detached from the body systems!

Learning

The heart learns essentially in hemodynamic aspects, and recognizably too little in cognitive aspect in spite of having plasticity in neuro-cardiac quasi-synapses.

Attitude

The affective brain is responsible for attitudinal development of personality. Since feelings have a major influence in development of attitude and the heart has a dynamic involvement in sourcing and dissemination of feelings, heart contributes to the development of attitude. Attitude reflects non-observable conscience enacted on observable behavioral rules with concurrence of logical rigor of ethics and the beauty of aesthetic. Attitude emanates in the overall personality. The heart is expected to have a lot of say in conscience and aesthetics.

Personality

We still do not know how the heart is enacted in personality! Attitudinal contribution has been discussed above. Bunzel et al. [25] have studied 47 cardiac transplanted patients to find out the presence of any changes in the personality of the recipients and if the source of such change was the donor [25]. They found out that 6% of recipients reported a distinct change of personality due to their new hearts. Pearsall [26] found 2-5 parallels (per case) in personality traits between a donor and the respective successful recipient. They suggested the plausibility of role of cellular memory and systemic memory. Pre- and post-transplant neurophysiological studies have been done to trace the cause of such changes in personality following transplantation of heart [27]. There are two diseases with known personality disorder which owe their origin to both brain and heart. One is autism, in which repetitive behavior has its origin primarily in the brain, lack of socialization in the heart and communication defect both in the brain and the heart. The second is gender dysphoria, in which there is fluidity of the sense of subject's gender, which evokes motivation so strong and deep that the subject wills to be operated to change his/her gender. The situation perhaps has more to do with heart feelings than to do with logic.

Decision-making ability and leadership quality

Decision-making process is not simple and straight. It is neither fully democratic, nor completely autocratic. It is hierarchically layered and often picks up a labyrinthine course. A robust environmental sensor is a must for making correct decision. As a consortium of

cardiomyocytes, the heart is an environmental sensor, sensor of vacuum, sub-vacuum and consciousness. In addition, the heart retains experiential memory. Possibly, most feelings have their place in the heart. Though scientifically not validated yet, the heart is said to be the seat of compassion and love. All such factors point towards active participation of the heart in individual's decision-making and leadership.

The leader can lead from different fronts:

1. Leading with head (brain) (e.g. scientific movement)
2. Leading from heart (e.g. bhakti movement)
3. Leading from both (e.g. servant leadership)
4. Leading from Gut feelings (decisive leader)
5. Leading with Brain, Heart and Guts

The most desired kind of lead is to lead simultaneously with head (rational), heart (emotional) and guts (decisiveness) [28,29]. The authors call this embryonic three-derm leadership, which casts lasting impressions on the followers, and in addition encourages them to lead too in a similar way (inverted leadership). There is a perpetual question; is leadership determined by weight or substance of the systems? Heart weighs 250 gm to 350 gm. The brain weighs 1300 gm to 1400 gm. Substantially two organs are different altogether. Probably, the contribution from the neuron-rich gut, the gut feelings, balances the weight and substances of the two important organs, the brain and the heart. This three-derm leadership has also far-reaching implications in talent management.

Summary

Because of syncytial aggregation and combination of cardiomyocytes with a significant number of neurons the heart could be a better 'sensor' of environment and nature than the brain. However, the heart is seriously handicapped in thinking. There is no explicit language of heart to express its feelings and will, except by bringing a change in its rhythm or synchrony.

Back to the Basics: Making the Case for Cardio-Centric Consciousness

Every living cell has variable capability of sensing its environment, i.e. nature at its different depths; vacuum, sub-vacuum and consciousness. The depth is objectively indicated by the presence of different information states such as signal, non-digitized information, non-factorizable information etc. Every living cell is thus a "sensor" to operate as a system of entropy-stabilizer, uncertainty-stabilizer and dark energy-visible energy stabilizer. Since vacuum's memory is holographic, any cell, which is in sync with vacuum, exhibits holographic memory!

Such properties of cell as sensor of vacuum and possessing holographic memory are compromised when cells come together to form tissue, organ and systems. Exceptions are found in two situations, the two organs - heart and the brain. Interestingly, both organs have compartmentalization structurally and functionally in both horizontal and vertical directions; in heart atrium and ventricle vertically, and horizontally into left and right heart for oxygenated and deoxygenated blood, respectively; while for the brain there are brainstem, limbic brain and cortical brain vertically, and left hemisphere and right hemisphere horizontally. This kind of vertical and horizontal compartmentalization of a live organ is an indication

Table 1: Comparing Brain's and Heart's access to deeper recess of nature; vacuum, sub-vacuum and consciousness.

Heart's access to deeper recess of nature; vacuum sub-vacuum and Consciousness	Brain's access to deeper recess of nature; vacuum sub-vacuum and Consciousness
Heart is a cellular syncytium of millions of cardiac myocytes. In addition, the heart has 40,000 neurons. Therefore, access is mightier in spite of less wt. (wt: 250 gm to 350 gm)	Brain is a networked organ of 10^{11} neurons and 2-10 times of glial cells. Therefore, access is comparatively constrained. (wt: 1300 gm to 1400 gm)
More access to non-digitized and non-factorizable information rather than digitized information	More access to digitized information rather than non-digitized and non-factorizable information
Because of comparatively more access to depth, entropy stabilizing capacity is comparatively more	Because of comparatively less access to depth, entropy stabilizing capacity is comparatively less
Memory storage and retrieval are largely holographic	Memory storage and retrieval are less holographic
Behavioral expression is mostly non-verbal, rich in feelings and emotion	Behavioral expression is more verbal, rational and logical
Leading by Heart (substance) and Leading by Head (mass) are brought to balance when one leads with Guts	

that it can sense varying depth and width of nature. The ability is limited of course, because both the organs operate within the premise of larger systems.

We have pointed out a major difference in aggregation of cells in heart as compared to brain. In the brain, the cells are connected by network. Brain is a networked organ of hundred billion neurons. In the heart, millions of cardiac myocytes form an unusually large syncytium. This is an advantage as it is easier for the heart to function as a whole. The brain usually functions in modules and rarely, the whole brain works in coherence. The latter situation demands for several integrations at different levels.

Being a syncytium and having 40,000 neurons in addition, could explain why the heart could perform as a better sensor of vacuum, sub-vacuum and consciousness than the brain and why the heart appears more close to the fabrics of the universe, constituted by the invisible dark matter web. A recent study [30] found the 'dark matter web connect' between the galaxies and the tiny unicellular brainless organisms, the slime moulds. The study found patterns in its slime similar to disposition of galaxies (10^{11} in number) in this universe.

This kind of cellular arrangement in the heart could also be the reason why the heart senses non-digitized and non-factorizable information better than the brain! That might also be the reason why the heart's memory is more holographic than that of brain! The digitized information requires cellular networking and synapses. Handling of non-digitized information and non-factorizable information requires syncytium of cells. The enhanced sensing capability of the heart and probably more connectivity with dark matter-web could perhaps be responsible for the emergence of the 'quality' to feel! The binding problem and the issue of qualia in neuroscience might find an instantaneous solution in the property of syncytial cardiomyocytes working with holographic memory and their ability to sense quality!

The readers are referred to a table (Table 1) which has been modified a bit from the one published earlier in one of the author's papers [6] for comparison and contrast of the two organ's access to deeper recess of nature.

The cellular architectural basis of why the brain could be a thinking organ, and not heart, has been explained. The brain's synapses are tripartite; there is involvement of astrocyte in each synapse. Neuro-neuronal junction without astrocyte merely transmits signal and is not necessarily meant for handling of information, its transmission or generation. Cerebral cortex is, therefore, called "Thinking Brain". Thinking is an operation that also requires quality management. Astrocytes seem indispensable in quality control of thinking. The sub-organ of brain which is richest in astrocytes is the cerebellum. A

recent paper elaborates that "about 80% of cerebellum is engaged in this smart stuff", i.e. quality control of thought process [31].

The property of consciousness-*philia* of cardiomyocyte, and cardiomyocyte-*philia* of consciousness merit investigation at molecular level of membrane ion channels as well as at the level of genes. Like neurons, the microtubular system of cardiomyocytes is relatively stable. Microtubular system works as the information highway for fast communication of information through important cell organelles such as cell membrane, nucleus, mitochondria, lysosome and endoplasmic reticulum.

While investigating cardio-centric consciousness, all such basic factors namely syncytium vs. networked, polarity of membranes, serenity of genes of cardiac myocyte, digitized and non-digitized information, their sensing and processing are to be taken into account and properly examined for reaching into a generalizable conclusion.

Why Brain's and Heart's Energy Consumption is so High?

The total skeletal muscle mass of our body (30% to 50% of body weight) consumes about 20% of cardiac output at rest, that rises up to 80% during exercise. In contrast, recall that heart contributes about 0.3% of body weight but consumes about 4% to 5% of total cardiac output. The brain constitutes about 2% of body weight and consumes about 20% of cardiac output. As compared to any other workhorse organ in the body, consumption of energy is disproportionately high in both the organs! Why? Could it be explained in heart by physical pumping only and in brain only by signal transmission and processing?

True, heart cannot be compared to skeletal muscle, which as a whole does not work! True, various ion pumps in heart and especially in brain consume more ATPs during signal handling! And, still the explanation does not seem very convincing and wholesome! Kidney, constituting about 0.5% of body weight, has large number of ion pumps and is perfused with about 20% cardiac output. This perfusion is meant for filtration and not for its energy consumption! Therefore, kidney never seems to be comparable in this context. The splanchnic bed constitutes 2% of body weight but consumes about 25% cardiac outputs. This is also too much!

All the three neuron-rich organs, Brain (Head), Heart and Gut, which determine overall attitude in the personality and the pattern of leadership, have significantly more energy consumption as compared to any other organs! Why? The issue merits research and investigation.

Our hypothesis is that high energy consumption by these three organs has some connection with conversion of visible energy into invisible dark energy for uncertainty management and life's

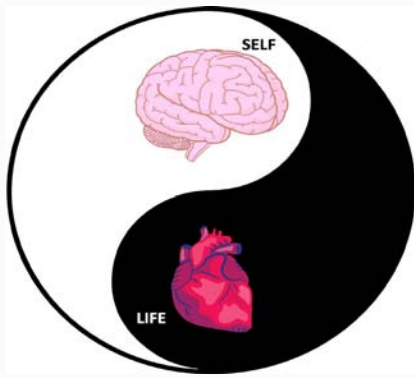


Figure 1: Neuro-centric and cardio-centric consciousness could be represented by Yang (masculine) and Yin (feminine) relationship. In the consciousness paradigm such tangled hierarchical relationship is observed between self and life.

symmetry-management. This property can be seen in any free living single celled organism. However, we propose that this property has been retained in these three organs. In the ladder of cognition, when any signal is read as information, visible energy is converted into an invisible dark energy. When information develops into experience there is more such conversion [32].

Seeking Evidence from Science in Favor of Cardiac Consciousness

Could the hybrid discipline like Neurocardiology or Cardioneurology offer the answer for cardiac consciousness and neurocardiac entrainment and enactment?

At present, the field of neurocardiology has been divided clinically into three spatial areas: i) the brain’s effects on the heart such as Takotsubo cardiomyopathy, which is named after Japanese octopus-trapping pot that the heart comes to resemble; ii) neurocardiac syndromes where both heart and brain are affected such as Friedreich ataxia; and iii) the heart’s effects on the brain, such as the embolic stroke originating from heart [33,34]. There is an interesting recent

publication on brain-heart connection in Takotsubo syndrome [35].

The first International symposium on Neurocardiology was held in 2009 by Serbian Neurocardiological Society, Belgrade and was followed by another one in 2010. The organizer should be acknowledged for their step in the desired direction. The International Conference on Heart and Brain (ICHB) held in Paris in March, 2012 deliberated on the issue which appeared too superficial to explore this field, as it simply aimed for the strokologists to teach the cardiologists about the brain and the cardiologists to teach neurologists how the heart is affecting the brain! Third ICHB was also held in Paris in 2016, which was followed by the Heart & Brain symposium in June, 2018 in Chicago. We are looking forward to the outcome of several such conferences scheduled in late 2020 and 2021. The clinician’s focus is on the diseased heart and brain. They usually open up windows and opportunities to learn more of the fundamentals of physiology from the pathological processes. The area of entrainment and enactment, however, seems far more complex to conceive, and this requires DeepScience. Without involvement of deep physics (hard science), no breakthrough is on the cards.

DeepScience for Heart Brain Entrainment and Enactment

Entrainment is when one system’s rhythm, frequency, oscillation synchronizes with that of another. On the other hand, “In the law of the United Kingdom, the term enactment may refer to the whole or part of a piece of legislation or to the whole or part of a legal instrument made under a piece of legislation”. The brain and the heart have independent rhythm, frequency and oscillations, which in many occasions may get entrained, and enacted occasionally (“Eureka moment” and “Galileo moment”) when both organs work under one piece of legislation.

The relationship between neuro-centric consciousness and cardio-centric consciousness could be represented by Yang-Yin picture. Yang (masculine) and Yin (feminine) make a tangled hierarchy where two, by name, are actually one where one accomplishes the other for a greater whole (Figure 1). In the paradigm of consciousness, ‘self’ and

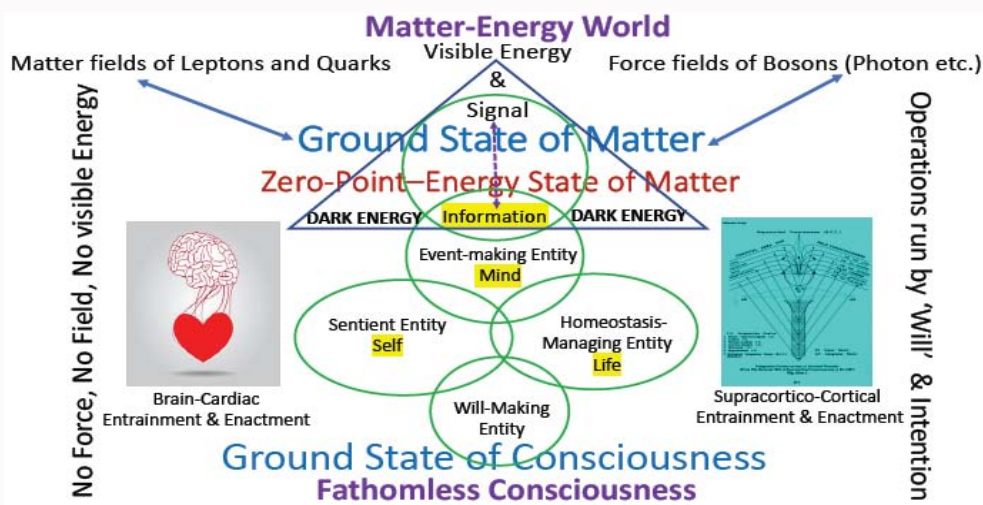


Figure 2: The proverbial ether has been replaced by presence of sub-quantum and sub-sub quantum nests of nature with four autonomous entities namely event-making entity, sentient entity, homeostasis-manging entity and will-making entity. They operate between the boundaries of ground state of matter-energy world (ZPE) and the ground state of consciousness. There is no force, no field, no visible energy to run the operations. Operations are run by intention and will generate from consciousness. There are dark energy and several information-states. The mechanism of two entrainments and enactments lies here; the heart and the brain, and supracortico-cortical brain. Entrainment and enactment have been happening in the domain of dark energy which is converted into visible energy across ZPE by operation of event-making entity, mind, during conversion of information into signal.

'life' maintain such a tangled relationship. Both of them are sourced from consciousness, which is beyond the masculine and feminine divide.

However, we will try to explain this entrainment and enactment diving beyond the cardio-centric and neuro-centric consciousness and beyond the domain of Yang and the Yin, from the level of Chi (*Chetna*, Consciousness).

A few such occasions where brain-heart entrainment and may be enactment occur are: During moments of intense feelings and emotions, at the time of recruitment of episodic holographic memory, at the moment of discovery, during emanation of overall attitude in personality, and while taking a complex decision. In all such occasions, there is instantaneous communication between the two systems at a distance that cannot be explained by their electromagnetic, neural or hormonal connection and never by hemodynamic continuity. For instantaneous communication, all four above pathways are too slow and energy-consuming. On the contrary, the four pathways adapt to the consequences of such instantaneous communication at distance.

In physics, this instantaneous communication at a distance is called nonlocality [36], which was also described as EPR (Einstein-Podolsky-Rosen) paradox. Such communication has been demonstrated between two meditation-synchronized brains [37]. Authors propose that similar phenomenon is replicated between the heart and the brain of an individual while performing certain functions. This is instantaneous two-way communication. Also, there remains a possibility that such communication happens between two or more individuals in the context of the brain as well as the heart.

What could be the media of such communication? Proverbial ether? No! Nothing like ether exists. There are vacuum, sub-vacuum and consciousness. To break this logjam we go into deeper recess of nature by extending the science vertically. We call it DeepScience [38], and dive into the pretemporal (vacuum) and pre-pre quantum (sub-vacuum) recess of nature and invoke the presence of consciousness at this fathomless depth. This depth is the domain of true nonlocality of pre-space, Pre-temporal nature. There are two all-pervading entities: Firstly nature's entropy-stabilizing, uncertainty-stabilizing and symmetry-stabilizing entity (i.e. homeostasis-managing 'life'), and at further depth another all-pervading intention - and "will"-making entity, i.e. ground consciousness. Both are omnipresent when one looks for those at this depth. In addition, there is one discrete entity within the systems, which works as chief executive officer for the system on behalf of consciousness. That is the sentient entity, the 'self'. With origin of such duality in consciousness, the organ which mediates communication between two conscious systems is always a 'mind'. Mind works as an event-making entity by converting information into form, a space time construct, as signal. The event is accompanied by the release of visible energy from invisible dark energy.

In fact, we are "seeing through" the ground state of matter, the Zero-Point-Energy (ZPE) state, where the matter fields of leptons and quarks, and force fields of bosons like photon and gluon are grounded. Our focus is on the ground state of consciousness at this depth as shown in Figure 2.

The area intervening between the ground state of matter, energy and the fields, and the ground state of fathomless consciousness is the playground of operation of autonomous cognitive faculty, namely consciousness, life, self and mind. There is no force, no field, and no

visible energy to run their operations. The area is stuffed with various information states, invisible (dark) energy, dark matter, some exotic matters and neutrinos!

The operations of the entities mentioned above are run by 'will' and intention originating from consciousness and mediated by different information-states. No specified algorithm or any mathematical equation is available here to describe their integral relationship. In this domain of nature there is fusion of ontology with epistemology, and phenomenology with axiology.

The event-making entity, the mind, connects this subquantum and sub-subquantum nests of nature across the ZPE to the matter-world. No other entity, life, self or even consciousness have any direct connection with the physical matter energy world. All of the three entities connect with the physical world through mind. Mind operates by converting information into signal and release of visible energy from dark energy.

Finally, the entrainment and enactment of brain and heart cannot take the final shape till the brain as a whole comes in synchrony with supracortical consciousness [39]. That is another story! When we go beyond the idea of neuro-centric and cardio-centric consciousness and let both brain and heart poise as consciousness-centric, then only entrainment and enactment of heart and brain can be explained.

Concluding Remarks and Perspectives

Phil Maguire, a computer scientist at Maynooth University in Ireland, is of the view that "breaking down cognitive process is so complex that it is not feasible". We think, the reason is messy human language! In this paper we have broken this domain-barrier into the sub-domains of vacuum, sub-vacuum and consciousness and made the language explicit. As a result, a new concept has been built up. The concept has been translated into formal logic of complex system with entities, hierarchy, operations, currency, flow and medium, upheld by fusion of ontology, epistemology, phenomenology and axiology [40].

In the process, we have shifted the worldview from the brain to heart to consciousness, from network organization to syncytial organization to tripartite relationship, from digitized information to non-digitized, non-factorizable information, along with togetherness of "life", "self" and consciousness; heart brain and systems cosmos; Yin Yang and *Chi*. This paper is a call for the humanity to become consciousness-centric.

Behavioral expression of pure unconditional consciousness is Love. Artificial Intelligence (AI) devices do not understand Love! Doesn't matter! The domain of application of AI is different. Let an emotionless AI scientists long for Love in their loveless tasks. Let a human being, who possesses the systems of both heart and brain, life and self, yin and yang, syncytium and network organizations do his/her own business with consciousness. The staunch molecular biologists might ask, does DNA have a "heart"? We would say, probably yes! The "heart" of DNA is in that spherical protein, histone, around which DNA's coils wrap [41,42]. DNA-Histone association is a remarkable achievement during molecular evolution. Love does not appear in turmoil state of mind! Love peeps through the windows of peace found in the gaps between the vortex points of turbulence. In the larger scale of the universe, this happens through ZPE. We have shown the possibilities of starting a new dialogue between systems physics and systems psychology across ZPE. This proposition has a great relevance in resolving the dichotomy between the brain and the

heart in individual, in science and in clinical medicine.

There are remarkable similarities between the complexities of social consciousness, human consciousness and cosmic consciousness in terms of layers and hierarchy of operators and operations, their currencies and the medium. In the context of social consciousness, economical consciousness and political consciousness, the dichotomy between the brain and the heart has been glaring at present as racial discrimination, discrimination against economically underprivileged and political opponents with the failure of existing regimes of Politics, Spirituality and Science to tame the loss of life. Every life is precious! Black and white is our distinction! Australian, Indian, European, American and Chinese etc. are geographical distinctions. Religions are conditioned distinctions. Economical standard is an artificially created distinction. Consciousness, although, is singular and One, the pluralism has been introduced by human mind, the event-making entity, the behavioral expression organ for which is the Brain.

Have we ever thought how a harmful information as an entity can die? A signal network could be destroyed. A programme in AI could be corrupted. DNA's information can be silenced or manipulated. What about non-digitized information within the psyche? The most dangerous "meme" (using Richard Dawkins' phrase) operating in presently observed phenomenology is the meme of hatred. While stressless life and Love might help to keep the blood pressure in check and might dissolve cholesterol, the morbid hatred initiates dystrophic calcification of the atherosclerotic coronary artery and may choke the heart. The non-digitized information-meme of hatred, which by means of its trifoliate structure binds the brain to self, mind and the external world in real 'life', is almost impossible to eradicate, probably till such time the mind dissolves, self transforms and the individuals are reborn across death with a new life, with a new heart! Some people, however, do not change! Therefore, in the rarest of rare occasions, there remains a provision of capital punishment in the court of Law. The harmful meme is destroyed with the death of the individual. The natural expression of such non-digitized information of hatred happens when it delivers space time and visible energy. This is what we observe as atrocities, tyranny and violence against which "good memes" manifest as protests. Information-based behavior is essentially an expression of non-digitized information creating space time and energy by the event-making cognitive faculty, the mind.

This dichotomy between the brain and the heart is supposed to be the principal cause of human sufferings especially when many of the prophets of science/religion/politics have been passing their own "free will" or tutored will as nature's/God's/nation's Will and, as a consequence corrupting the surface- (e.g., by creating fake news) and elemental information systems (e.g., by creating biological weapons). There is dearth of leaders who can lead to win this information war; leaders who do not pass their own free will or tutored will as Nation's will, Nature's will or God's will; leaders who lead with brain, heart and guts; leaders who can synchronize citizens' vibe with nature's vibe; leaders who could turn collective unconsciousness of the citizens into conscious state of confidence by using information holography; leaders who encourage their followers to lead in a similar way (inverted leadership). This kind of new leadership will not fall from the sky. They would emerge from the present species. If not, destruction remains the destiny. Psychologists know it better that people do not change when given option. They change when there is no option! Change covering several layers takes Time, often several generations covering a century or two. Meanwhile, we can spread

the non-digitized information-memes of Love, Trust and Hope, for which the heart has been suggested to be a sensor.

Those who are working on individual capacity or as an organization, or as a scientific institution to correct this fault line of brain-heart dichotomy are doing a great service to the humanity and the world as a whole.

Dementia, anxiety, depression, split-self, personality disorders are pandemic today along with economic peril and environmental disaster. Having experienced the COVID-19 phenomenon especially over last few months across the Nation's boundaries, the focus on this issue has sharpened. Human consciousness has become more relevant and important today.

Consciousness itself is most economical. It does not occupy any of our Space. In spite, it is as spacious as The Multiversity, or even larger! Consciousness does not waste a single moment of our Time. Yet, consciousness is the Emperor of timeless Eternity. Consciousness has a nature, which prefers to solve a large number of problems in one go! It is said to be parsimonious. Consciousness's operations are most economical too. It operates at the level of wisdom-economy [43], the true source of experience-economy and knowledge-economy. Consciousness itself is disarming. The currency of its mechanics is not Force, Energy or Fields. Consciousness operates with intention and will. Therefore, those who are seriously engaged in consciousness study are, by nature, moral and conscientious and do not try to "weaponize" consciousness with destructive information for misuse.

At the end of the day, the brain, heart, guts, DNAs, histone and proteins all count for human consciousness to manifest as behavior of the being. Consciousness retains the freedom what to use, when to use and how to use for a reason why to use. All play their respective role in emergence of *Homo spiritualis* from present *Homo sapiens* [44]. Entrainment and enactment of the brain and the heart through operational mechanics of consciousness is vital for the survival of the human race leading to this new speciation with growth of the memes of love, trust and hope, all are supposed to be situated within the heart. The discipline of cardiology and neurology has to relook into their respective discipline from this point of view so that the hybrid discipline of NeuroCardiology or CardioNeurology could grow with the growth of DeepScience. This has an incredible fall-out in psychology, psychiatry, neurology, cardiology, social science, economics and politics of the emerging new worldview.

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