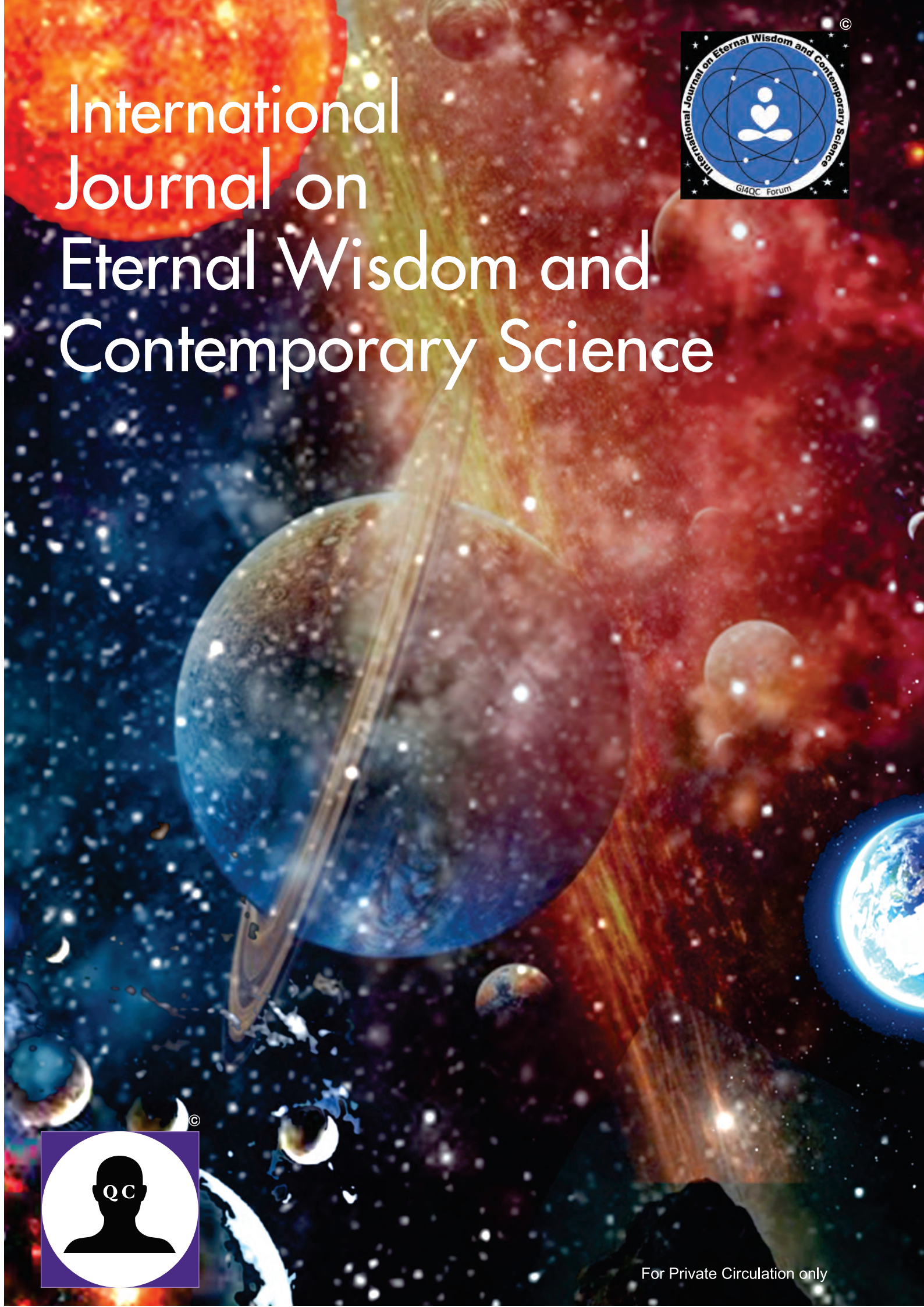
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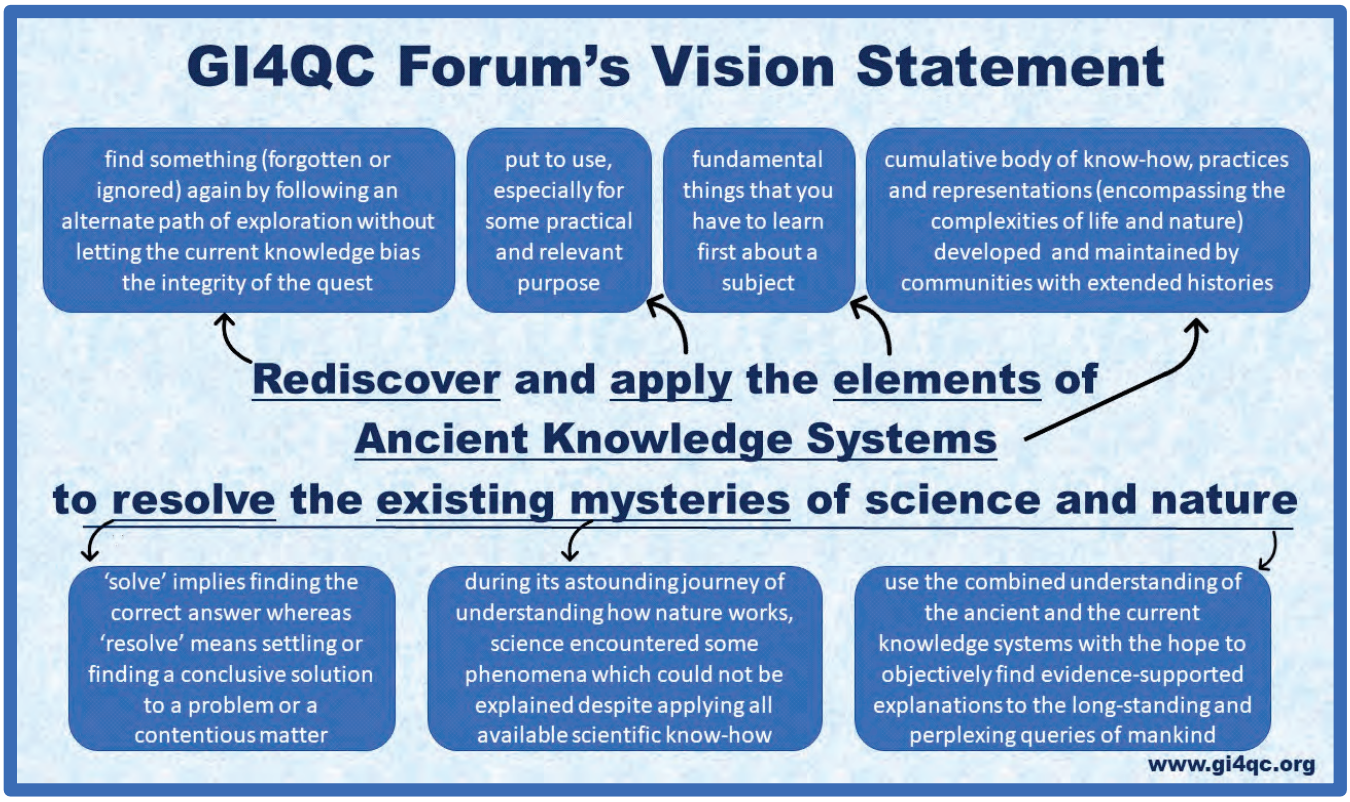

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Highlight and publish the credible evidence-based results of the research/study projects.

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Aims and Scope: GI4QC Forum is formed with a vision to "Rediscover and apply the elements of Ancient Knowledge Systems to resolve the existing mysteries of science and nature". The Forum hopes to use the combined understanding of the ancient and the current knowledge systems to objectively find evidence-supported explanations to the long-standing and perplexing queries of mankind, without letting the current knowledge bias the integrity of the quest.

This global platform of professionals is working towards generating innovative solutions that are practical and relevant for holistic development of the society. The Forum aims to disseminate the findings of the integrated approach of research through publication of papers and through organization of conferences, seminars, lectures, etc.

This Journal is an initiative to cater to the above-mentioned objectives. It is an online open-access peer-reviewed journal which will publish original research papers, review articles, case studies, and perspectives on various topics related to the integration of eternal wisdom and contemporary science from authors across the globe.

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International Journal on Eternal Wisdom and Contemporary Science
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Scientific Exploration of Foundations and Traditions in Yoga for Holistic Well-being

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FROM THE EDITOR'S DESK

Welcome to the inaugural issue of the International Journal on Eternal Wisdom and Contemporary Science (IJEWCS), a platform where timeless knowledge meets modern inquiry. This issue marks the beginning of a journey into the exploration of profound insights and innovative research that bridge the gap between ancient wisdom and contemporary scientific understanding.

In this first themed edition, we are proud to present six pioneering and absorbing papers into foundations in Yoga for holistic well-being that embody the journal's ethos. Each piece is a testament to the dedication, research and deep thoughtfulness of its authors, offering fresh perspectives and contributing to the ongoing dialogue between past and present and laying the groundwork for the conversations that will shape the future of our society.

As we present these articles, we would like to draw your attention to two interesting papers - 'Human Consciousness' and 'Artificial Intelligence'. While, on the surface, they might appear to be unrelated to Yoga, both of them address a very profound question. They explore the fundamental nature of Consciousness, as unless we understand and appreciate Consciousness, we cannot reap all the benefits that Yoga has to offer for a holistic well-being. We invite our readers to reflect on the interconnectedness of all knowledge and the value of considering diverse perspectives.

1. Pareekshit Dahal and Kaudinya Arpan - Inquiring into the Foundations of Yoga by Exploring the Subconscious Mind and Placebo Effect.
2. Manish Pajan, Dr. Anish Rakheja and Switi Gupta - Human Consciousness - An Emergent Property of the Brain or A Fundamental Property of the Universe?
3. Uday Karanjkar - The Scientific View of Yogaśāstra in the Bhagavad Gītā.
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5. Dr. Satish Kumar Pathak and Prof. P. Chaturani - Effect of Yoga on Hemorheological Parameters of Blood and their Connection with Health.
6. Dr. Subhash Kak - Artificial Intelligence (AI), Consciousness and the Self. (article reproduced with permission from the author)

As we embark on this journey, we welcome our readers to engage with the ideas presented within these pages. We encourage scholars, practitioners, and students alike to contribute to the ongoing discourse that will define the future of synthesis of science and spirituality. May this journal serve as a beacon of enlightenment, inspiring curiosity and fostering a deeper understanding of the world around us.

We extend our heartfelt gratitude to our contributors, reviewers, guest editors of this issue and readers who have made this inaugural issue possible. Your support and participation are the foundation upon which IJEWCS will build its legacy. Join us in celebrating the pursuit of knowledge and the shared passion that drives us all and propels this journal forward. Enjoy the read!

Ajit Kumar Verma,
Editor-in-Chief

(editor_in_chief@gi4qc.org)

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Inquiring into the Foundations of Yoga by Exploring the Subconscious Mind and Placebo Effect

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Abstract:

The ancient as well as contemporary yogis of India are believed to have achieved mastery over their mind and body. Through the practice of yoga, they create a certain psychological environment within the mind-body system which provides them access to the functions of the autonomic systems of the body. Many people have reported that in addition to having control of their somatic function (which comes under the radar of the conscious intelligence of the mind), yogis could expand their consciousness into the areas which, as per modern academic understanding, still lie in the subconscious zone. Just by living in their specific environment, some of them can sustain themselves without food, some can resist extremely painful stimuli, and some can live a long life without disease. Understanding and applying these methods can bring a significant amount of change in the type of medicine we practice today. Comprehending the biological mechanism behind this can be helpful in creating a holistic healthcare system for the public. But while modern medicine is evidence-based, the art of yoga is not. In this paper, we have reviewed biological environments based on modern medical sciences suitable for understanding subconscious systems in the context of placebo analgesia in the human body.

Keywords: autonomic systems, placebo analgesia, subconscious mind, *samyama*, *siddhi*

INTRODUCTION

Yoga, the word which in today's world means a set of postures having an Indian origin and providing some benefits to health, has rather a deeper and perhaps a simpler meaning. Yoga means, both literally and practically, 'union'. Broadly, it may mean a lot of things. Union of

mind and body, union of the mind-body with the environment, union of conscious mind with the subconscious mind, union of our intelligence with the cosmic intelligence, union of ancient medicine with modern medicine, and so on.

One of the most prominent works on this subject is Patanjali's Yoga Sutra. It not only discusses the components of 'Aśṭānga Yoga' (an eight-limbed path towards achieving the state of yoga) but also the composition of human personality. The Sutras mention that every individual has a unique personality which is the basis of their identity. This personality is the result of the interplay of a large variety of 'vritti' (variations) which occur in random compositions to uniquely individualize a person's identity. And based on this, there exists a unique psychology of every individual which, in turn, leads to their unique perception of the world.

The Sutras also mention that deep within, at the very fundamental level of consciousness, we are all same. It also guides us in various ways to swim through the barriers of the 'vritti' (variations) to achieve a union with our fundamental consciousness which allows us to have a full control over our mind and body including our health and disease states.

«The development of *Homo sapiens* as a species is considered the pinnacle of evolution because no other species have ever had such dominance over the resources of our planet be it biotic or abiotic (Sherwood et al. 2008). While the human body has transformed significantly during evolution, the key differentiator of the human species is the transformation of the brain. The way humans can think and execute motor functions with high accuracy and flexibility has by far been the most distinguishing feature that makes humans unique and different from other animals.» Reflection is the unique ability of human beings and it requires the mind. As per the current scientific research, most of the mind lies in the subconscious area in all species (Knox, 2003).

Let us try to understand the concept of reflection further using the example of "experiencing a galaxy". «The light falling from a distant galaxy reaches the eyes and neurons process that information and make an individual 'see' the galaxy. However, each individual experiences the galaxy in a different way, ranging from exclamation and curiosity to minimal reaction. This emotional response is related to the psychology of the individual which, in turn, is related to the subconscious mind. Science tries to explain this using the concept of chemical response in our brain. Our subconscious system creates some chemicals which generate corresponding thoughts and emotions.» These thoughts and emotions are the 'reflections' of the individual. The way our brain processes the reflections is itself a multidisciplinary idea. Appreciating the processes requires an understanding of natural sciences, biology, chemistry, philosophy, and many other branches of study. In this paper, we explore the mind (conscious as well as subconscious) and the mechanism of the placebo effect through biological sciences and psychology.

THE MIND

A study was carried out by Gopnik et al. (1992) which mentions different theories of mind. Here, the authors share an argument on why the child theory of mind (the understanding that people do not share the same thoughts and feelings as you do) could explain behavioural aspects of an individual. «In general, we find that every individual has their signature psychology, for example, some may like a mango fruit, some many like eating an orange, some may like the food as bitter as bitter gourd and some may not like to eat at all, some may like sports, some enjoy painting, some love to trek and with the same emotion some may like the universe.» The likes, dislikes, ideas, ways of living cannot be the same for every individual. All the behavioural aspects of an individual are based on cognition through the identified "self" (Knox, 2003). In a recent study it was noted that identity-oriented training could facilitate contact quality as a socioemotional outcome. It can reduce stereotype threats (Burmeister et al. 2021). In other words, this study also supports the idea that the behaviour of an individual is related to his identity. As previously discussed, Yoga Sutras also state that the personality of an individual is the result of the interplay of a large variety of 'vritti'. The commonalities between these two concepts demonstrate that the approach modern science takes towards studying human personality aligns closely with yogic principles.

«We have dissected the human body, cracked its code to very fundamental principles and understand almost completely the human anatomy and physiology. This knowledge has helped us identify various methods to cure numerous illnesses and a lot of research work is still in progress to explore the remaining unknowns. This progress can be attributed to our "intelligence". It is the result of intelligence that today we are not just discovering possibilities but also creating possibilities.

The term intelligence, as used in the above context, is a property which is related to the brain. To exercise intelligence our brain must be both active and awake. The awake state of the brain, or what we call wakefulness, is the result of the process called cerebral arousal. This happens because of the impulses sent by RAS (reticular activating system) to the cerebral cortex. In simple language, brain is like a battery that needs regular recharging. By the end of the day, it wears off and you must sleep to recharge it. So, we can define sleep as that state when your RAS is not active and your brain is not awake.

But even when our brain is not awake, it is active. It still keeps regulating various autonomic functions such as breathing, heartbeat, circulation, digestion, cell division, etc. (Maldonato, 2014). These autonomic activities do not have much to do with how awake our brain is. There is an altogether different phenomenon which is related to with these activities. We can call this phenomenon as the subconscious intelligence of our body. The autonomic activities happen in our subconscious mind which accounts for the majority of our mind. The instructions of how to process heart-beat, how to process the breath, how and when to activate hidden memories, are within the subconscious mind.»

Similarly, the feeling of pain is also controlled by the subconscious mind. Sometimes, a particular subconscious response is enough to provide relief from pain. This subconscious response can by triggered by a placebo and is called the placebo effect. The placebo effect is observed not just in pain relief but in other diseases too. However, we will focus specifically on pain relief while discussing placebo effect in this paper.

THE PLACEBO EFFECT

«Placebos are inert drugs that are not therapeutic, but when consumed, they may cause some symptomatic relief in certain individuals. They are biochemical compounds like normal saline, sugar etc., but, when they are administered into the body in the form of medicine, there is an actual response to them without the cognizance of our conscious-intelligence system. Placebos appear to trick our mind-body system into creating certain effects like pain relief, feeling refreshed etc.

Since a sugar pill cannot have any other impact on the body other than to increase the blood sugar level to a limited extent, it implies that certain endogenous mechanisms of the body itself are activated by this pseudo-drug. So, what placebo does is, works behind the cognizance of our conscious-intelligence system, bringing out certain changes in the body which, in turn, have the desired physiological effect.»

MECHANISM OF PLACEBO

«As per a study, placebo causes pain relief through an Endogenous Opioid Release Mechanism. This mechanism involves a process by which our body causes the release of endogenous opioids (Levine et al. 1978). Opioids are substances like morphine which are derived from the opium plant. And endogenous opioids are the opioids that are produced by the body. These endogenous opioids are endorphins and enkephalins.» Incidentally, we find mention of Soma (which is believed to provide disease-free life to an individual) in Rig Veda having characteristics similar to plants releasing opioids. (Kashyap, 2007).

Before discussing the relation of placebo drugs and subconscious mind in the context of benefits of yoga, we need to understand the mechanism by which placebos work.

«The midbrain has a central canal called the cerebral aqueduct for the circulation of the cerebrospinal fluid, which is important for the nourishment of the brain. The aqueduct is the part of the ventricular system of the brain and the CNS (central nervous system). Along its periphery, the aqueduct is surrounded by a variety of neurons (nerve cells) which form dark aggregations collectively called the peri-aqueductal gray (PAG). The neurons of PAG are

enkephalinergic, which means that on stimulation they release enkephalins (opioids). These enkephalins provide analgesia by exerting various inhibitory effects on the pain afferents (the nerve fibres that carry pain from the affected area to the higher centres in the CNS) (Vaz and Raj,2016).»

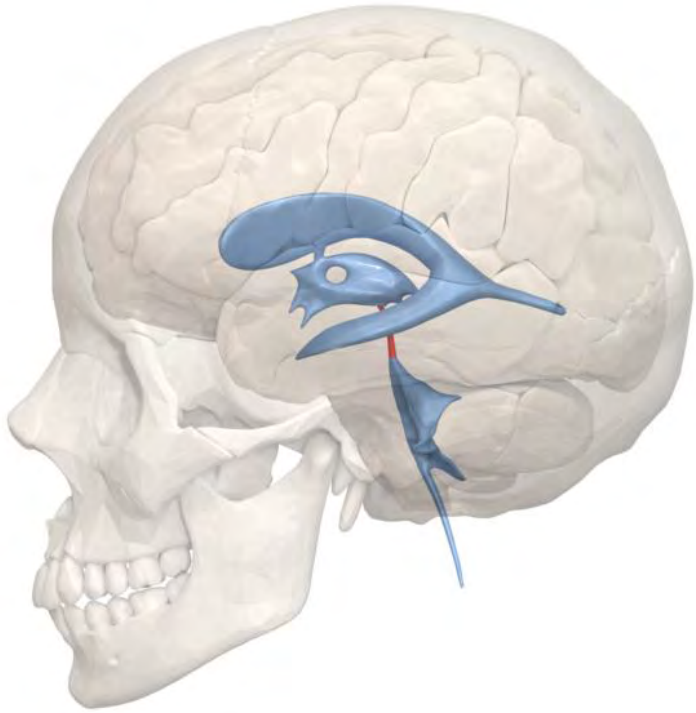


Figure 1: Cerebral Aqueduct (Source: Wikimedia Commons under fair use policy)

«Studies have shown that this pathway is activated in the analgesia initiated by the placebo drugs (Levine et al. 1978). But while this happens in all of the placebo-responders (placebo-responders are people who experience pain relief after receiving placebo), it doesn't happen in everyone. Theoretically, only one-third of the population are placebo-responders, and the rest are non-responders (Lasagna et al. 1954). Now the question arises why is this mechanism activated in only a fraction of the people? What makes them different? To discuss this we have to look into the dimension of psychology and behaviour which will further pave our way for appreciating the mind-body relationship.»

PSYCHO-PHYSIOLOGY OF PLACEBO-RESPONDERS

«The discussion on psychology of the placebo responders is required because placebo does not work in every individual. People who respond have some common characteristic psychology which seems to play an important role in producing the desired response to the pseudo-drugs.

Some studies suggest that placebos work in relatively elder people (>5 years from the non-responders), people who have strong religious faith and people who are more optimistic about the situations they are in (Cherniack, 2010). They complain less about the hospital care they receive, they were relatively happier and more cooperative; their opinions are frank and they are more emotionally expressive (Lasagna et al. 1954). Also, the responders were less formally educated than the non-responders, but they had, on average, similar IQ to that of the non-responders. The non-responders, were found to be of a more peculiar character, fussy, unsatisfied and with pessimistic mindset and they even talked and expressed less (Lasagna et al. 1954).»

The information provided by the aforementioned studies lead us to understand that, when given a placebo, a certain group of people having an overall positive mindset responded positively to placebo and reported acquiring analgesia. This group (the responders) consisted of people who were old, less educated, had faith and were optimistic.

But how can an overall positive mindset lead to the relief of deep pain, when the physiology of the body of every human is the same?

BIOLOGY AND PLACEBO RESPONSE

«When a placebo-responder takes a placebo pill, the mind is reminded about the memory of using a drug for this circumstance. Memories are present in the form of various neurons present in our cerebral-cortex in the region called the hippocampus and para-hippocampal regions of the limbic lobe. Mind associates a certain emotion to the memories you have about modern healthcare, drugs, faith, etc (Rolls, 2008). These memories can be due your personal experiences or due to experiences shared by others. If the emotions associated with these memories are optimistic, the corresponding neurons are fired and the associated region in the brain is activated. These emotional impulses are carried through a bundle of white fibres (nerve fibres in the CNS) called fornix, which forms a part of the Papez circuit.»

«The Papez circuit is a reverberating circuit responsible for the arousal of thoughts in your brain when emotional centres fire. The Papez circuit gives significant information to the cingulum. The cingulum is another centre to process emotions. But it has another important feature too. Some of the slow/deep-pain afferent fibres carrying visceral pain (pain from the viscera or organs) terminate here. So, at this level, there can be inhibition of pain to some extent (Levine et al. 1978)»

Also, some fibres of the Papez circuit (especially fornix) are reported to show termination in the peri-aqueductal gray (PAG) region of the mid-brain in rats (MacLean, 1955). While there are no experiments performed on human subjects to prove the existence of such branchings

from the fornix connecting to the peri-aqueductal gray region of the mid-brain, we can assume a similar connection in human CNS.

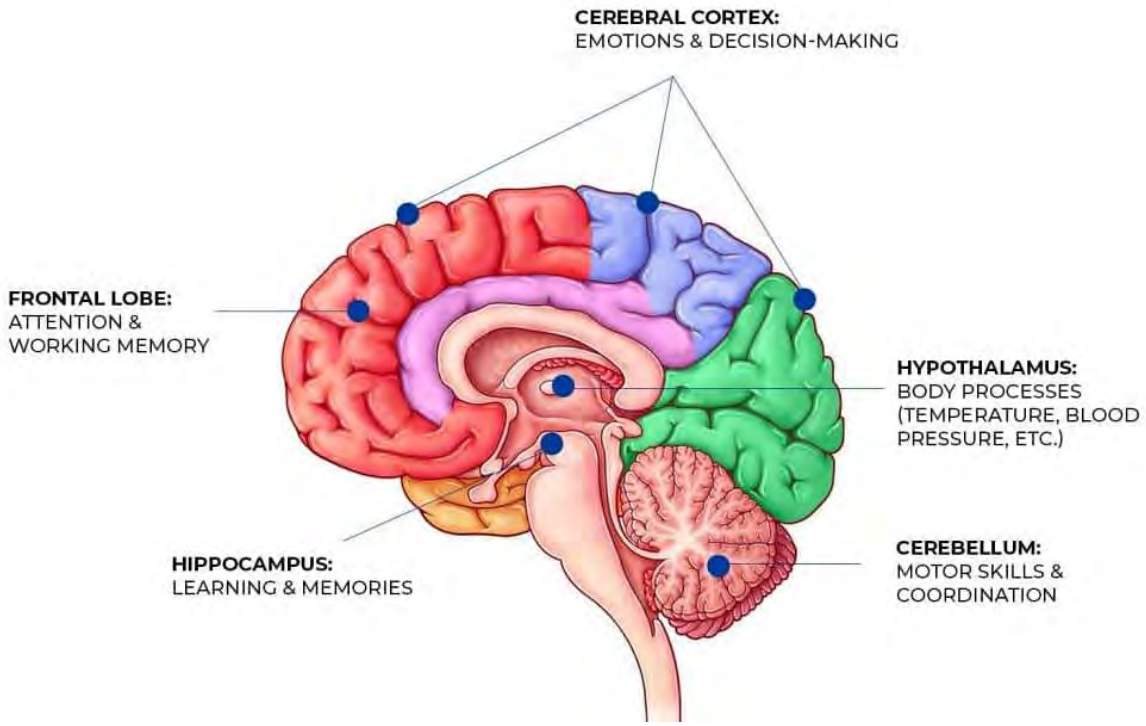
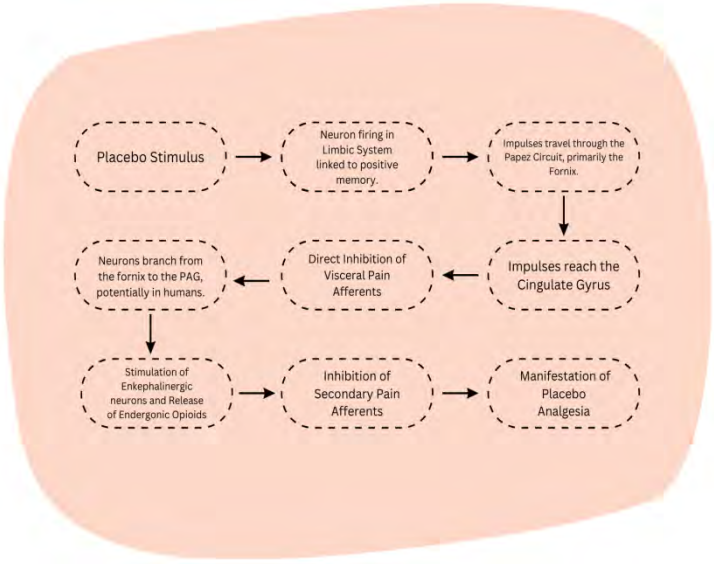


Figure 2: Parts of Human Brain and Psychological Response (Source: JourneyPure, journeypure.com/ask-our-doctors/)

«One of the important functions of this region (PAG) is that it produces endogenous opioid like enkephalin. Such endogenous opioids are known to inhibit the pain afferent signals at the level of secondary neurons of the antero-lateral pain pathway. Studies have found that when opioid inhibitors (naloxone) were given to the patients receiving a placebo, they showed no response to the placebo. So, the opioid system is the system causing placebo reliefs (Levine et al. 1978).»

However, in the biological system of human beings, the opioid release mechanism is not yet completely deciphered. The opioid system could be activated by some fibres which possibly connect the hippocampus to the PAG of the mid-brain through the Papez circuit. And the endogenous opioids released from there could cause the placebo response. If so, then the mechanism of placebo initiation can so far be mapped as:



«As shown above, placebo response is the feature of our subconscious mind. It bypasses our intelligence system (the neo-cortex) and acts through the pathways of emotional processing which activates the release of certain chemicals which, in turn, brings relief.»

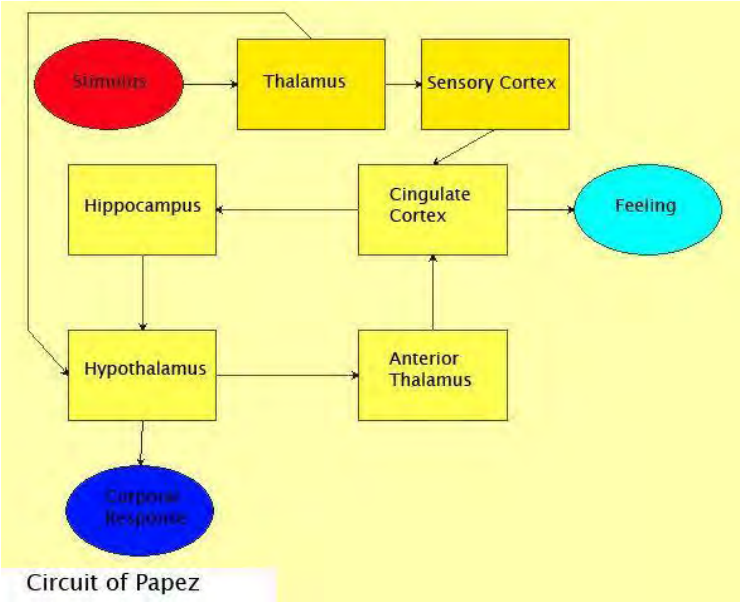


Figure 3: Papez Circuit (Source: Wikimedia Commons under fair use policy)

STIMULUS OF PLACEBO RESPONSE AND THE ROLE OF MIRROR NEURONS

Mirror neurons are defined by the property that they fire both during the execution as well as during the observation of a specific action. Rizzolatti et al. (2004) reported such types of

neurons in certain areas of the brain of macaque monkeys and found indirect evidence of neurons showing the same characteristics in certain homologous areas of the human brain.

There is direct evidence regarding the existence of mirror neurons in the brain of macaque monkeys. When the brain neurons of monkeys were recorded during tests involving action observation and execution tasks, certain areas in the frontal lobe (F4, F5 of monkey), inferior parietal lobule (area PF and PFG) and primary motor cortex fired during both observation and execution of the action (Rizzolatti et al. 2004).

Later on, by performing various brain imaging experiments, it was found that certain region of human brain showed similar properties of firing when action observation and execution was performed, although in variable ratio across different regions in the brain. Interestingly, these regions in human brains were homologous to those areas of the monkey brain where mirror neurons were found (Rizzolatti et al. 2004). This provided indirect evidence of the presence of mirror neurons or more accurately the presence of certain neurons which showed mirror activity in the human brain.

This is a significant discovery that can lead to better understanding of the human mind-body system.

IMPLICATIONS OF DISCOVERY OF MIRROR NEURONS IN HUMAN BRAIN

Mirror neurons, in simple words, are the neurons that act like a mirror, i.e, they reflect a particular action observed by an individual into his own motor repertoire. Depending upon the accuracy, they can be subclassified into strictly congruent and broadly congruent mirror neurons (Rizzolatti et al., 2004). We already know that mirror neurons have a chief role in the process of action imitation. But the same study has also reported that mirror neurons are not just involved in action imitation but also involved in understanding the action.

As mentioned earlier, the mirror neurons in monkeys were predominantly found in areas F4, F5 of the frontal lobe; areas PF, PFG of the parietal lobe and the STS (cortex of the superior temporal sulcus). Mirror neurons link these areas with the others and within themselves forming a fronto-parietal circuit that fires especially during action imitation. The PF receives the input from STS and transmits it to the F5 which is the pre-motor region in monkeys (Rizzolatti et al., 2004).

When we draw a correlation of the mirror neuron areas of monkeys with their homologues in humans, we find that area F4 represents the ventral premotor area (corresponding to Brodmann's Area-6), F5 lies in the posterior part of the pre-motor area (Brodmann's Area-44), STS includes Brodmann's area 22. The area PF is Brodmann's Area 40 and Area PFG corresponds to Brodmann's Area 39. Mukamel et al. (2010) reported that in addition to the

human brain areas corresponding to their monkey mirror area homologues, there were mirror neuron activities in the following areas of the medial side of the frontal and temporal cortices. These areas are entorhinal cortex, hippocampus, para-hippocampal gyrus and the supplementary motor area. Further, few minor impulses, which ultimately confirm mirror-like activities, were also recorded from the adjacent areas like anterior cingulate gyrus, amygdala and hippocampus.

So far, we have gathered information that humans do have mirror neurons and have translated them in terms of Brodmann's areas which are much widely used references in academia. The areas having mirror activities are Brodmann's area 6, 44,22,40,39 and from the medial side of the cortex, they are Brodmann's area 34 & 28 (entorhinal cortex), 28 & 35(hippocampus), 27 & 36 (para-hippocampal Gyrus).

Learning is a process where a repeated sensory stimulus leads to the formation of new neuronal circuits in the regions of the hippocampal and para-hippocampal gyrus. Later on, even a small fraction of that stimulus, given in a correct situation, may lead to the spontaneous recall of the episodic memory giving rise to specific motor output. At this point, it is crucial to know that the autonomic nervous system of the body is also a part of the motor system and the endogenous opioid activity of the mid-brain is an autonomic process of human body.

Mirror neurons are connected to each other, forming a circuit, and cooperatively add to the process of learning and memory retention of the learned action. In this way, mirror neurons are linked to a process called Hebbian Learning (Mukamel et al. 2010)

UNDERSTANDING THE FOUNDATION OF YOGA USING THE ABOVE CONCEPTS

In our quest to understand the pathway of yogic philosophy we can focus on the mirror activities of the medial frontal and temporal lobe and its is association with the formation of memory and emotions.

Patanjali Yoga Sutra mentions samyama (combined simultaneous practise of dharana/concentration, dhyana/meditation and samadhi/union) as a tool to achieve deeper knowledge of qualities of an object. It is a term summarising the comprehensive process of psychological absorption in the object of meditation/yoga. The Sutra then describes various psychic experiences (siddhis) that the yoga practitioner may experience through the conduit of samyama. As an example, when a yogi does contemplative meditation on elephants, he gets the power of elephants.

The significant point to be appreciated while considering this in a logical framework is that we can draw a strong analogy between transfer of characteristics to the meditator practicing contemplative meditation (samyama) and between pain relief in the placebo-responder.

This framework can be described as follows. When a person observes a siddha yogi (an accomplished yoga practitioner with psychic abilities), his initial efforts to learn the process comes from the activity of imitation and understanding of the moves by the mirror neurons located at the lateral aspects of the brain. A few repetitions of this process initiates Hebbian Learning and more mirror neurons are activated and their circuits are generated in the limbic mirror neuron areas and the areas on the lateral side of the forebrain (Mukamel et al., 2010). Regular practise enables the person to comprehend the moves just by some audio-visual hints since more mirror neurons are added to the medial areas of the brain and a circuit is established within the local area and the surrounding lobes of the brain leading to the formation of long-lasting memory of the action. Gradually, when connections are established with the cingulate gyrus, a particular emotion also gets associated with that memory. In other words, the addition of mirror activity in these areas of the brain lead to the powerful association of permanent memory and emotions related to the yogic method. And during the demand of the situation, spontaneous recall of that memory will lead to the execution of the motor activity corresponding to the psychic ability (siddhi) that he had been practising.

CONCLUSION

Repeated stimulation of the mirror neurons consistently add more and more mirror neurons which lead to the intensive formation of the neuronal circuit. Ultimately, this results in the individual being immensely capable of initiating the desired mechanism spontaneously. We can, therefore, conclude that regular and dedicated practise of appropriate yogic techniques can help improve the overall well-being of the individual. Understanding and applying these methods can bring a significant amount of change in the type of medicine we practice today and can be helpful in creating a holistic healthcare system for the public.

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Pareekshit Dahal is a Medical Undergraduate who is currently undergoing his Internship training at Bankura Sammilani Medical College and Hospital. He has co-authored the book Avatars of Brahma: Stories of India's Greatest Yogis. He seeks to improve and upgrade the practice of Modern Medicine by taking inspiration from the cultural legacy.

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Scientific Monk and write columns for outreach of Indian Culture. He is an author of Avatars of Brahma which was recently published worldwide.

Statements and Declaration: A simplified version of this article, written by the same authors, has been published as a non-academic article in www.scimonk.com. The common sections between the two write ups, which constitute about one-third of this paper, are included within the quotation marks « and ».
No financial support was received for the work presented in this manuscript. The authors declare they have no conflict of interest.

Glossary of Medical Terms Used:

« Analgesia: The phenomenon of relief from pain.

Autonomic Nervous System: Part of the peripheral nervous system that regulates involuntary physiological functions, including heart rate, blood pressure, digestion, and respiratory rate.

Cerebral-Cortex: Outermost part of brain or Neo-cortex composed of Gray Matter (Neuron Bodies).

Cerebrospinal fluid: CSF is the fluid that flows within the ventricles of the brain and provides nutrition to it.

Cingulum: Part of the Cerebral Cortex situated on the medial aspect, part of the Limbic System
Endogenous Opioids: Organic compounds produced by our body that resemble the structure of the opium poppy extracts.

Enkephalinergic: Neurons that release Enkephalin (Endogenous Opioid).

Fornix: A bundle of White Fibres of the brain (Nerve) forming a part of the Papez Circuit.

Hippocampus: A structure of the Limbic system, concerned with memory and emotions.

Limbic Lobe: Part of the CNS situated medially in the Brain, deals with emotional processing.

Mirror Neurons: They are found in the premotor cortex, the supplementary motor area, the primary somatosensory cortex, and the inferior parietal cortex. Mirror Neurons are responsible for the learning process.

Motor Functions: Ability to contract a muscle.

Neo-Cortex: The Telencephalon of the Brain, which is newly developed in humans during Evolution.

Papez Circuit: A circuit of neurons connecting through The Fornix, The Hippocampus, the Hypothalamus, Mammillary Bodies, Anterior Thalamic Nuclei and the Cingulum.

Para-hippocampal: Part of the Cortex around the Hippocampus. Part of the Limbic System.

Peri-aqueductal Gray (PAG): Collection of neuron cell bodies, around the cerebral aqueduct (a central canal of the midbrain containing cerebrospinal fluid).

Somatic Function: Ability to consciously perceive or influence a certain activity of the body.»

References:

Burmeister, A., Gerpott, F., Hirschi, A., Scheibe, S., Pak, K. and Kooij, D., (2021). Reaching the Heart or the Mind? Test of Two Theory-Based Training Programs to Improve Interactions Between Age-Diverse Coworkers. *Academy of Management Learning & Education*, 20(2), pp.203-232.

Cherniack E. P. (2010). Would the elderly be better off if they were given more placebos?. *Geriatrics & Gerontology International*, 10(2), 131–137. https://doi.org/10.1111/j.1447-0594.2009.00580.x

Dahal, P., & Arpan , K. (2024). Power of mind, placebo and connections. *Scientific Monk*. https://scimonk.com/indexphp/2021/06/21/power-of-mind-and-placebo/

Gopnik, A., & Wellman, H. M. (1992). Why the Child's Theory of Mind Really Is a Theory. *Mind & Language*, 7(1-2), 145–171. https://doi.org/10.1111/j.1468-0017.1992.tb00202.x

Kashyap, R. L. (Ed. & Trans.). (2007–2009). [Ṛgveda] Rig Veda Samhitā (Vols. 1–12). Sri Aurobindo Kapāli Sāstri Institute of Vedic Culture (SAKSHI) Bangalore, India

Knox, J. (2003). Archetype, Attachment, Analysis: Jungian Psychology and the Emergent Mind (1st ed.). *Routledge*. https://doi.org/10.4324/9780203391525

Lasagna, L., Mosteller, F., von Felsinger, J. M., & Beecher, H. K. (1954). A study of the placebo response. *The American Journal of Medicine*, 16(6), 770–779. doi:10.1016/0002-9343(54)90441-6

Levine, J. (1978). The Mechanism Of Placebo Analgesia. *The Lancet*, 312(8091), *654–657.* doi:10.1016/s0140-6736(78)92762-9

MacLean, P. D. (1955). The limbic system (" visceral brain") in relation to central grey and reticulum of the brain stem: Evidence of interdependence in emotional processes. *Psychosomatic Medicine*, *17*(5), 355-366.

Maldonato, M. (2014). The Ascending Reticular Activating System. In: Bassis, S., Esposito, A., Morabito, F. (eds) *Recent Advances of Neural Network Models and Applications. Smart Innovation, Systems and Technologies*, vol 26. Springer, Cham. https://doi.org/10.1007/978-3-319-04129-2_33

Mukamel, R., Ekstrom, A. D., Kaplan, J., Iacoboni, M., & Fried, I. (2010). Single-neuron responses in humans during execution and observation of actions. *Current biology*, *20*(8), 750-756.

Rizzolatti, Giacomo; Craighero, Laila (2004). The mirror-neuron system. *Annual Review of Neuroscience*. 27 (1): 169–192. doi:10.1146/annurev.neuro.27.070203.144230

Rolls, E. (2008). Functions of the orbitofrontal and pregenual cingulate cortex in taste, olfaction, appetite and emotion. *Acta Physiologica Hungarica*, 95(2), 131-164.

Sherwood, C. C., Subiaul, F., & Zawidzki, T. W. (2008). A natural history of the human mind: tracing evolutionary changes in brain and cognition. *Journal of anatomy*, 212(4), 426–454. https://doi.org/10.1111/j.1469-7580.2008.00868.x

Vaz, M., Raj, T. (2016). Guyton & Hall Textbook of Medical Physiology - E-Book: A South Asian Edition. India: Elsevier Health Sciences.

Vivekananda, S. (2022). Patanjali's Yoga Sutras: Bestseller Book by Swami Vivekananda: Patanjali's Yoga Sutras. Prabhat Prakashan.

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Human Consciousness - An Emergent Property of the Brain or A Fundamental Property of the Universe?

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Abstract:

This document attempts to identify the *root cause of the first-person experience*. We would be drawing on the knowledge repository of both ancient and contemporary philosophies and integrating/blending it with the know-how gained through scientific experiments and research in multiple fields including, but not limited to, quantum physics, neuroscience, astrophysics, psychology, cosmology, particle physics... *and making this knowledge accessible to non-specialists*.

The method for intellectual analysis adopted herein is based on a system of logic used by an Indic school of philosophy. It is in line with how contemporary science and philosophy conducts such analysis. The attempt is to identify valid sources of knowledge and to distinguish these from mere opinions while exploring the key question - What is the source of human consciousness i.e. the first-person experience or subjective sense of being aware of oneself and the environment.

We start with a brief overview of the two prevalent views followed by an outline of the methodology we will use for analysing them. We then define the scope of this study and share a glimpse of some unexplained experimental observations before proceeding to the basic concepts used by materialist and non-materialist frameworks for explaining human consciousness. Thereafter, we go into the details of the concept of the non-physical realm of existence as mentioned in the ancient texts and explore whether contemporary knowledge systems have inferred the presence of any abstract concept (which cannot be perceived by our senses) based on some unexplained observations in this universe. Then we look at some

approaches to gain experiential knowledge of our inner-most core or consciousness. We again go back to the ancient texts to understand what they say about the underlying and fundamental layer of reality and examine similar ideas unveiled by contemporary science. Next, we try and understand what quantum physics has discovered in the last 100 years or so and how it correlates to what the non-materialist framework says about manifested world arising from an unmanifested field of existence. We then focus our attention back to the unexplained experimental observations that we had mentioned earlier and see if the non-materialist framework is able to provide a useful explanation for the same. Finally, we discuss the most plausible inference that can be drawn - *with each new research study or experiment we are inching towards the realisation that non-materialist framework is a plausible framework for understanding human consciousness and we do not seem to have any valid reason to reject the non-materialist paradigm in favour of the materialist paradigm.*

Keywords: human consciousness, first-person experience, Universal-Consciousness, *brahman*, *tat tvam asi*

SOURCE OF HUMAN CONSCIOUSNESS: TWO CONFLICTING VIEWS

The on-going dispute is between

- Materialist view - consciousness is an epiphenomenon (emergent property) of the brain. This view considers that consciousness arises as an emergent property of large neuronal networks wherein the interaction of neurons forms a web sufficiently complex such as to generate and sustain conscious experiences.
- Non-materialist view - consciousness is the real and fundamental property of the universe. This view does not consider that a physical substrate generates consciousness, rather, it is the other way round. The physical world arises out of consciousness. (In fact, if we go deeper within the non-materialist framework, we will find numerous philosophies like theistic, non-dualistic, dualistic, non-theistic like Buddhism, subjective idealism and so on. While we have borrowed examples from various philosophies, as per the context of the discussion, we have consciously avoided restricting ourselves to any particular school of thought and have attempted to remain as generic as possible while presenting the arguments of non-materialist framework)

The human mind (an intricate labyrinth of thoughts, emotions and memories) has been a subject of fascination for centuries. Psychology, the scientific study of the mind and behaviour, seeks to unravel its complexities. So, to truly understand the mind, researchers decided to delve deeper into the biological machinery that drives it – the brain. This is where neuroscience, the scientific study of the nervous system, comes into play. The materialists are convinced that they can explain consciousness by understanding the details of the process of activation of

neurons in the brain because consciousness is nothing but an epiphenomenon (emergent property) of the brain.

The latest research work has demonstrated that a person's thoughts can be identified using brain scans and AI (Artificial Intelligence)[1]. Another recent experiment has shown that you can even understand with reasonable accuracy the music a person is listening to by studying the brain scans in real time[2]. Encouraged by such developments the materialists believe that they are exploring in the right direction. Neuroimaging techniques, such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) and other advanced sciences like optogenetics, are expected to become increasingly sophisticated, enabling researchers to study the brain in unprecedented detail. This gives them the conviction that they will be able to identify exactly how human consciousness is generated in a few years from now.

As per the non-materialist framework there exists an omnipresent field of consciousness (which we will call Universal-Consciousness to differentiate it from individual's consciousness). This Universal-Consciousness, when manifested through the body-mind complex, gives rise to an individual sentient being. In other words, the sense of existence or 'beingness' is neither an intrinsic attribute nor an epiphenomenon of the biochemical activities within the body-mind complex, but, a fundamental property of the universe.

The brain, with its intricate neural networks and biochemical processes, is undoubtedly a masterpiece of nature, however, it is merely a physical apparatus in the body-mind complex. While the brain can be observed and studied through empirical means, the mind eludes such direct scrutiny. The mind is a subtle, dynamic force that shapes our reality. It is not confined to the physical brain but extends beyond it, permeating every aspect of our being. Most of the current focus of neuroscience is around measuring and understanding the different states of mind or the vividness of perceptual phenomenology through the knowledge about the functioning of the brain, its regions, and their interconnectedness.

However, the non-materialists are confident that consciousness is not a 'content of mind', and by studying the working of either the brain or the mind, in waking, dreaming or deep sleep, both normal and pathological, one cannot truly understand the consciousness. One needs to go beyond the framework of the body-mind apparatus to appreciate the material and efficient cause of consciousness.

METHODOLOGY USED

The approach used by us to assess these two conflicting view-points is broadly based on *Nyāya Darshan* – a school of philosophy whose most significant contribution to Indic philosophy is a systematic development of the theory of logic. *Nyāya Sūtra* (the foundational text of this school of philosophy) gives a detailed account of how to distinguish credible sources of knowledge from mere opinions. The first *Sūtra* (aphorism) of this text states:

pramāṇa-pramēya-samśayā-prayōjana-dṛṣṭānta-sidhdhānta-avayava-tarka-nirṇaya-vāda-jalpa-vitaṇḍā-hētvābhāsa-chala-jāti-nigrahasthānām tatvajñānānniśrēyasādhigamaḥ (1.1.1)

The highest good (*niśrēyasa)* is attained or acquired (*adhigamaḥ)* by the knowledge (*jñāna)* of the real or true nature (*tatva)* and for acquiring this knowledge *Nyāya Darshan* recognizes sixteen elements (*pramāṇa* to *nigrahasthānām,* as listed in the first *Sūtra),* which we have briefly explained below.

The *Nyāya* metaphysics emphasises that one should use credible evidence and other valid means of knowledge (*pramāṇa*) to analyse the object (thing or concept) of that valid knowledge (*pramēya*) for removal of all doubts or disputes between different view-points (*samśayā*). Existence of conflicting views about the character of the *pramēya* gives rise to the question as to which of these is the reliable view, but this doubt must not be confused with an error or false knowledge. After identifying these elements, one must clearly define the aim or scope of investigation (*prayōjana*). This process ensures that an ordinary person as well as a learned expert will have the same understanding of the conclusion arrived at the completion of the investigation and they will have the same inferences for the familiar examples which are commonly experienced by them (*dṛṣṭānta*).

To arrive at any valid conclusion (*sidhdhānta)* one needs to use logical argument of statements using inferential reasoning. *Nyaya's* methodology of inference involves a combination of induction and deduction where the conclusion is obtained from two linked premises. This can be done is an unbiased manner by appreciating the members of syllogism (*avayava*) and the process of hypothetical reasoning (*tarka*). So long as the premises of the syllogism are true and the syllogism is correctly structured, the conclusion will be true.

The removal of doubts and the settlement of the dispute between alternate view-points, with a wish to establish the truth (*nirṇaya*), should be done by discussion (*vāda*) rather than by debate. The purpose of discussion is to come to the truth of the proposition under consideration. In *vāda,* it is not necessary to establish one's own thesis, it is enough to submit one's views for examination in order to ascertain the truth. The usual procedure is to maintain the thesis by means of right knowledge (*pramāṇa*) and to counter-thesis by the means of logical reasoning (*tarka*).

This is in contrast to other devices of debate that one usually employs as a means for self-defence with the sole purpose of gaining victory over the other party and with no desire to either gain further knowledge or to establish one's own position. These include vigorous verbal disputation (*jalpa*), wrangling or unnecessary objections (*vitaṇḍā*), fallacious reasoning (*hētvābhāsa*), casuistry or clever but unfair reasoning like play of

words, generalisation or invalidating a word used in a particular context by taking it literally when it was used metaphorically (*chala*) and futile rejoinder or sophisticated refutation (*jāti*). They involve mere attacks on the opposite side by offering frivolous objections as means of protecting one's knowledge which has not yet matured to a full blossomed conviction. When one does not understand or misunderstands the arguments stated by the opponent, one eventually loses the debate (*nigrahasthānām*).

Doubt is the result of first impression and gives impetus to investigation in order to ascertain the truth. Everything should be questioned and not accepted simply on face value, however, endlessly questioning for the sake of questioning is also not useful for coming to an acceptable conclusion. 'Ascertainment' is unnecessary in the case of direct perception or the verbal testimony of a trustworthy authority. However, in the absence of these, one has to rely on confutation (*tarka*) which is a method of attaining knowledge of the truth about an unknown or uncertain thing by comparing and then gradually eliminating all the competing suppositions. This is not a method which ascertains, determines and verifies a theory. It simply eliminates all other contesting theories to the supposition it supports; after which truth is established through the application of various means of accurate or valid knowledge (*pramāṇa)*. One can take help of a combination of multiple sources of valid knowledge or epistemic positions which includes perception (*Pratyaksha*), inference (*Anumāṇa*), comparison and analogy (*Upamāṇa*) and testimony of past or present reliable experts (*Śabda*). Apart from these four *pramāṇas,* some other philosophical schools mention two more *pramāṇas* – postulation or derivation from circumstances (*Arthāpatti)* and non-perception, negative/cognitive proof (*Anupalabdhi).*

We have decided to use this methodology to investigate the root-cause or source of human consciousness.

Since there is no purpose in entering into a discussion if one party is ignorant about the subject being investigated or the terminology being used by the other party, hence, we have tried to elaborate all unfamiliar concepts and terms used by us in this document.

SCOPE

The scope of this study is limited to exploring whether consciousness is an emergent brain phenomenon or it is a fundamental property of the universe that is more deeply connected to the fabric of reality than generally accepted.

This work does not attempt to

- Provide any detailed theory or mechanism of how Universal-Consciousness and/or individual's consciousness operates
- List down the practical applications of the concept of Universal-Consciousness i.e. how it can change our lives or impact the current technologies

- Carry out a comparative analysis of various consciousness philosophies

UNEXPLAINED EXPERIMENTAL OBSERVATIONS

Materialism (a framework that has been able to provide a good understanding of things that are manifested in our visual world of experience) tells us that everything that exists in the universe is the result of matter energy interactions. It also proclaims that empirical sciences and formal mathematics are the only tools with which we can discern the true nature of reality.

Hence, while analysing which of the two paradigms is useful in providing a satisfactory explanation of various observed phenomena with respect to human consciousness, we have decided to restrict ourselves to empirical experiments which have been conducted in a scientific manner and have been replicated in more than one laboratory.

Multiple experiments have shown that desired response can be spiked through hopeful expectancy. The most well-known of these experiments are the ones on Placebo effect. Both materialists and non-materialists agree that the human consciousness or thoughts have a role to play in the placebo effect. Nevertheless, these experiments cannot be used to determine whether consciousness is an emergent property of the brain or a fundamental property of the universe because the placebo effect is observed in the same body-mind complex with which the human consciousness is associated.

It is a known fact that electromagnetic waves are generated during the activation of neurons in the brain. However, these waves cannot be detected beyond a few centimetres from the skull despite using special devices like EEG, MEG etc[3]. As a result, it is highly unlikely that these waves could impact entities which are not in the 'immediate vicinity of the brain' (by immediate vicinity we mean within a few centimetres' radius from the brain/skull). So, even if we have one replicable experiment which demonstrates a link between (i) human intent/thought and (ii) impact on the physical world or other body-mind complex(es), which are at a considerable distance from one another, then, we have a valid case for exploring alternate root-causes of consciousness.

We know that mind-matter interaction research and parapsychology studies have demonstrated through a wide range of scientifically conducted experiments that a statistically significant correlation exists between human intent/thought and impact on the physical world or other body-mind complex(es). While it is a fact that many of the results and anecdotes cannot be reproduced on demand, but a sufficient number of experiments have been replicated so as to ensure that under the structure of meta-analysis there is no chance of the results being attributable strictly to accident.

Some of these results have been replicated according to standards that are higher than those used for pharmaceutical and social science studies. Hence, there is a sufficient case for exploring alternate theories of the material and efficient cause of human consciousness.

Before continuing further on our investigation by exploring other fields of contemporary research, let us first understand the basic terminology and concepts used by the materialist and non-materialist paradigms. For this, we will take help of one of the oldest surviving non-materialist philosophies – the ancient Indic philosophy (which itself is a bouquet of a number of similar philosophies like *nyāya*, *sānkhya*, *yoga*, *vedānta* etc.). The concepts used in other ancient and contemporary non-materialist philosophies are very similar to those described in ancient Indic philosophy and, hence, we can use it as a basis for our discussion, without any loss of generality.

OUR BODY-MIND COMPLEX AND CONSCIOUSNESS

According to Indic philosophy, considering ourselves as just a physical body of bones, muscles, blood etc., does not help in appreciating the true nature of our 'beingness'. A useful way of understanding our existence is to consider our body-mind complex as a system of three bodies consisting of five layers or sheaths which are illumined by the reflected consciousness (the reflection of the witness-consciousness or the Universal-Consciousness).

The witness-consciousness, which is reflected by the subtle body, is ultimately responsible for converting the body-mind complex into a living and experiencing sentient being (*jeeva*). The three bodies or five sheaths are mere tools which help the witness-consciousness to experience the presence or absence of the universe.

Witness-Consciousness is not a 'verb' and should not be confused with the act of witnessing or being aware of one's experiences, sensations, thoughts, surroundings etc. Instead, it is a 'noun' for the witness/experiencer of (i.e. cause behind) all experiences of the body-mind complex. Despite being the witness/experiencer, it remains uninvolved or unattached from all experiences and their consequences.

According to *yoga* philosophy (an ancient Indic school of philosophy), the body-mind complex of a sentient being is made of

1. Gross Body (*Sthūla Sharīra*) – This body includes the tangible aspects of the sentient being - muscles, bones, organs, and all the other parts that make up the physical form. The physical body is the tool body. We need it for doing anything in this physical world.

2. Subtle Body (*Sūkshma Sharīra*) – This body is the intangible aspect of the sentient being. It is the subtler plane of existence and includes the thinking/feeling (*mann*), the

discriminating/intellectual power (*buddhi*), the memory (*chitta*) and the integrative (*ahankāra*) aspect of our individuation.

3. Causal Body (*Kārana Sharīra*) – It refers to the innermost body where the creation is in the unmanifested form. The witness-consciousness or the Universal-Consciousness is covered by ignorance (*avidyā*) (just as clouds seem to cover the sun), resulting initially in the non-apprehension of our true identity and culminating in the misapprehension of the reality. This level has other names like blissful sheath, seed body and so on.

The subtle and causal bodies continue through all our lives and store impressions of all that has happened to us in this life and past lives. The causal body should not be confused with the soul because soul (a concept popular in various Abrahamic religions) does not go through the cycles of birth and death. Neither should the causal body be equated to the *ātman* or *Brahman* (Universal-Consciousness). The causal body, in a nutshell, is the ignorance (known as *avidyā* at an individual level or *Māyā* in its cosmic form). And once this veil of ignorance is removed or transcended, the sentient being attains self-realisation or enlightenment or *Moksha*.

The five layers or sheaths (*koshas*) act as a roadmap for our journey of self-discovery providing a step by step guide as we move from a grosser level to a subtler one. By understanding and working through each of these layers, we can gradually move towards a state of greater awareness and self-realization[38].

Gross Body (*Sthūla Sharīra*)

- *Annamaya Kosha*: Food Sheath - It is the physical body made up of matter, which includes the skin, bones, muscles, organs, and other tissues. This *kosha* is responsible for our basic survival needs, like food, water and shelter. It is through the *Annamaya Kosha* that we experience the physical world and interact with the natural environment around us[38].

Subtle Body (*Sūkshma Sharīra*)

- *Prānamaya Kosha*: Vital Sheath - It is the energy sheath of the body and is made up of the five major *prānas* which helping in flow of life force energy throughout the body. In other words, it plays an important part in the vital functions we need to stay alive, such as breathing, digestion, circulation, excretion[38].
- *Manomaya Kosha*: Mental Sheath - *Manas* means mind. This is the mental sheath of the body, and consists of our feelings, thoughts, emotions, memory and imagination. It is responsible for our cognitive functions like memory and perception and is where we process our experiences and emotions[38].
- *Vijnānamaya Kosha*: Intellectual Sheath - It means knowledge or wisdom. This is the sheath that sets human beings apart from animals. While both can experience

emotions and deep connections, only human beings have the intellectual ability to determine right from wrong[38]. Our intellect, intuition and inner wisdom are all part of this sheath.

Causal Body (*Kārana Sharīra*)

- *Ānandamaya Kosha*: Blissful Sheath - It is the fine veil of ignorance (*avidyā*) covering the inner-most core which is normally inaccessible to the individual. It is where we experience our interconnectedness with all things in the universe. This sheath is what allows us to feel bliss and contentment with the bliss aspect coming from the *Brahman* which this sheath is appearing to enclose.

Our true self lies hidden beneath these sheaths/layers, however, each layer feels so real that we are often deceived into believing that one of the sheaths is who we are.

Although every non-materialist philosophy does not look at the body-mind complex as a layered structure of five sheaths, but, they all agree, that there exists is a clear distinction between the various biochemical activities within the body-mind complex, contents of the mind (memory, intellect, thoughts & feelings) and consciousness. The consciousness or inner-most core of the personality of the living being emanates from a fundamental, eternal, omnipresent, non-physical realm of existence which is known by different names like *Brahman*, *Purusha*, Universal-Consciousness, Supreme Cosmic Spirit…

On the other hand, the materialists argue that cognition (information processing) and internal phenomenological sensations (consciousness), including emotions, are intimately related and are not separable.

Whereas machines are precisely the sum of their parts, biological systems are always more than the sum of their parts. Complexity theory was devised by mathematicians and computer scientists in the late 20th century. It attempts to explain how many (even millions of) independent actors can unintentionally demonstrate patterned behaviour and properties that, while present in the overall system, are not present in any individual component of that system. It is one of the pillars of biosciences and helps us understand what we see in our everyday lives.

> All living things follow the same four complexity rules (i) the more the interacting parts {cells, ants, people} and the greater their diversity, the greater is the complexity of the resulting system {bodies, ant colonies, cities, cultures, and civilizations} (ii) in self-organizing systems, all interactions are local (iii) negative feedback loops keep systems healthy and are necessary for their survival. Positive feedback loops exist, but they cannot predominate (iv) there must be some low-level randomness or unpredictability in every living system. However, if there is too much randomness or unpredictability, then there can be no self-organization, no greater whole. And if there is too little, then the system is unable to adapt to the environment changes.

Neuroscientists believe that phenomenological sensations are dynamical ‘modes’ of firing behaviour that (i) exist over time and over large parts of the brain’s neuron-to-neuron network and (ii) are consequences of the network-of-networks architecture, coupling the individual neuronal dynamics and the necessary time delay incurred by neuron-to-neuron transmission[4]. If something possesses these system properties, then it will have the dynamical modes and, thus, the phenomenological sensations or consciousness.

Most of the current work in neuroscience is, therefore, being done around measuring and understanding the different states of mind or the vividness of perceptual phenomenology. For example, deriving the perturbational complexity index (PCI)[5] using the LZW complexity, administering mind-altering psychedelics[6] like LSD, psilocybin, or DMT-based compounds[7], and using magnetoencephalography (MEG)[8] to study the brain activities at neuro chemistry level or even the study of the neural correlates of consciousness (NCC)[9]. The most ambitious advanced research study currently in progress is the one in which neuroscientists are attempting to slice the human brain into thousands of thin slices and then piece the scanned images back together inside a computer, and make a 3D 'atlas' of the brain[10].

While most neuroscientists agree that consciousness is a by-product of the neural activities in the brain, they disagree on the mechanisms like which parts of the brain are involved in the process etc. Two rival theories of consciousness, Global Neuronal Workspace Theory (GNWT)[11] and Integrated Information Theory (IIT)[12], were recently tested by independent researchers in a joint experimental study spanning almost two years. However, neither of these theories could be verified, and now, the proponents of these theories would need to rethink the mechanisms they proposed in the light of the new evidence[13].

«If we look closely at what all these neuroscientists are attempting, we find that they plan to measure the crackling of electrical activity among neuron networks and discover which part of the brain gets activated when we have a conscious experience. It does not throw much light on what is the root cause of these experiences; whether it is the brain circuitry or it is something which is apart from the body-mind system.»[39] The typical problem of correlation vs causation continues to hover around such design of experiments.

There are some scientists who are exploring alternate causes of conscious experiences by going beyond neuroscience. Orchestrated Objective Reduction (Orch OR)[14] model portrays consciousness as brain activities linked to fundamental ripples in spacetime geometry. It states that consciousness is likely due to quantum vibrations in microtubules deep within brain neurons as opposed to the conventionally held view that it is due to connections between neurons. In the Orch OR proposal, reduction of microtubule quantum superposition to classical output states are neither totally deterministic nor random and are influenced by a non–computable factor ingrained in fundamental spacetime. However, this not-yet-verified theory

is also exploring the source of consciousness at the brain level rather than considering consciousness to be something primary and fundamental.

THE CONCEPT OF A NON-PHYSICAL ETERNAL REALM OF EXISTENCE – UNIVERSAL-CONSCIOUSNESS

Sānkhya philosophy (considered by many to be the oldest school of philosophy in the world) considers everything in this universe to be made of essentially two things – (1) spirit or «the primal energy and (2) matter or the giver of form. We have to note here that matter does not mean only solid, liquid and gaseous substance but includes even those substance which do not have a form like all our thoughts, ideas, emotions, etc. These subtler planes of existence are considered matter according to the vast definition given to it in the Indic philosophies.»[39]

To avoid any confusion with the English language terms ‘spirit’, ‘energy’ and ‘matter’, let us call these as Category 1 and Category 2. Category 1 corresponds to the non-physical aspect of existence which cannot be perceived by any instrument of measurement including our sense organs. Its presence can only be inferred. Category 2 corresponds to everything that can be perceived. For ease of understanding, we will bifurcate this category further to Category 2a – everything physical like mass (solid, liquid, gas) and energy; perceived using our sense organs, and Category 2b - subtler planes of existence like thoughts, memories, emotions, etc.; perceived using our mind.

If we map the five sheaths explained in the previous section to these categories, then we can say that *Annamaya Kosha* (Food Sheath) corresponding to the Gross Body belongs to Category 2a and the remaining four sheaths belong to Category 2b. They all experience changes or modifications and are not eternal in nature. Even though the existence of some sheaths spans across innumerable life times, they are still considered to belong to Category 2b since they are subject to changes and can be perceived by the mind.

But body-mind complex (Category 2a and 2b) remains just that – body-mind complex – until it is infused with consciousness. It then becomes a sentient being. The consciousness or the inner-most core belongs to Category 1 and it is the witness or experiencer of all experiences of the body-mind complex.

The non-materialist paradigms differ with each other on the mechanism by which Category 2 is infused by or associated with Category 1. Some believe that the Universal-Consciousness shines on the body-mind system pervading it like the fragrance of an incense in the room, some believe that it resides within the body-mind system (pineal gland or heart), some believe in a stream of consciousness flowing through different life spans, another school of thought considers such a relation as an illusion, just like the appearance of a mirage in the desert, whereas some call it dissociated alters of universal phenomenal consciousness…

But whatever be the mechanism of association of Category 1 with Category 2 to make the sentient being, all non-materialist paradigms accept the existence of an all-pervading underlying layer of reality, «which itself does not undergo any change, and from which everything in this universe manifests. It is known by different names like *Brahman*, *Purusha*, Absolute, Universal-Consciousness, Supreme Cosmic Spirit… This omnipresent field, which is apart from the mind-body system, pervades and illumines the mind-body system and is known in its functioning.»[39]

«Despite the phenomenal manifestation of the entire material world from this ultimate layer of reality, it does not diminish a bit and remains absolute and unchanged. This powerful force, which has shaped the evolution and fate of the entire cosmos, is so vast that it outweighs everything else that we see or know. It is infinite, indestructible, eternal and independent of anything that resides within it and the manifested material world is transient or temporary in nature and depends on this omnipresent field for its existence.»[39]

«However, the mainstream scientific paradigm, with its roots in materialism, dismisses this concept of Universal-Consciousness as a figment of imagination. It is not ready to accept the existence of some abstract field that is latent and unknowable, something that is so vast that it outweighs everything else that we see or know in this universe.»[39] But the same mainstream scientific community is open to the idea of three abstract concepts - dark matter, dark energy and vacuum energy. They are not perceivable by the sense organs but their presence has been inferred by quantum physicists and cosmologists based on some unexplained observations in this universe.

«Originally known as the 'missing mass', dark matter's existence was first inferred in 1933 when it was discovered that the mass of all the stars in the Coma cluster of galaxies provided a very small percent of the mass needed to keep the galaxies from escaping the cluster's gravitational pull. The reality of this missing mass remained in question for decades. Finally, in the 1970s the existence of 'dark matter' was confirmed[15].»[39]

«In 1998, two research teams independently discovered that the expansion of our universe is accelerating. This discovery completely changed our understanding of the universe. It showed that about 70% of the mass of our universe is in an unknown form which is now usually referred to as 'Dark Energy'[16].»[39]

«Vacuum energy is an underlying background energy that exists in space throughout the universe. It is a special case of zero-point energy that relates to the quantum vacuum. The effects of vacuum energy can be experimentally observed in various phenomena such as spontaneous emission[17], the Casimir effect[18] and the Lamb shift[19] .»[39]

«The idea that empty space can have an intrinsic energy associated with it and that there is no such thing as a true vacuum is seemingly unintuitive, yet, it is now scientifically established.»[39]

Although physicists currently lack a full theoretical model for understanding zero-point energy, they suggest that it could contain a huge amount of latent energy. It is now a widely accepted fact that «the ordinary matter (which makes up all the stars, planets, galaxies and everything that we know) in this universe is less than 5 percent of the mass/energy that the universe has. The remaining 95% of the universe is made of some mysterious, invisible substance/force called dark matter/energy[20].»[39]

Billions of dollars are being spent on research projects to understand these mysteries of the universe. Latest in the list is a two-tonne Euclid space telescope[21], launched in July 2023, which is on a million-miles journey towards the Sun-Earth second Lagrange point L2 and aims to shed light on dark energy and dark matter. However, the same scientific community questions the rationale behind investing resources for investigating the concept of Universal-Consciousness. They consider Universal-Consciousness to be a figment of imagination and its associated concepts, especially causal and subtle body going through multiple rounds of birth and death, a bit too far-fetched.

«But over the past few decades some organisations have started exploring this area in depth. The Division of Perceptual Studies (DOPS)[22] at University of Virginia, founded in 1967, is a highly productive university-based research group focused on studying phenomena related to consciousness functioning beyond the confines of the physical body, and phenomena that suggest the continuation of consciousness after physical death. DOPS researchers have objectively documented hundreds of cases and rigorously analysed empirical data collected regarding human experiences which suggest that consciousness may persist in detectable ways beyond bodily death.»[39] This implies that human consciousness cannot be an emergent property of the brain because, had it been an emergent property, it could not have outlived the brain that produced it.

EXPERIENTIAL KNOWLEDGE OF OUR INNER-MOST CORE OR WITNESS-CONSCIOUSNESS

Vedānta (the culmination of Vedic wisdom - the world's most ancient spiritual texts) explores in great depth the question – 'Who am I?'. It explains the relationship of the inner-most core of the sentient being (individual's consciousness) and Universal-Consciousness. This relationship has been adeptly summarised in the *mahāvākya* (The Great Saying) – *'tat tvam asi'* which translates to 'thou art that'. 'Thou' stands for individual's consciousness and 'That' stands for Universal-Consciousness. Hence, *'tat tvam asi'* states that individual's consciousness is same as Universal-Consciousness.

Before understanding whether this relationship can be demonstrated or inferred experimentally, let us understand some of the ways or techniques available to us to gain experiential knowledge of our inner-most core.

There are many thought-experiments mentioned in the ancient texts as pointers to understanding and validating the presence of witness-consciousness within us. For example, *Drig-Drishya-Viveka* is an effective methodology for gaining the direct knowledge/experience (*Aparoksh Anubhūti*) of the witness-consciousness. In this methodology of gaining valid knowledge of our inner-most core, we iteratively move from the grosser level to the subtler level of our being, exploring the nature of the Knower and the Known at each stage, until we reach the inner-most core. This method, of reaching and realizing the witness-consciousness as our inner-most core, is based on the following premise:

- There is always a Knower and a Known.
- Knower and the Known cannot be same at any given time.
- Knower is always one whereas the Known can be many.
- Knower is never changing, whereas the Known is always changing.

The experiment starts with realizing that the eyes observe several objects around us, including the body. Hence, the eyes are the Knower whereas the body and all the objects are Known. In the next stage, the experimenter realizes that the eyes also have several states - closed, open, clear vision, blurred vision, etc. These states are observed by the mind. Hence, now the eyes become the Known and mind is the Knower. As we delve deeper, we observe that the mind and its content like thoughts, feelings, emotions are also continuously changing. This means that the mind has now become the Known. However, the question is who now becomes the Knower. Clearly, there is a substratum – a True Knower that is distinct from mind and its content. The spiritual texts refer it as the witness-consciousness. The non-dualist philosophies further mention that once we realise our true nature as the witness-consciousness, there remains no distinction between the Knowledge, the Knower and the Known. The three merge into One.

The materialists argue that this is the classic case of 'mind observing the mind' and not a proof of the existence of an 'entity' beyond the mind. An oft quoted thought-experiment which is used to counter this argument is from the *Māndukya Upanishad*.

This Upanishad describes three states of consciousness, namely waking (*jāgrat*), dreaming (*svapna*), and deep sleep (*suṣupti*) which are in line with the states of consciousness recognised by the contemporary knowledge systems too. The question to ponder is that which part of 'you' is experiencing these states, especially the third state. It's definitely not your mind because in deep sleep the mind is totally at rest. The waking state infers that we slept like a log, i.e. deep sleep state, but who/what was the witness? There is clearly some part of 'you' which is beyond and underlying these three states. The spiritual texts call this *Turiya* ('the fourth') which is witnessing the other three. As mentioned by *Gaudapada* in *Māndukya Kārikā*

nivṛtteḥ sarvaduḥkhānāmīśānaḥ prabhuravyayaḥ |
advaitaḥ sarvabhāvānāṃ devasturyo vibhuḥ smṛtaḥ || 1:10 ||

> "In it, indicated as the changeless and the Supreme Lord, there is a cessation of all miseries. It is the one without a second among all entities. It is known as the *Turīya* (Fourth), effulgent and all-pervading."

In other words, *Turiya* is not a part of us; it is our real or true nature; it is the witness-consciousness (Universal-Consciousness) pervading or underlying the other three states - waking, dreaming and deep sleep. Calling the waking, dreaming, and deep sleep as 'different states of consciousness' is actually a misnomer. Those three are essentially the different states of mind and that one and only consciousness or *Turiya* is that what we truly are.

A very simplistic way of understanding this concept is to look at water (H_2O). The three states in which it is perceived by us are ice, water and steam/water vapour. Each possesses different properties, yet, there is something common in all of them which links all these three forms of water and that is their chemical composition - H_2O. In other words, the 'true identity' of ice, water and steam/water vapour is H_2O.

Besides these two very useful methods of self-inquiry to identify that part of 'you' which is the witness or experiencer of everything that your body-mind system is experiencing, there are other ways of gaining experiential knowledge of the consciousness. Some of these are meditation, *tantra* (certain modes of worship), psychedelics, trance and NDE (Near Death Experience).

One may argue that the methods explained above only help us realise that consciousness is an independent 'entity' and not a content of mind but these methodologies do not offer any insight on the root cause of consciousness - whether it is an emergent or a fundamental property. To appreciate the root cause of consciousness we must first understand some other aspects of Universal-Consciousness.

THE UNDERLYING AND FUNDAMENTAL LAYER OF REALITY

The *Nāsadīya Sūkta*, of the *Rig Veda* (the oldest known spiritual text of the world) describes the Ultimate Reality as follows

> *nāsad āsīn no sad āsīt tadānīṁ nāsīd rajo no vyomā paro yat* |
> *kim āvarīvaḥ kuha kasya śarmann ambhaḥ kim āsīd gahanaṁ gabhīram* || *1* ||
> There was neither existence nor non-existence, neither matter nor space. What covered it? Where was it? What was its purpose? What protected it? Who was the master of the cosmic water (space plasma) that was dense and deep?
>
> *na mṛtyur āsīd amṛtaṁ na tarhi na rātryā ahna āsīt praketaḥ* |
> *ānīd avātaṁ svadhayā tad ekaṁ tasmād dhānyan na paraḥ kiṁ canāsa* || *2* ||

There was neither death nor immortality and nothing to separate night and day, That One existed enclosed in nothingness, there was only that One and no other.

tama āsīt tamasā gūlham agre 'praketa˛ṁ salilaṁ sarvam ā idam |
tucchyenābhv apihitaṁ yad āsīt tapasas tan mahinājāyataikam || *3* ||
Darkness covered darkness, all this was hidden intelligence in cosmic water (Space Plasma) And the One enclosed in nothing arose from the power of heat.

kāmas tad agre sam avartatādhi manaso retaḥ prathamaṁ yad āsīt |
sato bandhum asati nir avindan hṛdi pratīṣyā kavayo manīṣā || *4* ||
Desire entered and the primal seed appeared from the cosmic mind. The wise who searched deep within their heart could discern between that which is and that which is not.

tiraścīno vitato raśmir eṣām adhaḥ svid āsīd upari svid āsīt |
retodhā āsan mahimāna āsan svadhā avastāt prayatiḥ parastāt || *5* ||
From the primal seed sprang crisscross rays holding all the forces above and below. The strong powers made fertile forces with strength below and impulse above.

ko addhā veda ka iha pra vocat kuta ājātā kuta iyaṁ visṛṣṭiḥ |
arvāg devā asya visarjanenāthā ko veda yata ābab || *6* ||
Who can say and know where all this came from and how all this came to be? The Devas (Gods) came after all this manifested so who knows where all this came from?

yaṁ visṛṣṭir yata ābabhūva yadi vā dadhe yadi vā na |
yo asyādhyakṣaḥ parame vyoman so aṅga veda yadi vā na veda || *7* ||
Where did creation have its origin? Who is One that created it or did the One not create it? That One alone perceives all from above and knows the beginning or maybe even he does not know.

«Universal-Consciousness is the underlying and fundamental layer of reality. This all-pervading and all-encompassing field is *aparimey* (not measurable), *avyakta* (latent or not describable) and *agyey* (unknowable). There is no place where this field is not present and the entire material universe is created by it and from it; yet, it remains the same complete whole, as before, absolute and unchanged.»[39]

While the mainstream scientific community finds the above description of Universal-Consciousness as infeasible and is «not ready to accept the existence of some abstract field that is latent and unknowable, something that is so vast that it outweighs everything else that we see or know in this universe»[39], yet, they are themselves advocating the presence of dark energy. We are not arguing that dark energy and Universal-Consciousness are the same but

there are a lot of uncanny similarities between the two. So, if one concept is accepted and is being explored, why is the other rejected by the same scientific community?

«Astrophysicists have experimentally confirmed that the universe is expanding and that expansion is accelerating[23]. To explain the expansion, they theorised a new form of energy, one that exhibits properties that no other kind of matter or radiation or energy does – dark energy. The 'dark' in the name is a placeholder term that indicates that we do not know much about the true nature of this energy. Right now, it is believed to be about 70 percent of the mass/energy of the universe, but, oddly, even as the volume of the universe grows, its energy density remains remarkably constant across the universe[24]. It is almost as if there is something uniformly present in space whose nature is not dependent on anything that resides within space. This has prompted scientists to figure that dark energy could be a large field that permeates throughout the universe or even an inherent feature of space-time itself which doesn't dilute but rather maintains a constant energy density as time goes on.»[39]

«Quantum physics points out that the universe is made up of continuous fluctuating fields and all particles and forces are nothing but excitations of these quantum fields[25]. It also suggests that there seems a possibility of combining these various quantum fields into one single field, the Unified Field, from which everything else emerges - gravity, all particles, all forces, everything. String theory[26], and its subsequent versions like Superstring Theory[27] and M-Theory[28], is based on the fundamental concept that reality is made up of infinitesimal vibrating strings and as these strings vibrate, twist and fold, they produce effects in many tiny dimensions that we interpret as particles or forces. The Unified Field, which gives rise to these vibrating strings, is the non-material source of the material universe.»[39] (By material we mean something that can be measured or quantified using available tools of measurement and perceived by our senses).

In other words, the Unified Field «is an abstract unmanifested universal field that supports different waves of vibrations which appear as all the ingredients that we see in the universe. This Unified Field existed long before the universe came into existence (i.e. even before the Big Bang) and was contentedly sitting within itself, not dead, not lifeless, but reverberating within itself.»[39]

«String theory is extraordinary as it fulfils the quest to discover the unified source of the diversified universe. Although the mathematics of the theory seems perfect, there is no way to experimentally test it at the moment. But if these discoveries of science mean anything, they can only mean the existence of Universal-Consciousness which is present and working in all things.»[39]

MANIFESTATION OF THE MATERIAL WORLD FROM UNIVERSAL-CONSCIOUSNESS

Ancient Knowledge Systems also state that initially Universal-Consciousness «existed in the *avyakta* (latent) state, which was teeming with unmanifested energy, wherein everything was present, but, in an undifferentiated state. An oft repeated example is the seed of a tree - it has all the information of the tree that will develop from it, yet, if you open up the seed you will not find the rudiments of the tree in it. The tree is in the seed but in an undifferentiated state.»[39]

To explain «the process of manifestation of the universe from the abstract universal field, *Sānkhya* philosophy, for example, takes the help of a metaphor - dualism of *Purusha* (Category 1; as explained in one of the previous sections) and *Prakriti* (Category 2). *Prakriti* refers to the basic cosmic material that is the root of everything and *Purusha* to the spirit or conscious energy that governs life»[39] or existence. In the process of manifestation, Category 1 (spirit or *Purusha*) takes the form and identity of Category 2 (matter or *Prakriti*) and develops under its laws. However, one should remember that it is just one of the ways (though, most common) of explaining the creation. There are alternate philosophies (like some schools of *Vedānta*) that look at dualism as illusory and consider *Brahman* (Universal-Consciousness) as both the efficient and the material cause of creation.

Particle physicists explain the quantum/sub-atomic world as follows[29] - The universe is «made up of continuous fluctuating fields: matter fields, whose quanta are fermions (i.e., leptons and quarks) and force/interaction fields, whose quanta are bosons (e.g. photons and gluons). These fields give rise to particles»[39] – both matter and force/interaction. The world that is perceivable by us is made of these particles.

We can think of these particles as events in space-time. But underneath these events is a much larger field and a lot of 'invisible' activities are going on 'behind the scene' in this field and that is why it has a strange counter intuitive behaviour, that is both startling and puzzling. For example, people like to think of propagation as a kind of a domino effect or ripple effect where information and objects go from one point to another in a very local way (locality means that for an object or energy to affect another object or energy, the two have to interact); but quantum/sub-atomic world is non-local in nature with instantaneous information travel between two points separated in space and/or time.

«As science explored deeper into the atomic and sub-atomic world, it came across several counterintuitive and paradoxical ideas like Wave Particle Duality, Collapse of Wave Function, Superposition, Decoherence, Entanglement, Tunnelling and Time Reversal. These discoveries challenged the core assumptions of classical physics and gave birth to quantum physics.»[39]

«From the conceptual point of view quantum physics is profoundly puzzling but its mathematical formulae are much more successful in predicting the behaviour of the physical

systems than any other theory. Just as Newton's second law gives a mathematical formula to calculate the position of an object at any point of time, Schrödinger equation (which is Newton's second law's quantum counterpart) makes predictions as to what path a given physical system will take over time. It gives a wave function which describes the wave characteristics of the particle and its value at any given point of space and time is related to the likelihood of the particle being there at that time.»[39]

«The wave function collapse (a technical term for the wave giving rise to the particle) occurs when the wave function — initially in a superposition of all possible states — reduces to a single state due to interaction with the external world. This interaction is called observation.»[39] On observation, the wave collapses and acquires measurable particle properties like momentum, position etc. Although not much is understood about how this interaction takes place, it is generally accepted that consciousness has some role to play in this process.

Wave Particle Duality states that light and matter behave as particles only in the presence of an observer. Before observation, they exist in the wave form. (As science delved deeper into the sub-atomic world, the idea of wave has been translated into a field - an extended distributed structure.)

The founding fathers of quantum physics tried to brush aside this strange counterintuitive behaviour of the quantum systems by saying that the quantum world is not real and the particle, which is real, comes into existence only on observation. Bohr, one of the founding fathers of quantum theory, said that there is no quantum world, because, to him, those kinds of behaviour did not satisfy his criteria for what should be regarded as real.

And if you also define reality as something you can touch and measure, you would have to come to the same conclusion as Bohr. This erroneous definition of reality was one of the reasons for the inconsistencies and the gaps between the materialist and non-materialist paradigms.

Materialists say that quantum systems in themselves are abstractions because they have no measurable properties. They acquire a particle state and gain measurable properties (i.e. they become real) upon interaction with a conscious entity (observation).

But that makes no sense, because, if the quantum systems are not real then how do they undergo interactions with conscious entities?

The moment we use a different terminology to explain what is happening in the sub-atomic world, the materialist and non-materialist paradigms begin to converge. The physicists defined ‘Real’ as something whose physical properties can be measured. If we define the word ‘Real’ as something which exists, and ‘Manifested State’ as something whose physical properties can

be measured, and 'Unmanifested State' as something whose physical properties cannot be measured, then quantum theory will start making sense and will not appear so puzzling.

Using this new terminology, the scientists would say that quantum systems in themselves are real and they have no measurable properties (i.e. they exist in unmanifested state) until they undergo some specific type of interactions (observations). At that stage, the unmanifested state acquires a manifested state which can be measured/perceived by a conscious/sentient being.

This is so much in line with what the *Vedānta* talks about the manifested (*sagun*) and unmanifested (*nirgun*) world. (*Vedānta* is the culmination of Vedic wisdom - the world's most ancient spiritual texts. It is built on the foundations of the *Upanishads*, the *Brahma Sūtra* and the *Bhagavad Gītā.*) Maybe, that is why, a number of quantum physicists have said that once they studied the *Vedānta*, quantum physics started making sense to them.

«People like Einstein did not want to accept that reality exists in manifested and unmanifested form and were at unease with the role of probability and chance in quantum physics. They believed in a reality that exists 'out there' independently of whether it is observed or not. They were convinced that quantum physics is incomplete, only a part of the whole truth, and there is a complete theory waiting to be discovered.»[39]

In 1935, Einstein, Podolsky and Rosen published a paper outlining a mechanism to test whether an independent objective reality exists or not. «John Bell devised an inequality in 1964 to experimentally explore this concept. The experiments, however, demonstrated that the inequality was violated indicating that Einstein's view was incorrect. The experimental setup was questioned and some loopholes were identified. After multiple such rounds, it was finally in 2012 that the first loophole-free experiment, which violated Bell's inequality, was successfully conducted[30], proving that no independent objective reality exists;»[39] for which the Nobel Prize in Physics was awarded in 2022[31].

Another way of testing whether independent objective reality exists «is provided by the Leggett Garg inequality (devised in 1985). Experimental falsification of this inequality would not only falsify independent objective reality but would also confirm that quantum physics is not limited to micro-world but can also be applied to bigger objects. In Jan 2022, a team of scientists published their findings after successfully conducting the first loophole-free experiment that showed a significant amount of violation of Leggett Garg inequality[32].»[39]

These two are the most decisive experimental refutations of the notion of independent objective reality. The quantum theory, which is very similar to the concepts explained by the non-materialist philosophies, is an acceptable theory of viewing the sub-atomic world. The framework of manifested world arising from an unmanifested field of existence (which the non-materialists call The Ultimate Reality or Universal-Consciousness) is now considered as a useful framework for understanding this universe. Yet, some scepticism continues.

A question that is often asked by the materialist community is that if indeed this material world (Category 2) is 'kind of swimming' in the non-physical universal field of Universal-Consciousness (Category 1) and if indeed the material and efficient cause of all entities in this universe is Universal-Consciousness, then why are some entities animate and some inanimate? Why does the degree of consciousness in different entities vary e.g. plants display minimal consciousness, human beings display maximum and stones and rocks display none?

The answer lies in the nature/degree of association of Category 1 and Category 2. The metaphor often used to explain this is that of a mirror and light. If the mirror is clean and shiny, it reflects maximum light falling on it, whereas a dusty mirror reflects lesser light and a non-reflecting surface like mud or wood will not reflect any light. Another example of the nature/degree of association affecting the properties of various substances is available in Chemistry. Some elements are inert, some are highly reactive, some are very unstable and disintegrate (radioactive), some form ionic bonds, some form covalent bonds…yet, they are all composed of electrons, protons and neutrons. The properties displayed by each element depends on the nature of association of electrons, protons and neutrons, i.e. their number and their arrangement, within the atom.

MIND-MATTER INTERACTION AND PARAPSYCHOLOGY EXPERIMENTS

As mentioned in one of the previous sections, non-materialist paradigms claim that Universal-Consciousness is the material and efficient cause of everything in this universe. In other words, everything in this world arises from Universal-Consciousness which, in turn, implies that we are all interconnected at some level. *Vedānta* further describes the relationship of the inner-most core of the sentient being (individual's consciousness) and Universal-Consciousness using the *mahāvākya* (The Great Saying) – *'tat tvam asi'* which translates to 'thou art that'. 'Thou' stands for individual's consciousness and 'That' stands for Universal-Consciousness.

The materialists view the above statements with a lot of scepticism and say that these ideas, no matter how motivated by theory or by elegance, must stand up to experimental scrutiny. If there is no evidence to support an idea, it must be discarded.

'Tat tvam asi' states that the individual's consciousness is same as Universal-Consciousness. We also know that everything in this world arises from Universal-Consciousness. So, we are connected with everything else in this universe. Therefore, a person should be able to tap into this interconnection using the 'force of will' and the impact of the conscious intent should be observed in the physical world.

This impact of the conscious intent on the physical world can be and has been demonstrated experimentally[33].

Institute of Noetic Sciences (IONS)[34], which was established in 1973, has conducted extensive research to reveal the interconnected nature of reality through scientific exploration and personal discovery. We are sharing below a few paragraphs from a recent article[35] by their chief scientist, wherein he gives an overview of several well-documented experiments carried out in the last few decades that have patterns which are undeniable.

> *"Science involves two related efforts: methods for carefully observing and evaluating phenomena, and theoretical explanations of the resulting measurements. These endeavors are like two sides of a seesaw. Together they form the most effective way of understanding reality that humanity has devised, so far."*
>
> *"Force of will involves the use of focused intention to affect aspects of the physical world. In parapsychology, this claim has been studied on a wide range of physical targets, from the subatomic to the macroscopic. And again, we can say with some confidence that mental intention does affect aspects of the physical world. The observed effects are usually small in magnitude and appear to involve modulation of probabilistic effects rather than application of forces or fields. But it exists."*
>
> *"Of the various categories of experiments investigating intentional effects on the physical world, three classes of physical target systems stand out: tossed dice, random number generator outputs, and photon interference. The first class involves about a half-century of experiments involving the tossing of dice, from the 1930s to the 1980s. A review of all published relevant studies indicates that over time these experiments became progressively more rigorous as potential loopholes found in earlier studies were identified and closed. The most rigorously controlled studies continued to show small magnitude but statistically significant effects in experimental conditions, and null outcomes under control conditions when no one was trying to influence the outcomes."*
>
> *"In the 1960s, after the development of electronic circuits that could generate and automatically record random events, dice studies declined, and electronic random number generators (RNGs) became the primary physical target used in many parapsychology laboratories around the world. By the late 1980s, hundreds of RNG experiments had been reported. Several meta-analyses have since been published to review and integrate these studies, and the results again showed small magnitude but statistically significant effects."*
>
> *"Near the turn of the 21st century, investigators began to expand this type of research into an unsolved problem in physics called the "quantum measurement problem" (QMP). This refers to an intriguing phenomenon whereby quantum objects, like photons or "particles" of light, behave differently when they are observed than when they are not observed. This effect is most readily observed in a double-slit optical system, because with that apparatus if one observes which of the two slits a photon*

passes through, then the pattern of light observed on a screen after the photons go through the two slits will indicate that the photons behaved like particles. But if one does not observe the photons then the pattern of light will indicate that the photons behaved like waves."

"This "wave-particle duality" depending on observation remains a persistent puzzle because it violates the commonsense doctrine of realism, which assumes that the physical world is completely independent of observation. This conflict thrusts into stark contrast our everyday assumptions about the nature of reality, as sometimes expressed by the question: Is the moon still there if you don't look at it?"

"This puzzling phenomenon compelled the developers of quantum theory to deeply ponder the meaning of observation. Some, like Wolfgang Pauli, Pascual Jordan, and John von Neumann, believed that some aspect of consciousness, specifically meaning awareness, attention, and/or intention, might be key to understanding the QMP. For example, Jordan wrote, "Observations not only disturb what has to be measured, they produce it… We compel [the electron] to assume a definite position…. We ourselves produce the results of measurement.""

"This strong view of the role of consciousness in the QMP has been endorsed by many other prominent physicists, including a sizeable minority of contemporary physicists and scholars who specialize in studying the foundations of quantum theory. The prominence of those who originally proposed this idea has made the idea difficult to blithely ignore, but to many it challenges their deeply held intuition that the physical world must have been in its present form long before consciousness evolved to observe it. That resistance is, of course, based on the philosophical (and current scientific) doctrine of materialism, which assumes that consciousness evolved from matter. This is opposed to the esoteric view that consciousness is fundamental, which assumes that it was the material world that evolved, and not consciousness. Perhaps many contemporary physicists continue to resist this consciousness-related explanation of the QMP because they've forgotten, or never knew, that the founders of quantum theory were not merely interested in esoteric and mystical concepts, but that they used those concepts to assist in developing the mathematical formalisms of quantum theory."

"History and philosophical preferences aside, the double-slit experiment suggests an intriguing way to explore the meaning of observation in the QMP, and in particular the possible role of consciousness. If one takes the idea that consciousness is more fundamental than the physical world, then awareness itself should transcend everyday space-time constraints, in which case conscious entities like humans may be able to become aware of anything, anywhere, by narrowing their focus of attention to a particular location. If that were possible, then in principle one could gain which-path knowledge about photons passing through a double-slit interferometer. And if that

happened, then the photon interference pattern would shift from wave-like behavior to particle-like behavior, in proportion to the degree of certainty of the information gained. The ability of humans to precisely control awareness in this way would presumably be weak and variable due to the unavoidability of mind-wandering, but it would nevertheless be a way to test the "consciousness-collapse interpretation" of quantum mechanics, where the term collapse refers to a change in the quantum wavefunction, the probabilistic wave-like description of the physical world."

"To conduct such a test in practical terms, individuals would be invited to focus their attention toward or away from a double-slit system while holding the intention to gain information about the photons' path. Starting in 1998, some 30 experiments based on this idea have been reported by five independent labs using different protocols, optical setups, and analytical approaches. Of those tests, 14 were reportedly statistically significant at $p < 0.05$ (two-tail), where just one or two significant results would have been expected by chance. The probability of this outcome (a rough estimate of repeatability) is associated with odds against chance beyond a billion to one. This suggests the existence of a genuine mind-matter interaction effect as proposed by John von Neumann and others."

WHAT DOES ALL THIS REVEAL ABOUT THE ROOT CAUSE OF HUMAN CONSCIOUSNESS

Pure Sciences is now revealing many more pieces of information that are difficult to believe. For example, we all know that matter is made up of atoms, which, in turn, consist of electrons, protons and neutrons. About a century ago, physicists conducted multiple experiments and found that more than 99.9% of the atom is empty space[36]. They discovered that almost all the mass of the atom resides in the tiny nucleus (which contains closely packed protons and neutrons) and electrons revolve around this nucleus.

A few years ago, particle physicists made another startling discovery. The sum of the mass of the three quarks that make a proton or a neutron is only about 1% of the mass of the proton or neutron. The remaining 99% of the mass comes from the massless and very high energy particles called gluons (elementary particles corresponding to strong nuclear force) that hold the quarks (elementary particles of matter i.e. proton and neutron) together[37]. The gluons are locked up in the tiny confines of a proton or a neutron and their energy translates into what we perceive as mass (Einstein's equation $E=mc^2$).

In other words, Pure Sciences has revealed that what we perceive as matter is essentially empty space and mass is not an intrinsic property of matter. Actuality is very different from what the mind perceives as fact. The examples shared above confirm that nothing in this universe can be taken on face value.

Coming back to our key question – is consciousness an emergent property of the brain or a fundamental reality of the Universe?

The above discussions clearly show that with each new research study or experiment we are inching towards the realisation that non-materialist framework is a plausible framework for understanding our universe and we do not seem to have any valid reason to reject the non-materialist paradigm in favour of the materialist paradigm.

All current scientific know-how is, in fact, pointing towards the possibility that both the paradigms could be co-existing. This can only be possible if the materialist framework is recognized as a special case (subset) of the non-materialist framework.

Acknowledging such an inclusive framework will imply that the contemporary materialist knowledge system continues to provide a good understanding of things that are manifested in our visual world of experience whereas the spiritual knowledge system provides the explanation for all known human phenomenology including the root-cause of human consciousness.

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Brief Profile of the Authors:

Anish Rakheja: An alumnus of IIT and IIM, Dr. Anish is an internationally accredited Executive Coach, Jyotish Acharya, and an eternal student of different schools of Vedanta & the Nalanda traditions of Buddhism. He holds regular classes on the Indian spiritual heritage primarily focusing on the Mind and Consciousness - both scientific and scriptural.

In recent years, Anish has been working with global leaders and executives enabling their personal journeys and deepening the awareness of their own reality. He has been the founder of multiple start-ups and is currently on the board of a few. He is also the author of the highly acclaimed 'The Mystic Millionaire' series, which provides a practical approach to spiritualizing our life and living.

Manish Pajan: As leadership consultant and coach, Manish is committed to helping organisations and business leaders find their next level of empowerment, growth and excellence. He regards it as his *swadharma* (one's designated duty) to be a humble enabler of human evolution, one interaction at a time.

In pursuing this objective, he draws on his 25-year varied experience with leading organisations, and the formal education he is fortunate to have received at some of India's top institutions (IIM Ahmedabad, IIT Roorkee, DAV-Gopalapuram Chennai).

Born to Kashmiri Pandit parents who instilled in him good values and exposed him to Indic wisdom from childhood, he believes he is guided on his path by the *anugraha* (grace) of his spiritually-elevated ancestors.

Switi Gupta: A chemical engineer (IIT Roorkee) with a master's in management systems (IIT Delhi), Switi's key focus area in the last 25+ years has been to design and develop easy-to-use systems for recording, managing and analysing data to successfully run enterprises. As founder member of Broad Strokes Ventures, she uses this experience to design IT solutions for remote business management, B2C marketplace and ERP solutions for Dairy & Food businesses.

She is also founder member at not-for-profit R&D organisation, GI4QC Forum, which is scientifically exploring the fundamental realm of reality in a balanced and structured way. She actively collaborates with other organisations and brings together like-minded people with the aim to transform the existing worldview to embrace a comprehensive spirito-scientific framework.

Statements and Declaration: This writeup is an expansion of a previous work titled "Universal Consciousness: Actuality or a Fragment of Imagination?" by two of the authors - Manish Pajan and Switi Gupta, which has not published in any journal but a copy exists on the website img1.wsimg.com and can be accessed using the link.

https://img1.wsimg.com/blobby/go/dc0a0457-36e4-4997-9420-90413cd54f35/downloads/Imagination%20Or%20Actuality%20-%202022%20Jun.pdf?ver=1671195657134

The common sections between the two writeups, which constitutes about 15% of this paper, are included within the quotation marks « and » and have been cited with reference number 39. No financial support was received for the work within this manuscript. The authors declare they have no conflict of interest.

References:

1. Tang, J., LeBel, A., Jain, S. *et al.* (2023). Semantic reconstruction of continuous language from non-invasive brain recordings. *Nature Neuroscience* 26, 858–866. https://doi.org/10.1038/s41593-023-01304-9

2. Daly, I. (2023). Neural decoding of music from the EEG. *Scientific Reports* 13, 624. https://doi.org/10.1038/s41598-022-27361-x

3. Brazdzionis, J., Wiginton, J., Patchana, T. *et al.* (2022). Measuring the Electromagnetic Field of the Human Brain at a Distance Using a Shielded Electromagnetic Field Channel. *Cureus* 14(3), e23626. https://doi.org/10.7759/cureus.23626

4. Grindrod P., Brennan M. (2023). Cognition and Consciousness Entwined. *Brain Sciences* 13(6), 872. https://doi.org/10.3390/brainsci13060872

5. Casali, A. G., Gosseries, O., Rosanova, M., Boly, M., Sarasso, S., Casali, K. R., Casarotto, S., Bruno, M. A., Laureys, S., Tononi, G., & Massimini, M. (2013). A theoretically based index of consciousness independent of sensory processing and behavior. *Science Translational Medicine* 5(198), 198ra105. https://doi.org/10.1126/scitranslmed.3006294

6. Brys, I., Barrientos, S.A., Ward, J.E. *et al.* (2023). 5-HT2AR and NMDAR psychedelics induce similar hyper-synchronous states in the rat cognitive-limbic cortex-basal ganglia system. *Communications Biology* 6, 737. https://doi.org/10.1038/s42003-023-05093-6

7. Timmermann, C., Roseman, L., Schartner, M. *et al.* (2019). Neural correlates of the DMT experience assessed with multivariate EEG. *Scientific Reports* 9, 16324. https://doi.org/10.1038/s41598-019-51974-4

8. Proudfoot, M., Woolrich, M. W., Nobre, A. C., & Turner, M. R. (2014). Magnetoencephalography. *Practical Neurology* 14(5), 336–343. https://doi.org/10.1136/practneurol-2013-000768

9. Crick, F., & Koch, C. (1990). Towards a neurobiological theory of consciousness. *Seminars in the Neurosciences* 2, 263-275. https://profiles.nlm.nih.gov/101584582X469

10. https://www.humanbrainproject.eu/en/

11. George A. Mashour, Pieter Roelfsema, Jean-Pierre Changeux, Stanislas Dehaene (2020). Conscious Processing and the Global Neuronal Workspace Hypothesis. *Neuron* 105(5), 776-798. https://doi.org/10.1016/j.neuron.2020.01.026

12. Tononi, G. (2004). An information integration theory of consciousness. *BMC Neuroscience* 5, 42. https://doi.org/10.1186/1471-2202-5-42

13. https://www.science.org/content/article/search-neural-basis-consciousness-yields-first-results

14. Stuart Hameroff (1998). Quantum computation in brain microtubules? The Penrose–Hameroff 'Orch OR' model of consciousness. *Philosophical Transactions Of The Royal Society A.* 356, 1869–1896. http://doi.org/10.1098/rsta.1998.0254

15. Anisiu, Mira-Cristiana (2018). Vera Rubin and the hypothesis of dark matter existence. 36. 13-23. https://www.researchgate.net/publication/333131297_Vera_Rubin_and_the_hypothesis_of_dark_matter_existence

16. Schmidt, B. P. *et al*. (1998). The High-Z Supernova Search: Measuring Cosmic Deceleration and Global Curvature of the Universe Using Type IA Supernovae. *The Astrophysical Journal* 507(1), 46–63. https://iopscience.iop.org/article/10.1086/306308

17. Khosravi, H., & Loudon, R. (1992). Vacuum Field Fluctuations and Spontaneous Emission in a Dielectric Slab. *Proceedings: Mathematical and Physical Sciences* 436(1897), 373–389. http://www.jstor.org/stable/52041

18. G. L. Klimchitskaya & V. M. Mostepanenko (2006). Experiment and theory in the Casimir effect. *Contemporary Physics* 47(3), 131-144. https://doi.org/10.1080/00107510600693683

19. A. Fragner *et al.* (2008). Resolving Vacuum Fluctuations in an Electrical Circuit by Measuring the Lamb Shift. *Science* 322, 1357-1360. https://www.science.org/doi/10.1126/science.1164482

20. Why is the Universe accelerating? Nobel Laureate Brian Schmidt explains: https://youtu.be/55pcpTjd3BY

21. Euclid overview: https://www.esa.int/Science_Exploration/Space_Science/Euclid_overview

22. https://med.virginia.edu/perceptual-studies/

23. Paál, G., Horváth, I. & Lukács, B. (1992). Inflation and compactification from Galaxy redshifts? *Astrophysics and Space Science* 191, 107–124. https://doi.org/10.1007/BF00644200

24. I-Non Chiu *et al*. (2023). Cosmological constraints from galaxy clusters and groups in the *eROSITA* final equatorial depth survey. *Monthly Notices of the Royal Astronomical Society* 522(2), 1601–1642. https://doi.org/10.1093/mnras/stad957

25. Hobson, A. (2013). There Are No Particles, There Are Only Fields. *American Journal of Physics* 81(3), 211-223. https://doi.org/10.1119/1.4789885

26. https://math.berkeley.edu/~kwray/papers/string_theory.pdf

27. Schwarz, John H. (1998). Recent developments in superstring theory. *Proceedings of the National Academy of Sciences* 95(6), 2750-2757. https://doi.org/10.1073/pnas.95.6.2750

28. Edward Witten (1995). String theory dynamics in various dimensions. *Nuclear Physics B* 443(1–2), 85-126. https://doi.org/10.1016/0550-3213(95)00158-O

29. https://home.cern/science/physics/standard-model

30. Bernhard Wittmann *et al.*(2012). Loophole-free Einstein–Podolsky–Rosen experiment via quantum steering. *New Journal of Physics* 14, 053030. https://doi.org/10.1088/1367-2630/14/5/053030

31. Dalibard, Jean & Gigan, Sylvain (2022). A Nobel prize for Alain Aspect, John Clauser and Anton Zeilinger. *Photoniques*. 23-25. https://doi.org/10.1051/photon/202211623

32. Kaushik Joarder, Debashis Saha, Dipankar Home, Urbasi Sinha (2022). Loophole-Free Interferometric Test of Macrorealism Using Heralded Single Photons. *PRX Quantum* 3(1), 010307. https://doi.org/10.1103/PRXQuantum.3.010307

33. Teodora Milojević, Mark A. Elliott (2023). The causal influence of conscious engagement on photonic behavior: A review of the mind-matter interaction. *Progress in Brain Research* 280, 1-16. https://doi.org/10.1016/bs.pbr.2023.03.005

34. https://noetic.org/

35. https://noetic.org/blog/magickal-sigils-scientific-test/

36. Ernest Rutherford (1911). LXXIX. The scattering of α and β particles by matter and the structure of the atom. *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science* 21(125), 669-688. https://doi.org/10.1080/14786440508637080

37. Walker-Loud, Andre (2018). Dissecting the Mass of the Proton. *Physics Online Journal* 11, 118. https://physics.aps.org/articles/v11/118

38. http://www.arhantayoga.org

39. Manish Pajan, Switi Gupta, (2022). Universal Consciousness: Actuality or a Fragment of Imagination?, *not published in any journal but a copy exists on img1.wsimg.com and can be accessed using the link* https://img1.wsimg.com/blobby/go/dc0a0457-36e4-4997-9420-90413cd54f35/downloads/Imagination%20Or%20Actuality%20-%202022%20Jun.pdf?ver=1671195657134

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The Scientific View of Yogaśāstra in the Bhagavad Gītā

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Abstract:

Yogaśāstra is the systematic methodology to be adopted or the rules of conduct to be practised by *Jīva* (a living being) to attain *'Mokṣa'* (liberation or enlightenment). The word *'Yoga'* comes from the root *'Yuj'*, which means to join. *Yoga* is that, which joins *Jīva* to their real Self or to the path of Self-Realization. *Yogaśāstra* of the *Bhagavad Gītā* is a very systematic methodology for a *Jīva* to evolve from any stage and realise their ultimate seeking - *Mokṣa*, the liberation.

Keywords: *Yogaśāstra*, Self-Realization*, Mokṣa*

INTRODUCTION

Bhagavad Gītā, as we all know, is the summary or essence of all the *Upanishads* or *Vedānta*. *Vedānta* is the culmination of the knowledge contained in the *Vedas*. In addition, *Bhagavad Gītā* has a unique contribution to mankind, the *Yogaśāstra,* the method to attain the goal which is revealed by *Upanishads* or *Vedānta*. However, *Yogaśāstra* of the *Bhagavad Gītā* is not to be confused with the *Aśtāng Yoga* of Patanjali.

WHAT IS 'SCIENTIFIC VIEW'?

For the sake of clarity, it is essential to clarify what is implied by the term 'Scientific View' in a given context. There is a difference between 'Science View' and 'Scientific View'. 'Science View' means explanation on the basis of current knowledge base developed by science. 'Scientific View' means a systematic objective, rational view of the subject. This is the sense in which the term 'Scientific' is used here.

Hence, here, in this context, the term 'Scientific View' means an objective view of the *Yogaśāstra*, clearly establishing its purpose, the dependencies, it's process and how it systematically achieves the said purpose. The understanding should be clear, logical, without any ambiguity. It should be complete without any gaps or missing links. With this perspective, in this article, we will try to understand the *Yogaśāstra*, revealed in the *Bhagavad Gītā*.

THE SUBJECT MATTER OF THE BHAGAVAD GĪTĀ – BRAHMAVIDYĀ AND YOGAŚĀSTRA

The quest of *Jīva* (a living being)

My quest is to be happy, free from all limitations and dependence and to be full and complete forever. I am actually seeking immortality, awareness, bliss and freedom from all limitations and sufferings. This is the fundamental quest of every living being, which manifests in variety of ways, leading to variety of endless pursuits. In reality, this is what I am actually trying to achieve through all my pursuits.

However, in spite of endless efforts, one does not seem to achieve this state. One does get these to some extent but again they are transitory and are lost. Thus, one has to continuously make endless efforts to just get fleeting glimpses of this state and never reaches the state one is actually seeking.

The fundamental problem

The *Bhagavad Gītā* reveals that the fundamental problem of a *Jīva* is his ignorance about his own True nature, ignorance of what he is in reality. This ignorance is called *Ajñāna*. He considers himself as a mortal suffering *Jīva* and tries to improve his state based on this perception.

The Ultimate Solution revealed by the *Bhagavad Gītā*

The *Gītā* reveals the knowledge of all the three areas, I - the Self, Creation, and *Īśvara* (God) and their interrelationships. It reveals the apparent nature as well as the Truth or the 'Absolute Reality' of these three. The Absolute Reality of all the three, is one and same, *Sat-Cit-Ānanda Svarūpa*. *Bhagavad Gītā* reveals that, the True nature of a *Jīva* - is *Sat-Cit-Ānanda*. *Sat-Cit-Ānanda* is that which is immortal, awareness, blissful, all the time. This is what *Jīva* is actually seeking, his own *Ātmasvarūpa* (one's true nature). This is achieved by realizing one's *Ātmasvarūpa*. Realizing this *Ātmasvarūpa* is *Mokṣa*, which is the ultimate goal of a *Jīva*.

This knowledge is called ***'Brahmavidyā'*** and is the primary subject matter of the *Gītā*.

With this knowledge, the goal of our life becomes clear!

Methodology to realise the solution: *Yogaśāstra*

Once I know the goal, I need to know how to achieve it and how to lead my daily life so as to realize the goal.

The *Gītā* gives a systematic methodology for this. This methodology is *Yogaśāstra*. With *Yogaśāstra*, every human being, at any level of spiritual progress can evolve himself and reach this Supreme Goal revealed by *Brahmavidyā* - *Mokṣa* - the real seeking of a *Jīva*.

Yogaśāstra helps me realize my *Ātmasvarūpa* and be a *Muktaḥ* (liberated person). Practicing of *Yogaśāstra* is called *Sādhanā*. Since this *Sādhanā* is for realizing *Mokṣa*, it is *Mokṣa Sādhanā*.

The word *'Yoga'* comes from the root *'Yuj'*, which means to join. *Yoga* is that, which joins me to my real Self or joins me to the path of Self-Realization, *Mokṣa*.

I have to make my own efforts to progress by practising *Yogaśāstra* till I realize *Ātmasvarūpa* as my own nature. My progress is in my own hands. The grace of *Īśvara* and a *Sadguru* (true guide, a person who has attained enlightenment) can help me, but only when I put in my efforts.

THE NEED FOR YOGAŚĀSTRA

My reality is *Ātmā*. The *Ātmā* is already perfect, free from all limitations, immortal and is of the nature of infinite happiness and consciousness. There is nothing to improve upon in *Ātmā*. No *Yogaśāstra* is needed to make the *Ātmā*, *Sat-Cit-Ānanda Svarūpa*. *Ātmā* is already that.

Then, why do I need *Yogaśāstra*? I have ignorance of who I am in reality. I need to recognise that I am *Sat-Cit-Ānanda Svarūpa Ātmā*. *Yogaśāstra* helps me to recognise my *Ātmasvarūpa*.

THE ROLE OF YOGAŚĀSTRA

To achieve this, *Yogaśāstra* has two roles.

- My faulty notions about my Reality are deeply embedded in my mind and intellect as *Saṁskāras* over so many births. *Yogaśāstra* helps me to overcome the compelling hold of my misunderstandings and release my mind and intellect from their pressures, making them ready and capable for knowledge. This is called purification of mind and intellect, *Antaḥkaraṇaśuddhi*.

- Secondly, *Yogaśāstra* removes my fundamental ignorance about my reality, reveals my True nature and helps me to recognize my *Ātmasvarūpa*. This is the ultimate goal of *Yogaśāstra*.

THE PROGRESSIVE NATURE OF YOGAŚĀSTRA

The path of *Yogaśāstra* is based on two things.

Firstly, its foundation is the knowledge of the Ultimate Truth - Absolute Reality.

Secondly, it acknowledges my present condition based on my typical perception of the Self, *Īśvara* and Creation, in which I am currently rooted. Hence, it gives me a step-by-step progressive methodology to evolve from my present stage and reach the ultimate goal.

My present confusion and misunderstanding about myself, the world and *Īśvara* is not simple. I have built layers upon layers of deeper and deeper misunderstandings and faulty notions.

Hence, in the cleaning process, I have to remove these layers step by step starting from the most compounded misunderstanding to the lesser ones. It is like peeling an onion layer by layer. It is a process of progressively destroying these multiple layers of misunderstandings and their influence on my mind and intellect and finally destroying self-ignorance, the root cause of these wrong notions. With the destruction of the basic self-ignorance by *Ātmajñāna* (knowledge of one's own *Pūrnatvam* or completeness, the True nature), I realize my *Ātmasvarūpa*.

As I progress step by step, at each stage, there is a certain condition that needs to be addressed. In order to address this, certain relevant knowledge is required and based on that, certain corrective action and practice is required. Thus, there is something 'to know' and then something 'to do'. Hence *Yogaśāstra* has various *Sādhanās* or *Yogas*, which are relevant at each stage. This knowing and acting together is the appropriate *Sādhanā* or *Yoga* at that stage. *Sādhanā* at each stage serves the purpose by making one ready for the next stage. Each stage is important; at the same time, having reached a particular stage, one needs to work for the next stage. Finally, *Yogaśāstra* destroys the ignorance of *Ātmasvarūpa*.

I climb the stairs step by step to finally reach my destination. Each step I take makes me ready for the next step. Also, I do not get stuck on any step and I keep moving further so that I finally reach the destination.

Similarly, *Yogaśāstra* is a step-by-step ladder of progressive stages, finally leading to be a *Muktaḥ*.

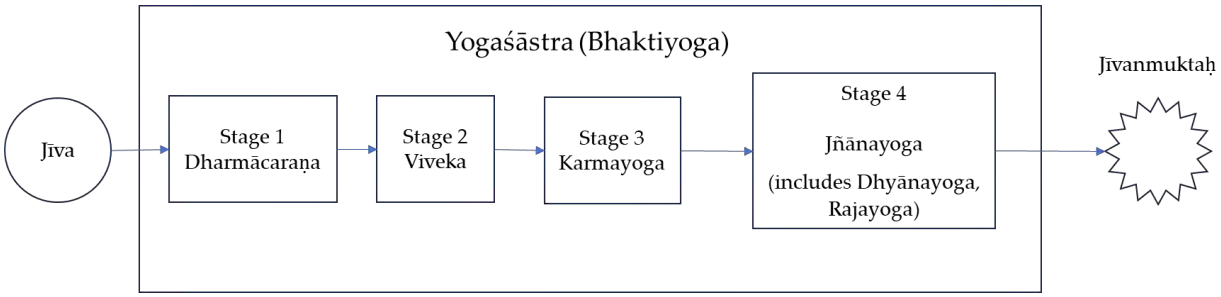
These successive stages of *Yogaśāstra* as given in the *Bhagavat Gītā* are –

1. *Dharmācaraṇa*
2. *Viveka*
3. *Karmayoga*
4. *Jñānayoga*
5. *Dhyānayoga* (This is considered as final stage of *Jñānayoga*)

There is a popular notion that *Karmayoga*, *Jñānayoga*, *Dhyānayoga* and *Bhaktiyoga* are independent paths leading to *Mokṣa*. However, if we analyse the prerequisites of each of first three and it's deliverable in terms of readiness it gives, as given in *Bhagavat Gītā*, then we find that deliverable of earlier stage in the above sequence is the prerequisite of next stage. Thus, these three are sequential stages. Similarly, these are preceeded by *Dharmācaraṇa* and *Viveka*.

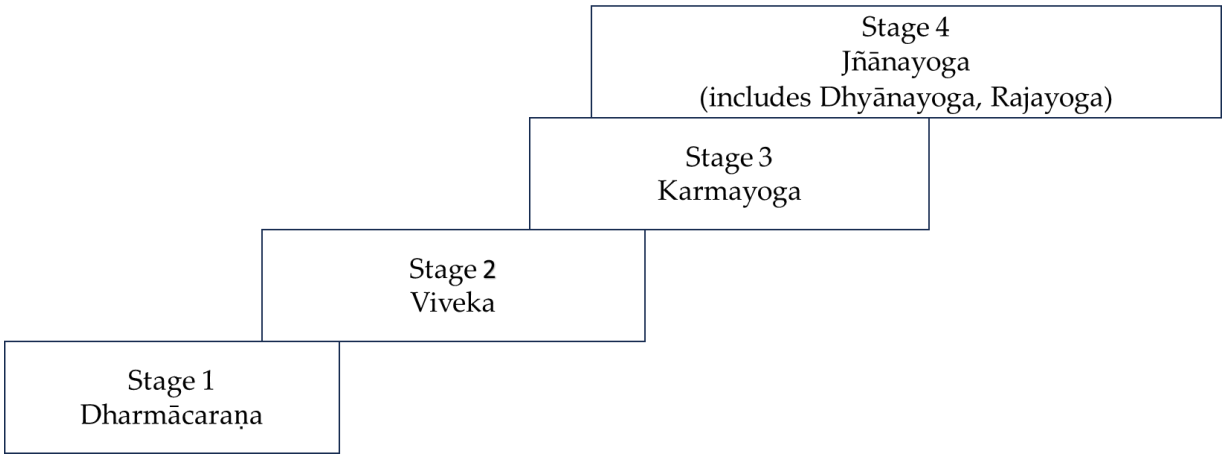
As regards to *Bhaktiyoga*, the vision of *Bhakti* in the *Bhagavat Gītā* has to be appreciated. As we will see, as per the *Bhagavat Gītā*, this whole process of *Yogaśāstra* together is *Bhaktiyoga*.

Thus, the progressive methodology that is *Yogaśāstra* which itself is *Bhaktiyoga*, can be represented as below.



OVERLAP OF PROGRESSIVE STAGES

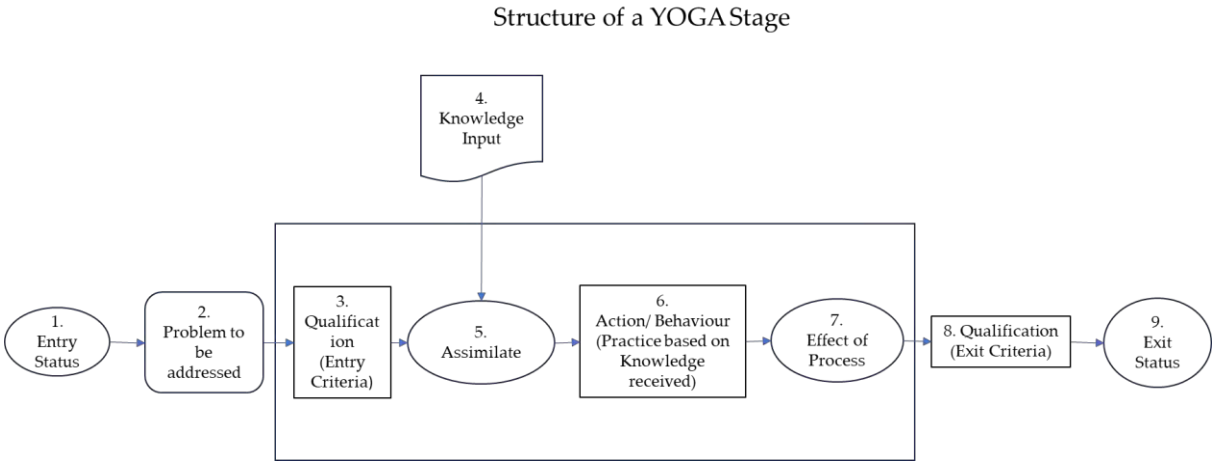
In reality, these are not watertight compartments as qualification of next stage gets acquired progressively. Hence the next stage to some extent can be started even before exiting the earlier stage fully. While all these steps of *Yogaśāstra*, namely *Dharmācaraṇa*, *Viveka*, *Karmayoga* and *Jñānayoga* can be pursued with overlap, the mastery of the earlier step makes it easier to practice the subsequent step. The earlier step makes one qualified for the next step. So, in reality the process may become something like what is depicted below.



THE STRUCTURE OF INDIVIDUAL YOGA

Yogaśāstra addresses needs at various stages. Since *Yogaśāstra* has to address the effects of different levels of confusion and misunderstandings, it has to do different jobs at each stage of progress. Hence, the different components of *Yogaśāstra* have specific purpose, which is relevant at that stage of progress and play different roles in my progress. Each component of *Yogaśāstra* is an individual *Yoga* or *Sādhanā* by itself. It removes the obstacle at that stage and makes me ready for the next stage, successfully steering the seeker to the ultimate goal of *Mokṣa*.

The structure of these stages or *Yogas* can be represented as in the diagram below.



1. Entry Status - A *Jīva* in the process of evolution is at a particular stage, e.g. *Asura*, *Ārta*, *Arthārthī*, *jijñāsu*, *Jñānī* etc.

2. Problem to be addressed – The most significant problem to be resolved at this stage so as to be able to progress further.
3. Qualification or Entry Criteria – There is certain amount of readiness necessary so as to be ready for a particular *Yoga.*
4. Knowledge Input – At this stage certain knowledge relevant for this *Yoga* is to be acquired.
5. Assimilation of Knowledge - This knowledge needs to be properly assimilated and appreciated.
6. Action or Behaviour – Based on the insight acquired with this knowledge, certain action or practice is to be done.
7. Effect of *Yoga* - This knowledge along with appropriate action creates its effect and resolves the Problem being addressed at this stage.
8. Exit Criteria – With the problem being resolved, the *Jīva* acquires certain qualification which is Exit Criteria at this stage and he becomes ready for next stage.
9. Exit Status – He gets a status which is subsequent status in the process of evolution.

Let us now briefly see each individual Stage of *Yogaśāstra*.

DHARMĀCARAṆA

Dharmācaraṇa is following the universal code of conduct, morals, and ethics. It consists of Values to be practised. There are several Values mentioned in the *Bhagavad Gītā*.

The focus of *Dharmācaraṇa* is the human mind and behaviour.

Dharmācaraṇa develops a *Sāttvika* (serene or balanced), peaceful mind and Intellect, free from internal conflicts. I get a relatively composed state of mind. It gives me mental strength and I get the capacity to reason out my way of living, *Viveka*. I get *Manuṣyatva*, a quality of a good Human Being.

Dharma sustains myself, society, and Creation. It is in the interest of all.

VIVEKA

Viveka is rational thinking and having an objective view of the world, my body, my mind, and my pursuits by understanding their nature and seeing their defects and limitations using rational enquiry.

The focus of *Viveka* is objectivity and correcting our perception of the world, my life and my expectations.

With *Viveka*, I can see the exaggerated positive or negative values I attach to things in the world and I correct them. With this, I grow out of the inappropriate longings or aversions for them. This is maturity called *Vairāgya* (growing out).

With *Vairāgya*, I get prepared for spiritual progress. I become ready for *Karmayoga*.

KARMAYOGA

Karmayoga is doing *Swadharma* as *Īśvarārpaṇa-Karma* with *Prasādabuddhi* towards the *Karmaphala* (visible and invisible result of action).

- *Swadharma* is doing what is appropriate for me to do in a given situation, considering larger interest, my duty and my own aptitude and nature.
- *Īśvarārpaṇa-Karma* is doing *Karma* (action) as service to *Īśvara* with an appreciation that it is *Īśvara's* will and one is the instrument for *Īśvara* to make it happen.
- *Prasādabuddhi* is an attitude towards the result of action, as the *Prasāda* (gracious gift), the acknowledgement from *Īśvara* and accepting it with reverence, independent of what it is.

The focus of *Karmayoga* is *Īśvara*.

Karmayoga gives me a serene and peaceful mind, undisturbed by anything around, and a clear intellect. I lose all impurities one by one and reach a stage where I get the purity of mind and intellect. This is *Antaḥkaraṇaśuddhi*.

My mind and intellect are now ready and become capable of acquiring and absorbing *Ātmajñāna*.

JÑĀNAYOGA (INCLUDING DHYĀNAYOGA OR RĀJAYOGA)

Jñānayoga is removing my *Ajñāna* (ignorance) about Self, by acquiring *Ātmajñāna.*

Jñānayoga consists of –

- *Śravaṇa*: Learning *Ātmajñāna*, the knowledge of the Absolute Reality of the Self, Creation and *Īśvara*, the Truth, from the *Sadguru* and from the *Vedāntik* texts, the scriptures.
- *Manana* means: Gaining complete clarity by reflecting on the knowledge acquired, doing analysis, introspection, and resolving all the doubts.

- *Dhyāna* and *Nididhyāsana* (Also called *Dhyānayoga* or *Rājayoga*): Assimilating the *Jñāna* and becoming one with it, by contemplation on the *Ātmasvarūpa*, *Brahmasvarūpa* and; while living in the world, being constantly awake to the Truth that everything is *Brahman* and I am *Brahman*. The focus of *Jñānayoga* is *Ātmajñāna*.

My root problem is *Ajñāna* of True Self, because of which, I exist as a mortal suffering *Jīva*. *Ātmajñāna* destroys *Ajñāna*. Once my *Ajñāna* goes, my *Ātmasvarūpa* is revealed and I get *Jñānaniṣṭha* (stabilised in knowledge), that is, I get established in *Ātmasvarūpa*. I awaken to the reality that I am *Sat-Cit-Ānanda Svarūpa*, I am *Muktaḥ*.

This knowledge releases me from all sufferings and limitations and gives the realization of that state of everlasting peace and happiness. I attain *Mokṣa*. I realise that, I am that which I am seeking. I become *Jīvanmuktaḥ*, one who has become *Muktaḥ*, in this life.

BHAKTIYOGA

Bhaktiyoga is seeking *Īśvara* with growing clarity, ultimately recognising oneness with *Īśvara Svarūpa*. This is *Mokṣa*. The whole *Yogaśāstra* itself is *Bhaktiyoga*.

Bhakti means devotion to *Īśvara* and is the process of seeking *Īśvara*. *Bhakta* is a devotee who is seeking *Īśvara*.

The focus of *Bhaktiyoga* is increasing clarity and knowledge about *Īśvara* and finally identify with *Īśvara*. The stages of maturity in *Bhaktiyoga* are:

- *Kāmyabhakti* of *Saguṇa* (with attributes), *Sākāra* (with form) *Īśvara* with *Dharmācaraṇa* and *Viveka*. It deepens my *Śraddhā* (faith) in *Īśvara*.
- Then *Niṣkāmabhakti* of *Saguṇa*, *Nirākāra* (formless) *Īśvara* with *Karmayoga*. It gives me *Antaḥkaraṇaśuddhi* and *Jijñāsā* (quest to know the Truth).
- *Ultimately Jñānabhakti and Ekabhakti of Nirguṇa* (attributeless)*, Nirākāra Īśvara with Jñānayoga. It leads me to Ātmajñāna.*
- With *Ekabhakti* with *Dhyāna* and *Nididhyāsana*, I recognise my identity with *Īśvara*. I become *Jīvanmuktaḥ*.

I attain *Mokṣa*, the ultimate seeking of a *Jīva*.

Having realised *Mokṣa*, nothing further is to be gained, as the ultimate purpose is realised.

CONCLUSION

Thus, *Yogaśāstra* of *Bhagavad Gītā* is a very systematic methodology for a *Jīva*, a worldly person, to evolve from any stage and realise the ultimate seeking of a *Jīva*, *Mokṣa*, the liberation.

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Brief Profile of the Author:

Uday Karanjkar is author of the book titled 'Gītā Bodh' which is conceptual presentation of The Bhagavad Gītā and Vedānta. The unique approach of the book makes it very easy for a seeker to grasp the total vision of the Bhagavad Gītā and Vedānta with clarity. The book has been highly appreciated. It is based on his 30 years of research and analysis of these text under the guidance of Pujya Swami SatSwarupananda ji. Based on his work Uday has been conducting Gītā sessions for several years.

He is a highly successful corporate leader. In his illustrious career of 37 years, he has handled a variety of senior management and expert responsibilities across various Engineering and IT industries. Last he was head of the Enterprise Systems Group in a leading IT industry. He was born in 1955 at Nagpur. He is an Electronics and Telecommunication engineer and a Post-Graduate in Industrial Engineering from NITIE Mumbai. Currently he lives in Pune, India. He is a passionate artist and loves painting watercolour landscapes and making sculptures. He loves the Himalayas and enjoys nature and trekking.

Glossary of Sanskrit Terms Used:

Please note: Since some Sanskrit words may not have a direct equivalent term in English language, we have mentioned the nearest English translation in this glossary. Also, some Sanskrit terms may have multiple meanings. This glossary lists the closest meaning in the context of this paper.

Antaḥkaraṇaśuddhi: purification of mind and intellect from hold of compulsive desires and all faulty notions

Ajñāna: ignorance about the Reality of Self

Ārta: distressed person who is suffering very much

Arthārthī: seeker of earthly possessions like wealth, power, position

Aśtāng Yoga: the eight-limbed path of conscious living and spiritual practice that guides one towards Self-knowledge. It is presented in the Yoga Sutras which was compiled by Patanjali.

Asura: those who live for themselves without any ethics and do nothing for others

Ātmā: Self

Ātmajñāna: knowledge of the True nature of Self

Ātmasvarūpa: one's True nature

Bhagavad Gītā: often referred to as the *Gītā,* it is a 700 verse Indic scripture, which is part of the epic – Mahabharata and is a dialogue between the Lord Shri Krishna and Arjuna.

Bhakta: a devotee who is seeking *Īśvara*

Bhakti: devotion to *Īśvara*; process of seeking *Īśvara*

Bhaktiyoga: seeking *Īśvara* with growing clarity, ultimately recognising oneness with *Īśvara Svarūpa*

Brahman: the sole, ultimate, unchanging reality underlying all phenomena; *Sat-Cit-Ānanda*

Brahmasvarūpa: of the nature of *Brahman*

Brahmavidyā: the knowledge that my true nature is *Sat-Cit-Ānanda* or I am *Brahman*

Dharma: morals and ethics

Dharmācaraṇa: following the universal code of conduct, morals and ethics

Dhyāna: contemplation

Dhyānayoga: contemplation on the Truth, my True nature as the Truth of all.

Ekabhakti: the stage of *bhakti* when one awakens to the Truth that everything is *Brahman* and I am *Brahman*

Īśvara: God

Īśvarārpaṇa: as service to God

Jijñāsā: quest to know the Truth

Jijñāsu: seeker of knowledge of the Truth

Jīva: a living being

Jīvanmuktaḥ: one who has gained Self-knowledge and is, therefore, liberated while living

Jñānayoga: removing ignorance about Self by acquiring knowledge of one's True nature and assimilating the same

Jñāna: knowledge

Jñānabhakti: the stage of Bhakti when you gain the knowledge of the True nature of Self

Jñānī: a person who has attained knowledge of Self

Jñānaniṣṭha: stabilised in knowledge

Kāmyabhakti: devotion with desire or expectations

Karma: action

Karmaphala: visible and invisible result of action

Karmayoga: doing *Swadharma* as *Īśvarārpaṇa-Karma* with *Prasādabuddhi* towards the *Karmaphala*

Manana: contemplating on the knowledge acquired to gain complete clarity by reflecting, doing analysis, introspection, and resolving all the doubts

Manuṣyatva: quality of a good human being

Mokṣa: liberation; enlightenment

Muktaḥ: liberated person

Nididhyāsana: assimilating the acquired knowledge by contemplation and being awake to it all the time

Nirākāra: formless

Nirguṇa: attributeless

Niṣkāmabhakti: selfless devotion

Prasāda: gracious gift

Prasādabuddhi: attitude of accepting all results of action with reverence, independent of what they are, with an appreciation that it is the *Prasāda* from *Īśvara*

Pūrnatvam: completeness

Rājayoga: Nididhyāsana

Sadguru: true guide, a person who has attained enlightenment, who gives the knowledge of the Truth

Sādhanā: disciplined or dedicated practice

Saguṇa: with attributes

Sākāra: with form

Saṁskāras: notions; mental impressions

Śāstra: the spiritual texts

Sat-Cit-Ānanda: immortal-awareness-blissful

Sāttvika: serene or balanced

Śraddhā: faith

Śravaṇa: learning or acquiring knowledge (traditionally through listening, but it also includes other means like reading etc.)

Svarūpa: true nature

Swadharma: doing what is appropriate for me to do in a given situation, considering larger interest, my duty and my own aptitude and nature

Upanishads: ancient Indic texts which appear at the end of Vedas and explain the *Brahmavidya*

Vairāgya: growing out of the inappropriate longings or aversions

Vedānta: it is the culmination of *Vedic* wisdom. It is covered in the *Upanishads*, the *Brahma Sutras*, the *Bhagavad Gītā* and some explanatory texts by Authorities

Vedāntik: belonging to *Vedānta*

Veda: the world's most ancient spiritual text originating in ancient India. It is the collection of four ancient Indic scriptures containing hymns, prayers, liturgical formulae and philosophy of life.

Viveka: rational thinking

Yoga: (1) to join; union (2) disciplined or dedicated practice

Yogaśāstra: the systematic methodology to be adopted to attain *'Mokṣa'* i.e. liberation or enlightenment

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Yoga for Industrial Workers with Prolonged Standing Hours: A Single-Blind Randomized Controlled Trial

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Abstract:

Several work scenarios necessitate long hours of standing. Prolonged standing is known to be associated with lower limb discomfort, vascular disorders, trunk discomfort and musculoskeletal disorders. Health problems due to prolonged standing affects individual's well-being resulting in absenteeism and productivity loss at the workplace. It can also burden health insurance. Therefore, prevention and management of adverse effects of long-term standing is an important concern in industries.

The present study was designed to understand the effect of yoga intervention on the adverse effects associated with prolonged standing work environment. A total of 66 participants from a factory setting in Pune were randomly assigned into experimental and control groups of 33 each. Rater's blinding was used while analysing the data. A standardised and validated yoga intervention was provided at the factory to the experimental group, after completing their shift, for a period of 60 min, 6 days a week for four weeks. The control group was offered the same intervention after completion of the study period.

Yoga intervention for four weeks has shown significant improvements in parameters like Ankle Blood Pressure, Ankle Brachial Pressure Index, Ankle and Mid-Calf Circumference, Body Mass Index (BMI), Respiratory rate, Bhramari Pranayama duration, as well as subjective feeling of fatigue, perceived level of stress and quality of life. The control group on the other hand, showed increase in fatigue, worsened quality of life in the follow-up period of four weeks. We can, therefore, say that yoga intervention for four weeks improves health parameters at both physical and psychological levels which may, in turn, potentially improve work

efficiency. Yoga, thus, could be a useful practice to enhance workplace wellness in industry settings.

Key Words: Yoga, Lower limb discomfort, Vascular disorders, Lower limb venous flow, workplace wellness, Musculoskeletal disorders

INTRODUCTION

Sitting vs. standing has been ongoing debate in human well-being because the human body is not designed for prolonged sitting. While standing offers benefits, remaining in one position for extended periods also carries health risks. Finding an optimal balance seems ideal, but achieving it in real-world scenarios can be challenging.

Many workplaces require employees to stand for extended periods, including assembly lines, machining operations, supermarket cashiers, quality control workers, healthcare staff, etc. In some scenario, the person has to stand in the same position for hours to carry out their work, whereas in some situations, some movement is a part of the process design. The standing working environment, which is a widely adopted industrial practise, can be broadly categorised into two types: dynamic standing, where some movement is involved, and static/passive standing, where the worker remains in a fixed position.

Previous research links prolonged standing to lower limb discomfort, vascular disorders, trunk discomfort, and musculoskeletal disorders. Factors contributing to discomfort include muscular fatigue and increased blood pooling in the lower limbs. It's hypothesized that standing reduces venous return, leading to higher pressure and potentially explaining increased discomfort, impaired venous valves, and peripheral vascular disorders (Antle et al., 2018; Antle & Côté, 2013). Additionally, research suggests stationary standing decreases blood flow to muscles, accelerating fatigue and causing pain in legs, back, and neck (Halim et al., 2012). Prolonged standing may also lead to temporary joint immobility and potential rheumatological issues due to wear and tear on tendons and ligaments (Putz-Anderson et al., 1997). Diurnal work with prolonged stationary standing can worsen muscle fatigue, lower back pain, neck/shoulder stiffness, and other health problems.

These health issues impact individual well-being, increase absenteeism, decrease workplace productivity, and strain health insurance systems. Therefore, the prevention of musculoskeletal disorders that were associated with prolonged standing in the workplace has become an increasingly important concern in vast majority of industries.

Yoga, practiced in India for centuries to promote physical and mental well-being, has shown effectiveness in managing musculoskeletal issues like lower back pain (Cramer, 2013; Tekur et al., 2008), lower limb pain (Deepeshwar et al., 2018), and fatigue (Kiecolt-Glaser et al., 2014). Research demonstrates its benefits for medical professionals (Saoji, 2016), computer

professionals (Telles et al., 2009), defense personnel (Highland et al., 2018), and athletes (Hakked et al., 2017; Polsgrove et al., 2016)

While limited research exists on the effects of yoga for industrial workers with prolonged standing shifts (Pravalika et al., 2023; Yamuna et al., 2024), the potential to address the health concerns associated with prolonged standing justifies further investigation. This study aimed to explore this possibility.

OBJECTIVES AND HYPOTHESIS

The present study aims to investigate the effects of a yoga intervention on the adverse health conditions associated with prolonged standing work environments.

Objectives:

- To examine the effect of yoga intervention on lower limb blood pressure.
- To evaluate the effectiveness of yoga in managing musculoskeletal symptoms and fatigue.
- To explore the effects of yoga on perceived stress and quality of life.

Research Hypothesis:

Yoga intervention may reduce lower limb discomfort, fatigue, and perceived stress, and improve quality of life.

Null Hypothesis:

Yoga intervention has no significant effect on lower limb discomfort, fatigue, perceived stress, and quality of life

METHODOLOGY USED

A total of 66 participants/subjects were recruited (33 in experimental group and 33 in control group). Subjects were selected from a factory located in Chakan, Pune, India, operated by M/s Keihin FIE Private Limited, a subsidiary of Keihin Corporation, Japan.

Inclusion criteria:

- Adult volunteers aged 20-50 years, working in shifts at M/s Keihin FIE Private Limited, Chakan, for at least 6 months prior to study recruitment.
- Subjects with self-reported lower limb discomfort and/or pain, or low back pain attributed to work.
- Cleared for participation by a trained physician through a routine clinical examination.

Exclusion criteria:

- Subjects with major health conditions, including cardiovascular, respiratory, or psychiatric illnesses, were excluded.
- Subjects with osteoarthritis of the hips or knees, other rheumatological problems, or back pain due to spinal pathology were excluded.

Ethical Consideration:

Written informed consent was obtained from all participants after a detailed explanation of the study protocol. Participants had the opportunity to ask questions and were free to withdraw at any point without penalty. The study was approved by the Institutional Ethics Committee of Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA), Bangalore.

Study Design:

We employed a single-blind, randomized wait-list controlled design. This is a type of randomized controlled trial (RCT) where participants are divided into two groups (intervention and control). The initial 66 participants were randomly assigned to either the yoga group (n=33) or the wait-list control group (n=33). The control group received no yoga intervention during the four-week study period but was offered the same intervention after the completion of the study and assessment of the yoga group. Blinding of the data analysts was ensured.

Intervention:

Yoga program was specifically designed and validated by S-VYASA to address the needs of workers in prolonged standing postures was implemented. The details of the yoga practices are presented in Table 1 (Yamuna et al., 2023).

Table 1: Validated Yoga module

Sr	Yoga Module – Subject content	Rounds (Nos)	Time (Min)
	Starting Prayer: ॐ सहनाववतु.....	1	2
	Loosening Exercises: Sitting position		
1	Knee tightening and rotation (Clock wise / Anti clock wise)	10	2
2	Ankle rotation (Clock wise / Anti clock wise)	10	2
3	Feet movements – (Push/Pull & Right / Left)	10	2
	Loosening Exercises: Standing Position		
4	Toe walking – (Forward and Backward)	10	1
5	Heel walking – (Forward and Backward)	10	1
	Instant Relaxation Technique	1	1
	Loosening Exercises: Supine Position		
6	Side lying leg lifts	10	2
7	Supine position- Single and both Leg raise to 10, 30, 45, 60 and 90 degrees with a hold for 5 seconds.	5	3
8	Supine position- Single straight leg raising slowly to 90 degree and then rotation clockwise and anticlockwise. Do for both legs.	5	3
	Breathing Exercises		
9	Ankle Stretch Breathing	10	2
10	Tiger Breathing	10	2
11	Alternate Leg Raising (from Supine position)	10	2
	Quick Relaxation Technique	1	4
	Asanas - Standing Postures		
12	Parivritta trikonasana (RH side and LH side)	1	2
13	Veerabadrasana (RH side and LH side)	1	2
	Asanas - Sitting Postures		
14	Vakrasana (RH side and LH side)	1	2
	Asanas - Prone Postures		
15	Bhujangasana	1	2
16	Shalabasana	1	2
	Asanas - Supine Postures		
17	Pawanamukthasana (Left leg, Right leg, Both legs)	1	3
18	Vipareetakarani	1	2
	Deep Relaxation Technique	1	8
	Pranayama		
19	Nadisuddhi Pranayama	5	3
20	Bhramari Pranayama	3	2
	Closing Prayer: ॐ सर्वे भवन्तु सुखिनः	1	2

ASSESSMENT TOOLS

Blood Pressure (Systolic and Diastolic) at Arm and Ankle:

Blood pressure was measured using an automated oscillometric blood pressure monitor (OMERON HEM 7130 Model) on participants in a lying down position at both the arm and ankle. Ankle-brachial pressure index (ABPI) was calculated to assess peripheral vascular health based on the readings (Verberk et al., 2012).

Pulse Rate:

Pulse rate, measured in beats per minute (bpm), was assessed using the same automated oscillometric blood pressure monitor that was used to measure blood pressure.

Leg Circumference at Ankle and Mid-calf:

Ankle and mid-calf circumference were measured manually using a flexible tape to assess potential lower limb swelling. Participants were seated on an examination table with legs dangling at a 90-degree knee flexion, ensuring no weight bearing on the feet.

Respiratory Rate:

Respiratory rate (cycles per minute) was observed by monitoring chest or abdominal rise and fall while participants were asked to relax on a chair, close their eyes, and focus on pleasant memories to minimise manipulation.

Breath holding time - Bhramari Pranayama duration:

Breath-holding time (BHT) was measured as the maximum duration a participant could hold their breath comfortably before resuming breathing. Participants were instructed to take four long breaths to calm down, followed by one long inhalation and exhalation with an "Om" sound (Bhramari Pranayama). The longer duration of two attempts was recorded.

BMI – Body Mass Index:

BMI was calculated using weight (kg) divided by height squared (m^2). The standard BMI categories were mentioned (normal: 18.5-24.9, overweight: 25-29.9, obese: 30-39.9, morbidly obese: >40).

Biologically it is possible that person may have obese BMI and be metabolically healthy and person with normal BMI can be metabolically unhealthy. But it is also true that Obesity does have links with many health consequences like high blood pressure, type 2 diabetes, coronary heart disease, Sleep apnea, etc.

Musculoskeletal Health Questionnaire:

It is a validated tool for assessment of joint, back, neck, bone and muscle symptoms (Hill et al., 2016). This 15-item scale was used to determine the overall health of musculoskeletal system in healthy as well as clinical population.

SF 12 Health Survey:

The 12-Item Short Form Health Survey (SF-12) is a validated tool to assess the physical and mental Quality of Life (Gandek et al., 1998) of an individual and was deployed to assess the impact of yoga intervention on Quality of Life.

Chalder Fatigue Scale:

This self-administered 14-item questionnaire was used for measuring the extent and severity of physical and mental fatigue (Chalder et al., 1993).

Fatigue Severity Scale:

It is a self-report measure (Krupp, 1989) which was used to assess the respondent on a 9-item scale like how fatigue affects motivation, exercise, physical functioning, carrying out duties, interfering with work, family, or social life.

Perceived Stress Scale:

The Perceived Stress Scale (Cohen et al., 1983) is a classic stress assessment instrument which was used to understand the impact of yoga on the perceived stress using questions related to the subject's feelings and thoughts during the period of the study.

DATA EXTRACTION & DATA ANALYSIS

Data Extraction:

Data was collected from participants before and after the intervention using standardised measurements, questionnaires, and manual scoring keys for all participants in both the experimental and control groups. The data was organized in a spreadsheet with one row for each participant.

Data Analysis:

The normality of the data was tested using Shapiro-Wilk's Test and based on the normality, appropriate tests were employed for analysis of the data.

Within Group Analysis:

- For normally distributed data, paired-samples t-tests were performed to analyse changes within each group over time.
- For non-parametric data, Wilcoxon signed-rank tests were used to assess changes within each group.

Between Group Analysis:

- For normally distributed data, independent-samples t-tests were conducted to compare changes between the experimental and control groups.
- For non-parametric data Mann-Whitney U tests were used for between-group comparisons.

RESULTS

The results of the objective variables are presented in Table 2. The results of the questionnaires are presented in Table 3. Statistical significance levels are indicated in the tables.

Table 2: Results of the objective variables

Variable	UoM	Experimental Group		Control Group		p-value	df	Effect size
		Pre	Post	Pre	Post			
Weight	Kgs	71.02 ± 7.88	70.08 ± 7.70 ***	71.05 ± 8.06	70.80 ± 8.01	=0.708	64	0.091
BMI – Body mass index	Kg/m^2	24.85 ± 2.53	24.52 ± 2.40 ***	25.44 ± 2.23	25.35 ± 2.15	=0.147	64	0.364
Respiratory rate (RR)	Cycles/Min	19.52 ± 2.82	17.33 ± 2.38 ***	18.48 ± 2.74	19.39 ± 3.37	<0.05	64	0.706
Bhramari time (BhrT)	Sec	16.61 ± 4.37	21.36 ± 4.08 ***	15.18 ± 4.79	15.21 ± 4.40	< 0.001	64	1.449
Pulse rate – Arm (HR)	beats/Min	78.36 ± 8.52	73.79 ± 6.17 **	78.88 ± 9.04	79.55 ± 8.61	< 0.01	64	0.769
BP (Systolic) – Arm (SBP Arm)	mmHg	118.15 ± 9.97	116.58 ± 9.09	118.00 ± 10.05	118.91 ± 8.95	=0.297	64	0.258
BP (Diastolic) – Arm (DBP Arm)	mmHg	74.24 ± 6.84	74.06 ± 6.34	74.52 ± 7.13	75.88 ± 6.94	=0.271	64	0.274
BP (Systolic) – Ankle SBP Ankle)	mmHg	126.67 ± 12.51	122.15 ±10.02 **	127.70 ± 11.09	128.12 ± 8.85	<0.05	64	0.631
BP (Diastolic) – (DBP Ankle)	mmHg	73.15 ± 7.37	71.03 ± 5.98**	74.76 ± 7.05	75.79 ±6.19	<0.01	64	0.782
Ankle Brachial Pressure Index	No.	1.07 ± 0.08	1.05 ± 0.07 *	1.08 ± 0.06	1.08 ± 0.06	=0.067	64	0.460
Ankle – Circumference (Ank Cir)	Cms	26.94 ± 1.41	25.39 ± 1.52 ***	27.02 ± 1.34	27.17 ± 1.65	<0.001	64	1.122
Mid-Calf – Circumference (Calf Cir)	Cms	36.39 ± 2.14	34.64 ± 2.86 ***	36.44 ± 2.02	36.36 ± 2.14	<0.01	64	0.681

Table 3: Results of the Subjective variables

Variable	Experimental Group		Control Group		p-value	df	Effect size
	Pre	Post	Pre	Post			
CFS: Chalder Fatigue Scale Scores	13.97 ± 4.38	8.601 ± 5.18 **	13.79 ± 1.11	14.48 ± 1.25 ***	<0.001	64	1.558
FSS: Fatigue Severity Scale Score	3.75 ± 0.90	2.91 ± 1.20 ***	3.96 ± 0.70	4.11 ± 0.67 **	<0.001	64	1.235
PSS: Perceived Stress Scale Score	18.79 ± 3.43	14.33 ± 4.35 ***	19.30 ± 1.90	20.18 ± 1.70 *	<0.001	64	1.771
MHQ: Musculoskeletal Health Questionnaire Score	24.09 ± 7.67	13.73 ± 8.75 ***	22.36 ± 2.86	23.82 ± 3.20 ***	<0.001	64	1.531
SF12_P: SF12 Health Survey Physical Score	13.64 ± 2.01	15.55 ± 1.72 ***	13.58 ± 1.84	14.15 ± 1.09 **	<0.001	64	0.972
SF12_M: SF12 Health Survey Mental Score	16.88 ± 2.30	21.67 ± 2.12 ***	16.36 ± 1.73	16.18 ± 1.74	<0.001	64	2.831
SF12_G: SF12 Health Survey Global Score	30.52 ± 3.90	37.21 ± 3.37 ***	29.94 ± 3.23	30.27 ± 2.41	<0.001	64	2.369

df: Degree of freedom
** $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$*

DISCUSSION

Our four-week yoga intervention resulted in significant improvements in weight, BMI, respiratory rate, Bhramari pranayama time, blood pressure at the ankle (systolic and diastolic), ankle-brachial pressure index and ankle and mid-calf circumference. The control group, on the other hand, did not show significant changes in most variables and even exhibited increased perceived stress, fatigue scores, and worsened musculoskeletal health at the follow-up. These trends are presented in Tables 4 and 5.

Industry workers engaged in prolonged standing are susceptible to lower limb blood vessel problems (Krijnen et al., 1997). Studies suggest that such populations have higher lower limb blood pressure and ABPI, which are risk factors for peripheral vascular diseases (Aboyans et al., 2012). The observed reductions in ankle blood pressure, ABPI, and ankle/mid-calf circumference following yoga intervention are particularly significant in preventing these vascular complications in the target population.

Musculoskeletal issues and fatigue are other major health concerns for these workers. Our findings demonstrated a reduction in both after the intervention period. Similar improvements in musculoskeletal health with yoga practice have been observed in other populations, such as patients with low back pain (Tekur et al., 2008) and osteoarthritis (Deepeshwar et al., 2018). The reduction in fatigue aligns with findings from studies on patients with chronic disorders (Banasik et al., 2011).

Table 4: Trends of changes in the objective variables

Variable	Experimental Group	Control Group
Weight	↓↓↓	—
BMI – Body mass index	↓↓↓	—
Respiratory rate (RR)	↓↓↓	—
Bhramari time (BhrT)	↑↑↑	—
Pulse rate – Arm (HR)	↓↓	—
BP (Systolic) – Arm (SBP Arm)	—	—
BP (Diastolic) – Arm (DBP Arm)	—	—
BP (Systolic) – Ankle (SBP Ankle)	↓↓	—
BP (Diastolic) – Ankle (DBP Ankle)	↓↓	—
Ankle Brachial Pressure Index	↓	—
Ankle – Circumference (Ank Cir)	↓↓↓	—
Mid Calf – Circumference (Calf Cir)	↓↓↓	—

Table 5: Trends of changes in the subjective variables

Variable	Experimental Group	Control Group
CFS: Chalder Fatigue Scale Scores	↓↓	↑↑↑
FSS: Fatigue Severity Scale Score	↓↓↓	↑↑
PSS: Perceived Stress Scale Score	↓↓↓	↑
MHQ: Musculoskeletal Health Questionnaire Score	↓↓↓	↑↑↑
SF12_P: SF 12 Health Survey Physical Score	↑↑↑	↑↑
SF12_M: SF12 Health Survey Mental Score	↑↑↑	—
SF12_G: SF12 Health Survey Global Score	↑↑↑	—

We also assessed quality of life using the SF-12 and perceived stress, finding significant improvements in the yoga group. These observations regarding enhanced quality of life and reduced perceived stress are consistent with the effects of yoga practices reported in other studies (Bower et al., 2012; Twal et al., 2016; Yang et al., 2016). In recent years, yoga has been utilized in various contexts to promote well-being, including reducing distress among tsunami survivors (Telles et al., 2007) and flood victims (Telles et al., 2010). Additionally, yoga has been extensively used in occupational settings to reduce discomfort and enhance worker efficiency, with applications for medical students (Saoji, 2016), healthcare professionals (Woodyard, 2011), athletes (Hakked et al., 2017), defence personnel (Amaranath et al., 2016), computer professionals, and musicians (Khalsa et al., 2009). To our knowledge, this is the first study to investigate the role of yoga in improving the health of industrial workers required to stand for extended periods. Similar studies could be replicated with other professions with prolonged standing requirements, such as supermarket cashiers and traffic police officers.

An important aspect of this study was the implementation of the yoga intervention directly at the workplace, promoting workplace wellness. Workplace wellness programs are crucial due to their impact on worker efficiency and overall industry output. The World Health Organization designated 2015 as the year for "Healthy Workplaces," aiming to address work-related physical and psychosocial risks and promote healthy behaviours among the workforce ("WHO | Healthy Workplaces: A WHO Global Model for Action," 2015).

Because the intervention occurred at the workplace, compliance was 100%. All participants completed the study without dropping out. While not formally measured, the company reported negligible worker absenteeism due to illness during the study period. Participants also expressed satisfaction with their improved health and found yoga beneficial for maintaining optimal physical function.

The observed positive effects in the experimental group may be attributed to the nature of the yoga intervention itself. The program included physical postures designed to stretch and relax muscles, yogic breathing techniques to regulate energy flow, and meditation for mental calmness. This integrated mind-body-breath approach is known to be beneficial in various health conditions. Specific focus on inverted postures, leg strengthening exercises, and core work might have improved lower limb circulation, contributing to the reduction in ABPI and ankle/mid-calf circumference. Additionally, yoga's stress-reducing and mood-enhancing effects (Kirkwood et al., 2005; Rao et al., 2017) likely contributed to the improved psychological well-being observed in the yoga group. Enhanced mood and better musculoskeletal health may have further contributed to reduced fatigue and improved quality of life.

The lack of improvement or even decline in fatigue, musculoskeletal health, perceived stress, and quality of life scores in the control group highlights the potential need for an active intervention like yoga for this target population.

CONCLUSION

The four-week yoga intervention significantly improved the physical and psychological health of industrial workers who stand for prolonged periods. These improvements included reduced blood pressure at the ankle, improved ankle-brachial pressure index, decreased ankle and mid-calf circumference, reduced fatigue and musculoskeletal complaints, improved perceived stress, and enhanced quality of life. This study suggests that yoga can be a valuable tool for workplace wellness programs in industries requiring prolonged standing, potentially benefiting workers in similar occupations such as supermarket cashiers and traffic police officers.

SUGGESTED FUTURE WORK

The study employed a randomized controlled trial design with rater blinding, which minimizes bias as double-blinding is not feasible with yoga interventions. Additionally, the wait-list control group received the intervention after the follow-up period. A strength of the study was the high compliance rate with no dropouts in either group due to the workplace intervention setting. The assessment battery comprehensively evaluated both physical and psychological

health aspects relevant to workers with prolonged standing. The yoga module itself was specifically designed and validated for this target population by experts at S-VYASA.

One limitation of the study was the use of a passive control group that continued with their usual activities. Including an active control group with a different physical exercise program could have provided insights into the specific effects of yoga compared to other forms of exercise. Additionally, the impact of the yoga intervention on work efficiency was not objectively measured but could be explored in future studies.

The study findings suggest that yoga is a safe and effective intervention to improve the health of workers with prolonged standing. This approach can be beneficial in various work environments with similar demands, potentially impacting a large population. Future studies could incorporate objective measures, such as Doppler studies, to assess vascular health and evaluate work performance changes in response to the yoga intervention. Additionally, including objective stress measures and biomarkers could provide further insights into the mechanisms underlying the observed positive effects.

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Brief Profile of the Author:

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He has 34 years of working experience in Automobile Industry in various functions like Production, Quality, Research and Development, Project Management, Component Development, Supply Chain Management and Export Operations. He completed Yoga Teachers course from Shivananda Ashram, Thiruvananthapuram and Basic Vedanta from Shivananda Ashram, Rishikesh. He likes Trekking, Scuba Diving and reading Spiritual Text.

Statements and Declaration: This paper is an expansion of the work done by Pramod Shahane towards the partial fulfilment of Master of Science in Yoga Therapy (2018), under the guidance of Dr. Apar Saoji & Dr. Ragavendraswamy, from Swami Vivekananda Yoga Anusandhana Samsthana, No.19, Eknath Bhavan, Gavipuram Circle, Kempegowda Nagar, Bangalore-560019, India. No financial support was received for the work within this manuscript. The authors declare they have no conflict of interest.

The consent forms and questionnaires used for monitoring the changes in the subjective variables to assess quality of life were not included while submitting this paper. These forms are available upon request from the author.

References:

Aboyans, V., Criqui, M. H., Abraham, P., Allison, M. A., Creager, M. A., Diehm, C., Fowkes, F. G. R., Hiatt, W. R., Jönsson, B., Lacroix, P., Marin, B., McDermott, M. M., Norgren, L., Pande, R. L., Preux, P.-M., Stoffers, H. E. J., Treat-Jacobson, D., American Heart Association Council on Peripheral Vascular Disease, Council on Epidemiology and Prevention, … Council on Cardiovascular Radiology and Intervention, and C. on C. S. and A. (2012). Measurement and interpretation of the ankle-brachial index: a scientific statement from the American Heart Association. *Circulation*, *126*(24), 2890–2909. https://doi.org/10.1161/CIR.0b013e318276fbcb

Amaranath, B., Nagendra, H., & Deshpande, S. (2016). Effect of integrated Yoga module on positive and negative emotions in Home Guards in Bengaluru: A wait list randomized control trial. *International Journal of Yoga*, *9*(1), 35–43. https://doi.org/10.4103/0973-6131.171719

Antle, D. M., Cormier, L., Findlay, M., Miller, L. L., & Côté, J. N. (2018). Lower limb blood flow and mean arterial pressure during standing and seated work: Implications for workplace posture recommendations. *Preventive Medicine Reports*, *10*, 117–122. https://doi.org/10.1016/j.pmedr.2018.02.016

Antle, D. M., & Côté, J. N. (2013). Relationships between lower limb and trunk discomfort and vascular, muscular and kinetic outcomes during stationary standing work. *Gait & Posture*, *37*(4), 615–619. https://doi.org/10.1016/j.gaitpost.2012.10.004

Banasik, J., Williams, H., Haberman, M., Blank, S. E., & Bendel, R. (2011). Effect of Iyengar yoga practice on fatigue and diurnal salivary cortisol concentration in breast cancer survivors. *Journal of the American Academy of Nurse Practitioners*, *23*(3), 135–142. https://doi.org/10.1111/j.1745-7599.2010.00573.x

Bower, J. E., Garet, D., Sternlieb, B., Ganz, P. A., Irwin, M. R., Olmstead, R., & Greendale, G. (2012). Yoga for persistent fatigue in breast cancer survivors: A randomized controlled trial. *Cancer*, *118*(15), 3766–3775. https://doi.org/10.1002/cncr.26702

Chalder, T., Berelowitz, G., Pawlikowska, T., Watts, L., Wessely, S., Wright, D., & Wallace, E. P. (1993). Development of a fatigue scale. *Journal of Psychosomatic Research*, *37*(2), 147–153. https://doi.org/10.1016/0022-3999(93)90081-P

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A Global Measure of Perceived Stress. *Journal of Health and Social Behavior*, *24*(4), 385. https://doi.org/10.2307/2136404

Cramer, H. (2013). Review: Yoga reduces low back pain and back-specific disability. In *Annals of Internal Medicine* (Vol. 159, Issue 8). https://doi.org/10.7326/0003-4819-159-8-201310150-02013

Deepeshwar, S., Tanwar, M., Kavuri, V., & Budhi, R. B. (2018). Effect of yoga based lifestyle intervention on patients with knee osteoarthritis: A randomized controlled trial. *Frontiers in Psychiatry*, *9*(MAY), 180. https://doi.org/10.3389/fpsyt.2018.00180

Gandek, B., Ware, J. E., Aaronson, N. K., Apolone, G., Bjorner, J. B., Brazier, J. E., Bullinger, M., Kaasa, S., Leplege, A., Prieto, L., & Sullivan, M. (1998). Cross-validation of item selection and scoring for the SF-12 Health Survey in nine countries: Results from the IQOLA Project. *Journal of Clinical Epidemiology*, *51*(11), 1171–1178. https://doi.org/10.1016/S0895-4356(98)00109-7

Hakked, C. S., Balakrishnan, R., & Krishnamurthy, M. N. (2017). Yogic breathing practices improve lung functions of competitive young swimmers. *Journal of Ayurveda and Integrative Medicine*. https://doi.org/10.1016/j.jaim.2016.12.005

Halim, I., Omar, A. R., Saman, A. M., & Othman, I. (2012). Assessment of Muscle Fatigue Associated with Prolonged Standing in the Workplace. *Safety and Health at Work*, *3*(1), 31–42. https://doi.org/10.5491/SHAW.2012.3.1.31

Highland, K. B., Schoomaker, A., Rojas, W., Suen, J., Ahmed, A., Zhang, Z., Carlin, S. F., Calilung, C. E., Kent, M., McDonough, C., & Buckenmaier, C. C. (2018). Benefits of the Restorative Exercise and Strength Training for Operational Resilience and Excellence Yoga Program for Chronic Low Back Pain in Service Members: A Pilot Randomized Controlled Trial. *Archives of Physical Medicine and Rehabilitation*, *99*(1), 91–98. https://doi.org/10.1016/j.apmr.2017.08.473

Hill, J. C., Kang, S., Benedetto, E., Myers, H., Blackburn, S., Smith, S., Dunn, K. M., Hay, E., Rees, J., Beard, D., Glyn-Jones, S., Barker, K., Ellis, B., Fitzpatrick, R., & Price, A. (2016). Development and initial cohort validation of the Arthritis Research UK Musculoskeletal Health Questionnaire (MSK-HQ) for use across musculoskeletal care pathways. *BMJ Open*, *6*(8), e012331. https://doi.org/10.1136/bmjopen-2016-012331

Khalsa, S. B. S., Shorter, S. M., Cope, S., Wyshak, G., & Sklar, E. (2009). Yoga Ameliorates Performance Anxiety and Mood Disturbance in Young Professional Musicians. *Applied Psychophysiology and Biofeedback*, *34*(4), 279–289. https://doi.org/10.1007/s10484-009-9103-4

Kiecolt-Glaser, J. K., Bennett, J. M., Andridge, R., Peng, J., Shapiro, C. L., Malarkey, W. B., Emery, C. F., Layman, R., Mrozek, E. E., & Glaser, R. (2014). Yoga's impact on inflammation, mood, and fatigue in breast cancer survivors: A randomized controlled trial. *Journal of Clinical Oncology*, *32*(10), 1040–1049. https://doi.org/10.1200/JCO.2013.51.8860

Kirkwood, G., Rampes, H., Tuffrey, V., Richardson, J., & Pilkington, K. (2005). Yoga for anxiety: a systematic review of the research evidence. *British Journal of Sports Medicine*, *39*(12), 884–891; discussion 891. https://doi.org/10.1136/bjsm.2005.018069

Krijnen, R. M., de Boer, E. M., Adèr, H. J., & Bruynzeel, D. P. (1997). Venous insufficiency in male workers with a standing profession. Part 1: epidemiology. *Dermatology (Basel, Switzerland)*, *194*(2), 111–120. https://doi.org/10.1159/000246077

Krupp, L. B. (1989). The Fatigue Severity Scale. *Archives of Neurology*, *46*(10), 1121. https://doi.org/10.1001/archneur.1989.00520460115022

Polsgrove, Mj., Eggleston, B., & Lockyer, R. (2016). Impact of 10-weeks of yoga practice on flexibility and balance of college athletes. *International Journal of Yoga*, *9*(1), 27. https://doi.org/10.4103/0973-6131.171710

Pravalika, B., Yamuna, U., & Saoji, A. A. (2023). Yoga for musculoskeletal pain, discomfort, perceived stress, and quality of sleep in industry workers: a randomized controlled trial. *International Archives of Occupational and Environmental Health*, *96*(10), 1349–1360. https://doi.org/10.1007/s00420-023-02013-3

Putz-Anderson, V., Bernard, B., Burt, S. S. E. S., Cole, L., Fairfield-Estill, C., Fine, L. L. J. L., Grant, K., Gjessing, C., Jenkins, L., Hurrel Jr., J., Nelson, N., Pfirman, D., Roberts, R., Stetson, D., Haring-Sweeney, M., & Tanaka, S. (1997). Musculoskeletal Disorders and Workplace Factors - A Critical Review of Epidemiologic Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper Extremity, and Low Back. In *Public Health: Vol. Publicatio* (Issue July 1997).

Rao, R., Raghuram, N., Nagendra, H., Kodaganur, G., Bilimagga, R., Shashidhara, H., Diwakar, R., Patil, S., & Rao, N. (2017). Effects of a yoga program on mood states, quality of life, and toxicity in breast cancer patients receivi ng conventional treatment: A randomized controlled trial. *Indian Journal of Palliative Care*, *23*(3), 237. https://doi.org/10.4103/IJPC.IJPC_92_17

Saoji, A. A. (2016). Yoga: A Strategy to Cope up Stress and Enhance Wellbeing Among Medical Students. *North American Journal of Medical Sciences*, *8*(4), 200–202. https://doi.org/10.4103/1947-2714.179962

Tekur, P., Singphow, C., Nagendra, H. R., & Raghuram, N. (2008). Effect of Short-Term Intensive Yoga Program on Pain, Functional Disability and Spinal Flexibility in Chronic Low Back Pain: A Randomized Control Study. *The Journal of Alternative and Complementary Medicine*, *14*(6), 637–644. https://doi.org/10.1089/acm.2007.0815

Telles, S., Dash, M., & Naveen, K. V. (2009). Effect of yoga on musculoskeletal discomfort and motor functions in professional computer users. *Work*, *33*(3), 297–306. https://doi.org/10.3233/WOR-2009-0877

Telles, S., Naveen, K. V., & Dash, M. (2007). Yoga Reduces Symptoms of Distress in Tsunami Survivors in the Andaman Islands. *Evidence-Based Complementary and Alternative Medicine*, *4*(4), 503–509. https://doi.org/10.1093/ecam/nem069

Telles, S., Singh, N., Joshi, M., & Balkrishna, A. (2010). Post traumatic stress symptoms and heart rate variability in Bihar flood survivors following yoga: a randomized controlled study. *BMC Psychiatry*, *10*(1), 18. https://doi.org/10.1186/1471-244X-10-18

Twal, W. O., Wahlquist, A. E., & Balasubramanian, S. (2016). Yogic breathing when compared to attention control reduces the levels of pro-inflammatory biomarkers in saliva: a pilot randomized controlled trial. *BMC Complementary and Alternative Medicine*, *16*, 294. https://doi.org/10.1186/s12906-016-1286-7

Verberk, W. J., Kollias, A., & Stergiou, G. S. (2012). Automated oscillometric determination of the ankle-brachial index: A systematic review and meta-analysis. In *Hypertension Research* (Vol. 35, Issue 9, pp. 883–891). https://doi.org/10.1038/hr.2012.83

WHO | Healthy workplaces: a WHO global model for action. (2015). *WHO*.

Woodyard, C. (2011). Exploring the therapeutic effects of yoga and its ability to increase quality of life. *International Journal of Yoga*, *4*(2), 49–54. https://doi.org/10.4103/0973-6131.85485

Yamuna, U., Madle, K., Majumdar, V., & Saoji, A. A. (2023). Designing and validation of Yoga module for workers with prolonged standing. *Journal of Ayurveda and Integrative Medicine*, *14*(5), 100788. https://doi.org/10.1016/j.jaim.2023.100788

Yamuna, U., Pravalika, B., Madle, K., Majumdar, V., & Saoji, A. A. (2024). Effect of Yoga in Industrial Workers with Chronic Venous Insufficiency: A Randomized Controlled Trial. *Journal of Integrative and Complementary Medicine*. https://doi.org/10.1089/jicm.2023.0691

Yang, Z.-Y., Zhong, H.-B., Mao, C., Yuan, J.-Q., Huang, Y.-F., Wu, X.-Y., Gao, Y.-M., & Tang, J.-L. (2016). Yoga for asthma. *The Cochrane Database of Systematic Reviews*, *4*, CD010346. https://doi.org/10.1002/14651858.CD010346.pub2

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Effect Of Yoga On Hemorheological Parameters Of Blood And Their Connection With Health

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Abstract:

Many diseases, including some mental ones, are observed to be cured by yoga. Besides an overall improvement in physical and mental health, the practice of yoga is also believed to improve the immunity of the individual. The aim of this paper is to identify the hemorheological parameters of blood which can be used as indicators of physical and mental health, and to show the qualitative and quantitative effect of yoga on these parameters.

A sample of 16 subjects was considered. They were taught preliminary yoga and they practiced yogic exercises everyday (for about 1 hour) for 50 consecutive days. Their early morning (fasting) blood samples were collected, before starting the yogic exercise course as well as after the 50 days of yogic exercise. Hemorheological parameters (whole blood viscosity, red cell aggregation, red cell rigidity) of the subjects were measured by contravas LS30 viscometer at eighteen different shear rates. It was observed that yogic exercise had a significant influence on blood viscosity factors. A drop in aggregability and rigidity of red cells and apparent viscosity at different shear rates was observed. The subjects also reported that they felt much better, physically and mentally, after the 50 days of yogic exercise course. It can therefore be concluded that the well-being is connected with hemorheological parameters of blood and yoga can positively impact these factors.

Keywords: Yoga, Blood Viscosity, Hemorheological Parameters

INTRODUCTION

Yoga improves individual's physical, mental and spiritual capabilities [1]. It is believed that yoga works on different systems of body and improves their functioning. For instance,

- Cleansing processes remove toxin materials from the body [2].
- Asanas provide relaxed muscles [3] which in turn demands less blood supply to muscles [4] and hence the load on the heart is reduced.
- Pranayam improves breathing pattern which helps in providing better oxygenated blood to organs and muscles, reducing lactic acid formation [5]

The hemorheological parameters of the blood can be measured and be used as an indication of physical health. e.g. viscosity of blood, which plays a very important role in maintaining good circulation of blood to all parts of the body, is one such indicator.

While it is generally believed that there are no quantitative measures of mental stress and emotional disturbance, it has been observed that hemorheological parameters change significantly and adversely under emotional disturbance and mental tensions [6,7,8].

Yoga acts on both body and mind [9]. We can therefore assume that the comprehensive effect of yoga, on both mental as well as physical well-being, should be exhibited in terms of improved hemorheological parameters.

In the present work, an effort is made to study the effect of preliminary yogic practices on an individual's health, by measuring hemorheological parameters of blood. Such an approach to study the impact of yoga on overall health of individuals is an objective approach rather than a questionnaire based survey which can be very individual specific and subjective.

APPROACH

An exploratory survey was conducted to find out whether yoga practicing people have any specific features, regarding hemorheological parameters, in comparison to non-yoga practicing people. Comparison was made between the persons of same age, sex and habits. It was observed that in general (1) whole blood viscosity, (2) plasma viscosity and (3) red cell rigidity were less in yoga practicing people as compared to people who are not practicing yoga.

A survey of few yoga institutions was done and their methodology was studied. Ghantali Mitra Mandal, an institute for yoga in Thane, was chosen for recruiting the participants/subjects. This organization conducted two months preliminary course for beginners and it followed the same holistic yoga approach as Vivekananda Kendra, Bangalore, a world-renowned yoga institution.

Aspirants have to report every day in the morning for one hour yoga practice. Subjects were recruited from this preliminary course conducted by Ghantali Mitra Mandal.

PROCEDURE

Blood samples were collected from 16 subjects, on the first day of the course. They were collected early in the morning after making sure that each subject was fasting with only moderate water consumption prior to sample collection. This ensured standardization of the samples. Vials for collection of blood were filled with 0.15 ml of anticoagulant solution (E.D.T.A.) to prevented blood clotting for 6-7 hours. Samples were gently agitated before use.

Experiments on samples were conducted within 5 hours of collection of blood. Contravas LS30 viscometer was used to obtain the viscosity at 18 different shear rates. The blood was filled in capillaries for finding out hematocrit. Some blood was filled in test tubes to separate plasma and cells by putting in centrifuge for 10 minutes at 15000 rpm. Plasma viscosity was measured for 3 shear rates only. All the viscosity measurements were taken at 37°C. The temperature was maintained by circulating bath.

The samples were again collected after 50 days of yoga practice, to analyze the changes in the hemorheological parameters during this period.

RESULTS

Whole blood viscosity variation with different shear rates, before and after Yogic practice course has been given in Tables (1-4), and represented as viscosity I and II respectively. Variation of this viscosity with shear rate along with comparisons, before and after yogic practices are shown in Figs. (1-4).

It is observed from Tables (1-4) and Figs. (1-4) that after 50 days of Yoga practice, the blood viscosity at low shear rates is considerably reduced (maximum change observed is 54%). Since low shear rate viscosity is an indication of aggregability of red cells [10] (viscosity at low shear rate (0.51/sec) gives aggregability when standardized to 45% hemotocrit level [11]), it appears that one can control red cell aggregation with yogic practices.

It is of interest to note that five of the sixteen subjects (subject nos. 2, 8, 10, 13 and 16) did not show desirable change in viscosity at lower shear rate. A careful case study of these individuals showed that:

- Subject No. 2: Blood sample of this subject, before yoga course, was partially hemolysed. Presence of few crushed cells reduces viscosity and hence viscosity before yoga is less.

- Subject No. 8 and 10: Change was relatively small. We looked into both subject's case history, however, nothing significant could be identified.

- Subject No. 13: The blood sample after yoga course was partially hemolysed. This sample was, therefore, not considered in finding maximum % change in viscosity at low shear rate.

- Subject No. 16: Very insignificant change in blood viscosity at low shear rates (as a matter of fact at shear rate 0.512 per sec., viscosity increased 5%). A careful look at his case history revealed that this subject had some heart problem, therefore, was not advised cleansing processes and some other practices.

It is further observed from Tables (1- 4) and Figs.(1 - 4) that 50 days yogic course has brought down marginally whole blood viscosity at high shear rate (maximum change 17%). It may be noticed that the blood viscosity at higher shear rate gives a measure of rigidity of red cells [10,11]. Therefore, it may be concluded that yogic practices have some correlation with the reduction of red cell rigidity.

It is of interest to note that subject no. 6 had a good reduction of blood viscosity at low shear rate (reduction in red cell aggregability, Table 2 and Fig. 2b) but rigidity of red cells (blood viscosity at high shear rate) did not change significantly. While going through his case history, it was observed that he was an elderly person of 56 years and he had a lot of mental tension (regarding his daughter's marriage). This indicates some correlation of mental tension with cell rigidity.

It is further noticed that subject no. 4 was a young person and he had already been practicing yoga since few months, hence relatively very little change in viscosity was observed at all shear rates.

Subject no. 14 had recently undergone some operation, therefore could not do cleansing process, asanas and some breathing exercises. In addition to this, she had some depression problem. She could do only meditation and relaxation part of yogic course. It is of interest to note that there is no major change in blood viscosity at low shear rate (aggregability). However, there is a reasonable response at high shear rate.

TABLE 1: Viscosity before and after yoga, at 18 Shear rates for subject nos. 1, 2, 3 and 4

Shear rate	Subject No. 1		Subject No. 2		Subject No. 3		Subject No. 4	
	Vis I	Vis II	Vis I	Vis II	Vis I	Vis II	Vis I	Vis II
0.512	40.80	30.60	16.58	17.85	31.88	24.23	26.78	20.40
0.695	32.83	27.20	15.95	15.95	26.26	20.64	23.45	17.82
0.945	26.91	22.77	14.49	13.11	22.08	17.25	20.01	15.87
1.285	22.86	19.30	12.19	11.18	18.80	14.73	17.27	14.22
1.747	19.02	16.04	10.82	9.70	16.04	13.06	14.55	12.31
2.37	16.23	14.30	9.35	8.80	13.75	11.55	12.93	11.00
3.23	13.94	12.32	8.28	7.88	12.32	9.49	11.11	9.90
4.39	12.33	10.70	7.58	6.84	10.70	8.47	9.96	9.06
5.96	10.93	9.62	6.78	6.23	9.51	7.54	8.85	8.09
8.11	9.73	8.76	6.19	5.71	8.60	6.91	7.96	7.48
11.02	8.70	7.76	5.74	5.27	7.87	6.22	7.28	6.87
14.98	7.79	7.13	5.35	4.87	7.18	5.70	6.66	6.39
20.4	7.10	6.53	4.99	4.58	6.59	5.31	6.08	5.92
27.7	6.51	6.02	4.65	4.32	6.07	5.00	5.59	5.55
37.6	5.51	5.60	4.40	3.97	5.60	4.58	5.15	5.04
51.2	5.65	5.38	4.17	3.90	5.24	4.44	4.74	4.83
69.5	5.33	5.01	4.01	3.71	4.91	4.21	4.46	4.54
94.5	5.05	4.64	3.83	3.55	4.61	4.00	4.17	4.29

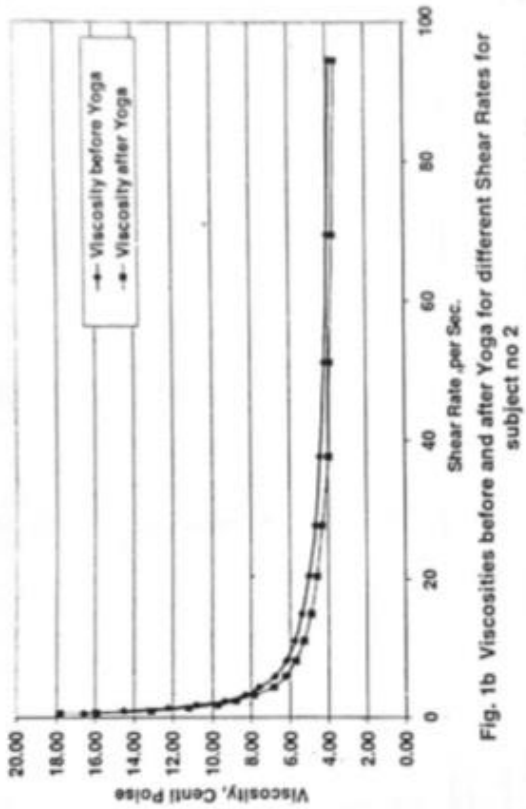

Fig. 1b Viscosities before and after Yoga for different Shear Rates for subject no 2

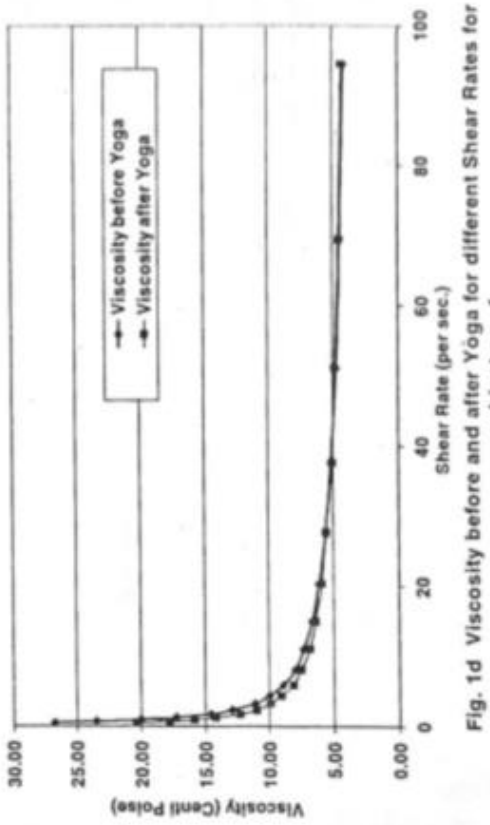

Fig. 1d Viscosity before and after Yoga for different Shear Rates for subject no. 4

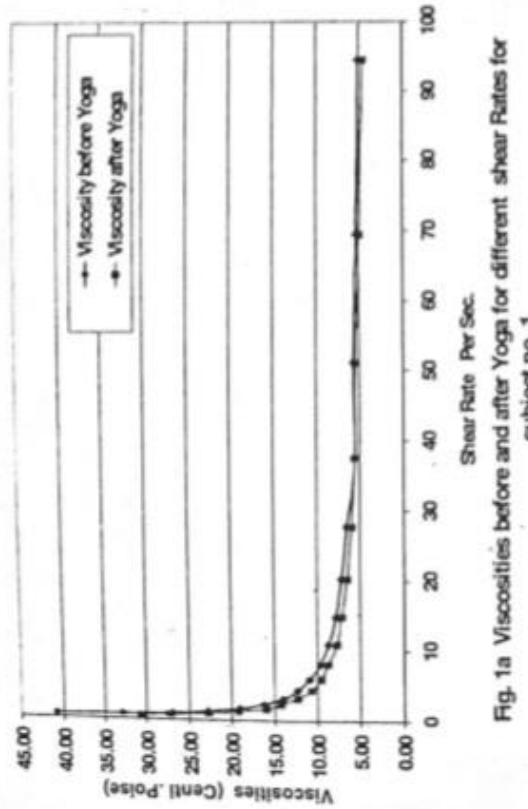

Fig. 1a Viscosities before and after Yoga for different shear Rates for subject no. 1

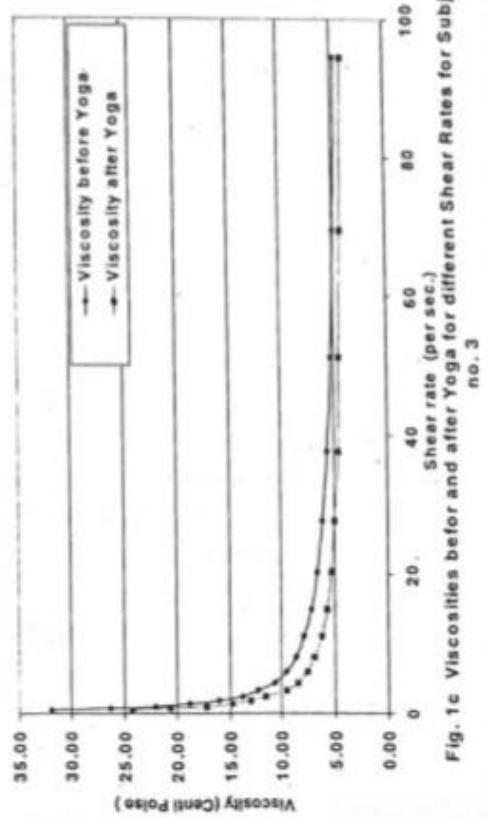

Fig. 1c Viscosities befor and after Yoga for different Shear Rates for Subject no. 3

TABLE 2: Viscosity before and after yoga, at 18 Shear rates for subject nos. 5, 6, 7 and 8

Shear rate	Subject No. 5		Subject No. 6		Subject No. 7		Subject No. 8	
	Vis I	Vis II	Vis I	Vis II	Vis I	Vis II	Vis I	Vis II
0.512	33.15	17.85	30.60	17.85	26.78	22.95	19.13	17.85
0.695	27.00	15.01	26.26	15.95	24.39	21.57	15.95	15.95
0.945	22.77	12.42	22.08	13.80	21.39	18.63	14.49	13.80
1.285	18.29	11.18	18.80	12.70	18.29	16.26	13.21	12.19
1.747	15.29	9.33	15.67	10.82	16.04	14.17	11.94	10.82
2.37	13.20	8.25	13.20	9.63	13.48	12.10	10.73	9.63
3.23	11.31	7.27	11.72	8.48	12.32	10.91	9.70	8.48
4.39	10.10	6.39	10.40	7.73	10.85	9.36	9.06	7.43
5.96	8.96	5.68	9.29	7.10	9.62	8.53	8.31	6.67
8.11	7.88	5.31	8.28	6.43	8.60	7.56	7.64	6.03
11.02	7.16	4.80	7.52	6.04	7.81	6.93	7.10	5.56
14.98	6.57	4.44	6.83	5.66	7.22	6.18	6.53	5.13
20.4	6.02	4.16	6.27	5.38	6.75	5.76	6.08	4.77
27.7	5.55	3.92	5.78	5.10	6.28	5.33	5.69	4.48
37.6	5.20	3.10	5.37	4.77	5.89	5.03	5.37	4.02
51.2	4.55	3.56	5.05	4.70	5.55	4.72	5.09	4.04
69.5	4.77	3.45	4.76	4.54	5.26	4.61	4.84	3.92
94.5	4.60	3.33	4.49	4.33	5.02	4.24	4.64	3.74

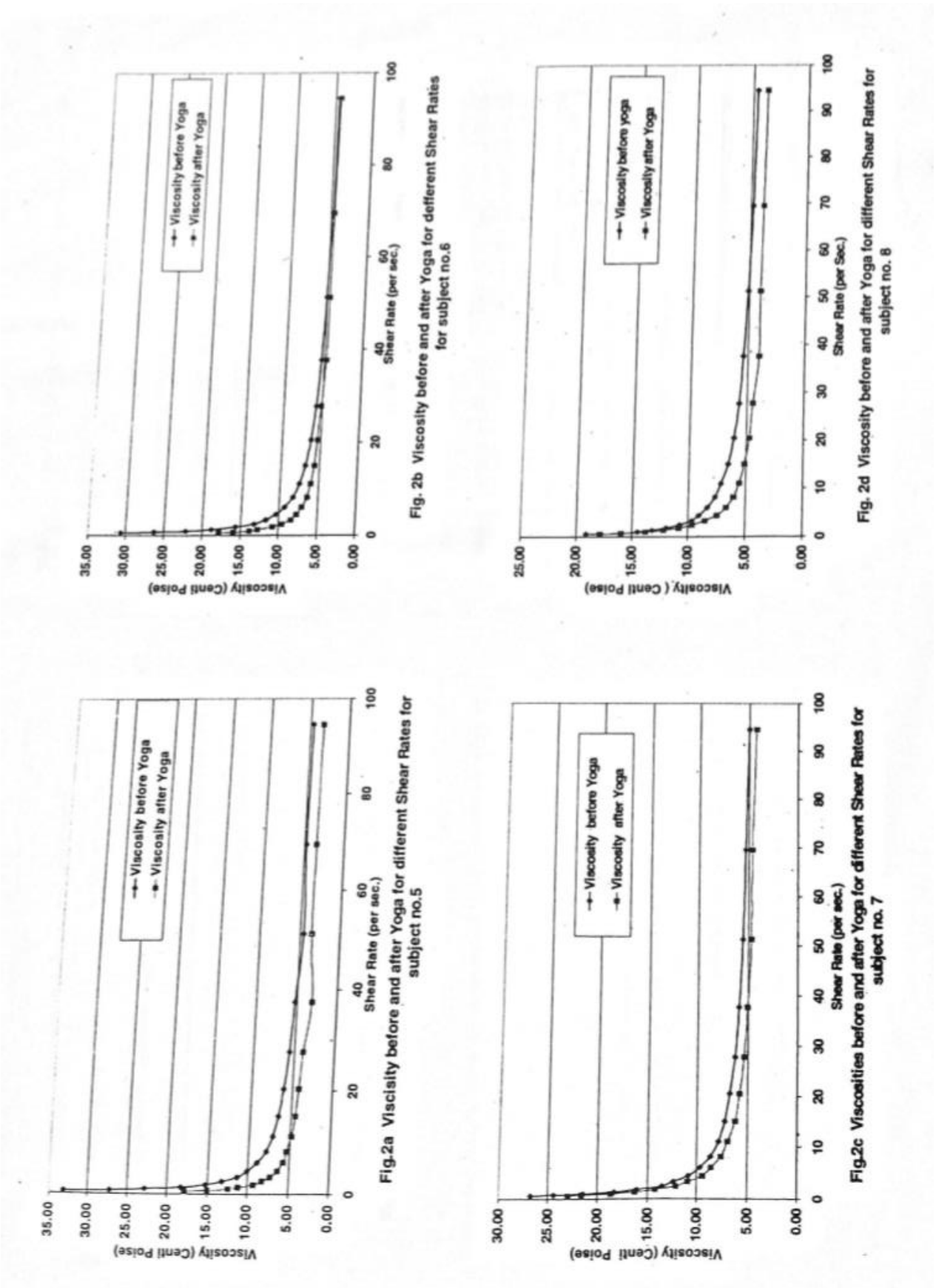

Fig.2a Viscisity before and after Yoga for different Shear Rates for subject no.5

Fig. 2b Viscosity before and after Yoga for defferent Shear Rates for subject no.6

Fig.2c Viscosities before and after Yoga for different Shear Rates for subject no. 7

Fig. 2d Viscosity before and after Yoga for different Shear Rates for subject no. 8

TABLE 3: Viscosity before and after yoga, at 18 Shear rates for subject nos. 9, 10, 11 and 12

Shear rate	Subject No. 9		Subject No. 10		Subject No. 11		Subject No. 12	
	Vis I	Vis II	Vis I	Vis II	Vis I	Vis II	Vis I	Vis II
0.512	31.88	20.40	34.43	31.88	20.40	15.30	24.23	19.13
0.695	27.20	16.88	27.20	24.39	17.82	14.07	19.70	16.88
0.945	22.77	15.18	23.46	21.39	15.87	13.80	16.56	13.80
1.285	19.81	13.21	20.83	18.80	13.72	11.18	13.72	11.68
1.747	17.16	11.56	17.53	15.67	11.94	9.70	11.56	9.70
2.37	14.85	10.18	15.13	13.75	10.73	8.53	10.18	8.25
3.23	12.93	8.89	13.13	11.51	9.49	7.88	8.69	7.07
4.39	11.44	8.02	11.59	10.40	8.77	7.13	7.73	6.24
5.96	10.38	7.21	10.38	9.18	7.98	6.56	7.00	5.57
8.11	9.33	6.67	9.25	8.20	7.32	6.03	6.19	5.07
11.02	8.41	6.22	8.35	7.40	6.75	5.62	5.62	4.61
14.98	7.74	5.79	7.57	6.53	6.22	5.18	5.13	4.05
20.4	7.14	5.41	6.94	5.95	5.76	4.83	4.70	3.71
27.7	6.63	5.03	6.37	5.43	5.38	4.51	4.34	3.33
37.6	6.15	4.63	5.86	5.11	5.03	4.18	4.07	3.28
51.2	5.70	4.39	5.38	4.60	4.73	4.00	3.91	3.07
69.5	5.38	4.15	5.08	4.31	4.49	3.66	4.16	3.35
94.5	5.10	3.93	4.78	4.01	4.29	3.53	4.04	3.26

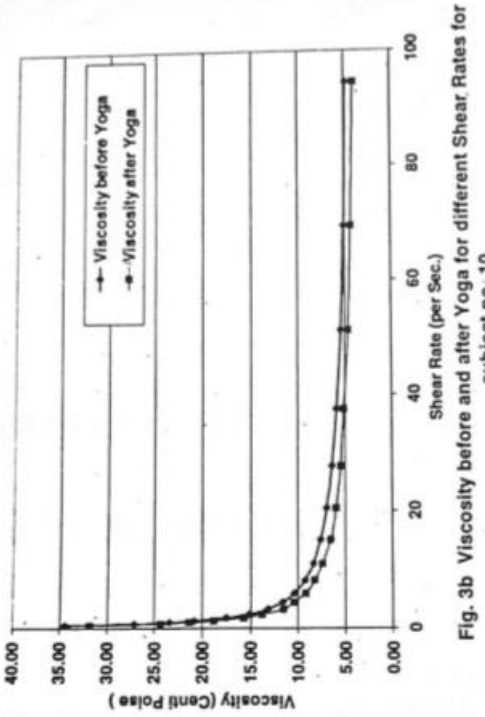

Fig. 3b Viscosity before and after Yoga for different Shear Rates for subject no. 10

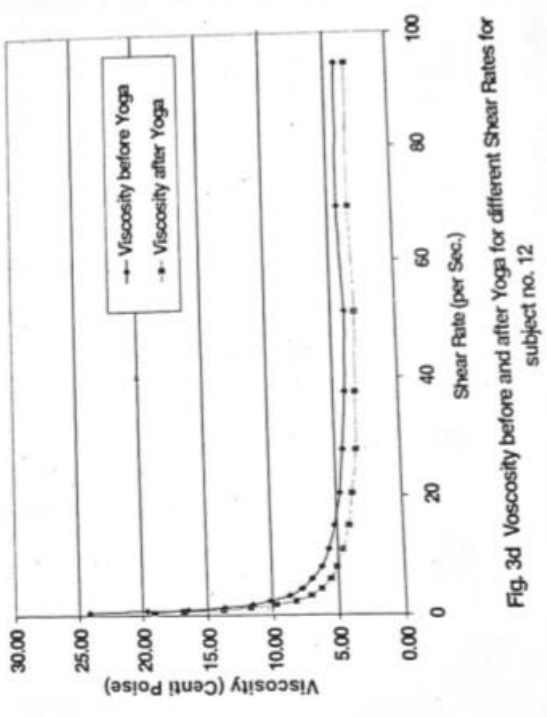

Fig. 3d Voscosity before and after Yoga for different Shear Rates for subject no. 12

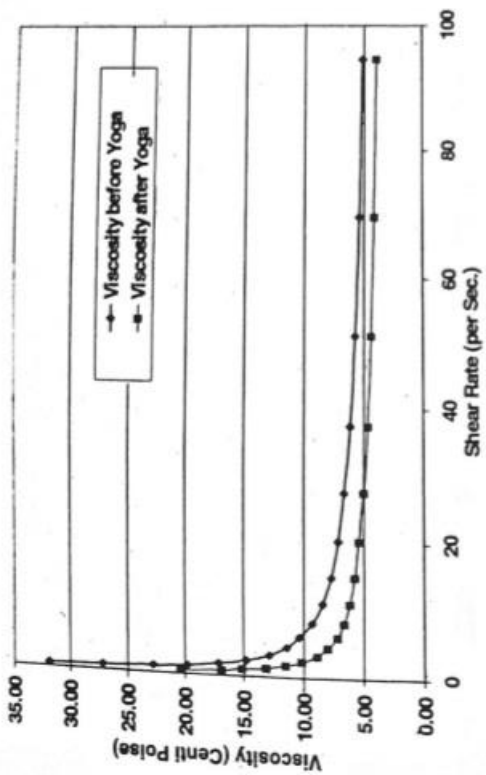

Fig. 3a Viscosity before and after Yoga for different Shear Rates for subject no. 9

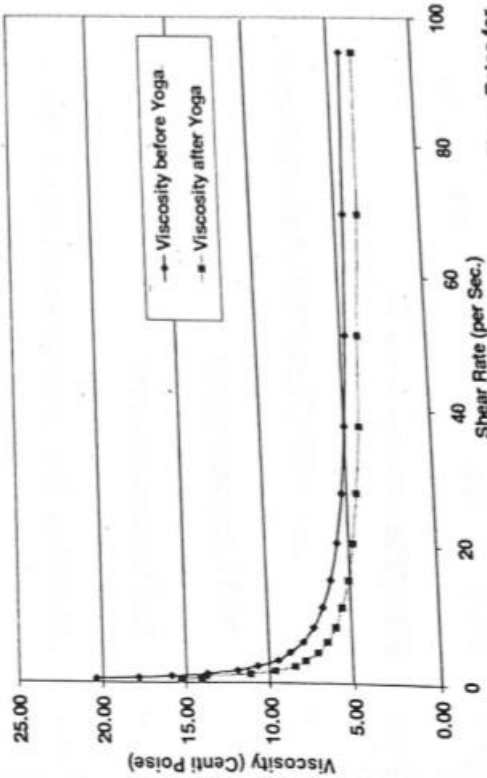

Fig. 3c Viscosity before and after Yoga for different Shear Rates for subject no.11

TABLE 4: Viscosity before and after yoga, at 18 Shear rates for subject nos. 13, 14, 15 and 16

Shear rate	Subject No. 13		Subject No. 14		Subject No. 15		Subject No. 16	
	Vis I	Vis II	Vis I	Vis II	Vis I	Vis II	Vis I	Vis II
0.512	24.23	8.93	21.68	20.40	35.70	21.68	21.68	22.95
0.695	19.70	7.50	17.82	16.88	28.14	18.76	18.76	17.82
0.945	16.56	7.59	15.18	15.87	24.15	16.56	15.18	15.18
1.285	13.72	7.11	13.21	13.21	21.34	14.73	12.70	12.70
1.747	11.56	6.34	11.19	11.19	17.90	12.68	11.56	10.82
2.37	10.18	6.05	10.18	9.08	15.68	11.55	9.90	9.35
3.23	9.09	5.45	8.89	8.28	13.94	10.50	8.69	8.08
4.39	8.02	5.05	8.17	7.43	12.33	9.36	7.88	7.43
5.96	7.21	4.59	7.54	6.56	11.04	8.53	7.00	6.56
8.11	6.43	4.26	6.83	5.79	9.97	7.88	6.35	5.95
11.02	5.80	3.97	6.28	5.33	9.06	7.22	5.86	5.33
14.98	5.31	3.78	5.70	4.87	8.31	6.66	5.44	4.83
20.4	4.93	3.52	5.25	4.45	7.58	6.02	5.09	4.48
27.7	4.60	3.37	4.86	4.06	6.89	5.48	4.77	4.20
37.6	4.40	3.15	4.54	3.74	6.33	4.75	4.44	3.55
51.2	4.11	3.20	4.30	3.66	5.85	4.87	4.28	3.75
69.5	4.35	3.14	4.24	3.53	5.43	4.56	4.08	3.56
94.5	4.32	3.14	4.15	3.42	5.06	4.31	3.88	3.44

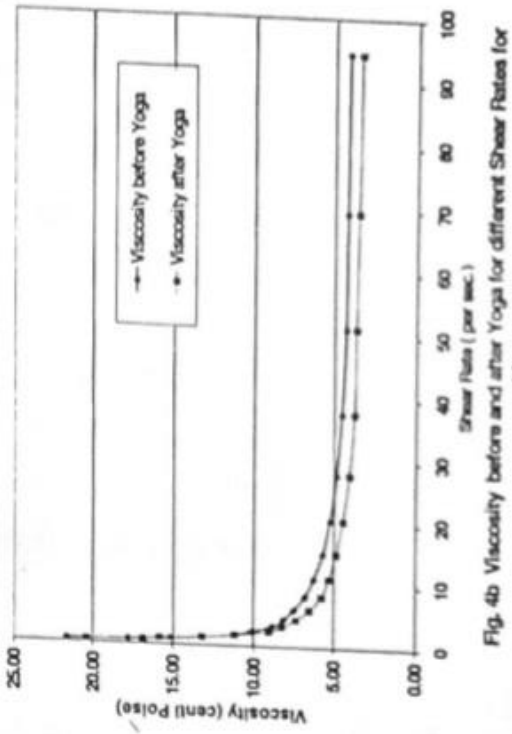

Fig. 4b Viscosity before and after Yoga for different Shear Rates for subject no. 14

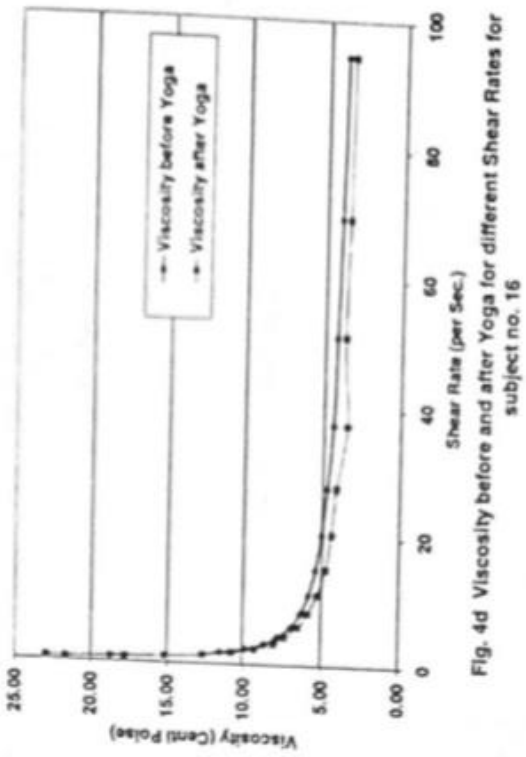

Fig. 4d Viscosity before and after Yoga for different Shear Rates for subject no. 16

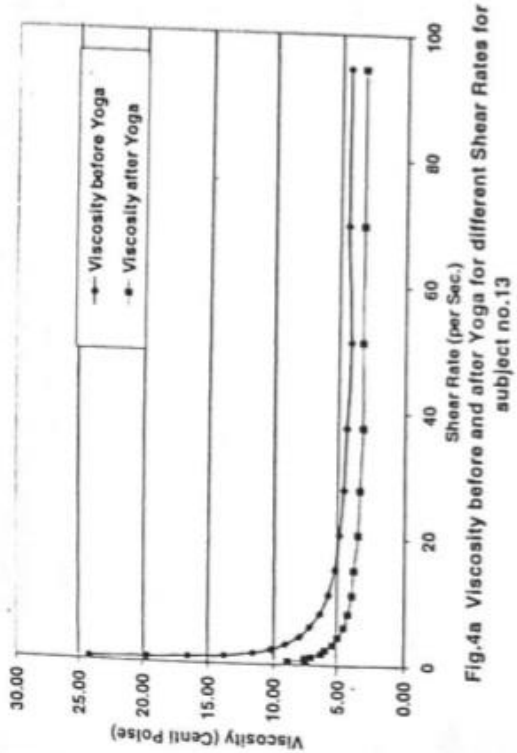

Fig.4a Viscosity before and after Yoga for different Shear Rates for subject no.13

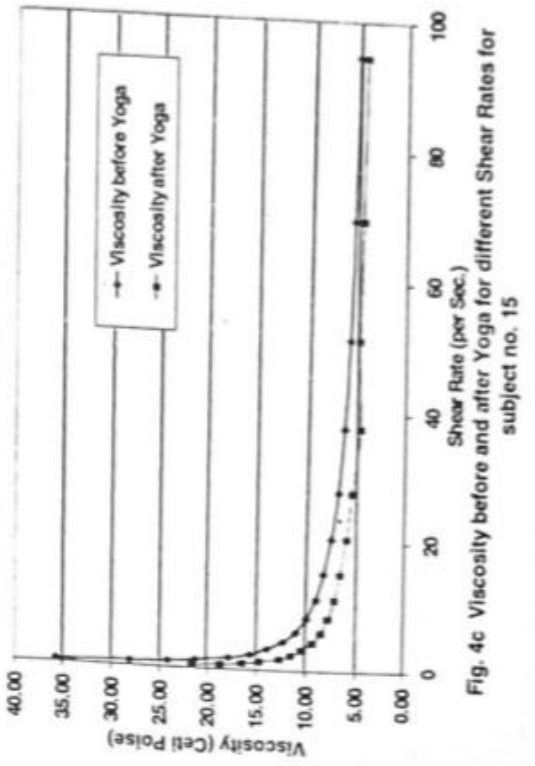

Fig. 4c Viscosity before and after Yoga for different Shear Rates for subject no. 15

Subject no. 16 had some heart problem and had some depression also. She could do only meditation and relaxation practices. After yoga practice aggregability did not reduce much but rigidity decreased.

A feedback talk with subjects 14 and 16 indicated that they were feeling better (relaxed) after these yogic practices. This indicates the possibility of relationship of red cell rigidity with mental tensions and depression. It is interesting to note that Ernst et. al. [6] and Dintenfass and Zadar [7] have made similar observations regarding the connection of mental tension, psychoemotional stress and depression, with red cell rigidity.

CONCLUDING REMARKS

Yogic practices like cleansing processes, Asanas, Pranayam etc. reduce blood viscosity at low shear rate (Table 1 subject no. 3, Table 2 subject nos. 5 and 6 etc.); implying reduction in red cell aggregability. Hence, these Yogic practices may be used to control the aggregability of red cells. Meditation and relaxation part of yogic course appears to be connected with reduction of red cell rigidity. From Table 4 (subject No. 14) and other observations, it appears that these yogic practices (meditation, relaxation etc.) may be used to control the rigidity of red cells.

Over all it appears that with yogic practices the whole blood viscosity drops for most of the subjects over a wide range of shear rates with some variations and exceptions. Those who had health problems and could do yoga practices well, improved significantly.

SUGGESTED FUTURE WORK

Further study can be conducted by increasing sample size and longer and advanced versions of yogic practices. The study can be made more comprehensive by including another group with a different physical exercise program. This would provide insights into the specific effects of yoga compared to other forms of exercise.

Also, the future study could include questionnaire based survey of each subject, before and after the yoga course, and this score can be used to determine their satisfaction. The score can further be correlated to the change in hemorheological parameters of blood. Also, atleast three blood samples could be collected from each subject, both before and after the yoga course, to ensure that no information is lost due to hemolysis of samples collected.

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Brief Profile of the Author:

Dr. Satish Kumar Pathak has done Ph.D in Biomedical Engineering. He has retired from Indian Institute of Technology – Bombay where he taught Descriptive Geometry and Engineering Graphics to undergraduates. He was also associated with Robotics Laboratory.

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References:

1. Yogendra, S., 1956, Yoga-Physical Education, The Yoga Institute, Santa Cruz, Mumbai, India.
2. Nikam, P.R., 1992, Swasthya Yoga (Part I) - Cleansing Processes, Shri Ambika Yoga Kuteer Prakashan, Thane, Maharashtra, India.
3. Nikam, P.R., 1992, Swasthya Yoga (Part II) - Asanas, Shri Ambika Yoga Kuteer Prakashan, Thane, Maharashtra, India.
4. Chaturani, P., Pathak, S.K. and Saxena-Bhartiya, S., Mathematical Modelling of Yogasana and other Exercises, Int. Conf. on Frontiers in Biomechanics, Supplemented with Yoga concepts, Bangalore, Dec. 12-15, 1999, P. 165.
5. Kuwalayananda, S., 1988, Pranayam, Popular Prakashan, Mumbai**.**
6. Ernst, E., Aumann, M.B. and Matrai, A., Prolonged Psychoemotional Stress Decreases Blood Fluidity, Clin. Hemo. 4, 1984, P. 423.
7. Dintenfass, L. and Zadar, J., Blood Rheology in Patients with Depressive and Schizoid Anxiely, Biorheology, 13, 1976, p.33.
8. Ehrly, A.M., Lanograp, H., Herrier, J. and Salger-Larrenj's K., Influence of Vediofilm Induced Emotional Stress on the Flow Properties of Blood, Clin. Hemo. 1983, p.254.
9. Feuerstein**,** G. and Miller, J., 1971, A Reappraisal of Yoga, Rider and Company, London.
10. Fung, Y.C., 1981, Biomechanics, Mechanical Properties of Living Tissues, Springer-Verlag, New York.
11. Dintenfass, L. 1985, Blood Viscosity, MTP Press.

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Artificial Intelligence (AI), Consciousness and the Self

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INTRODUCTION

There many scientists and engineers who believe that computers will eventually become conscious. Computer scientists Bernard Baars and Stan Franklin wrote in 2009[1]: "consciousness may be produced by … algorithms running on the machine." MIT Technology Review in October 2017 opined that this may happen in the not-too-distant future[2]. Given the fact that biological evolution is slower than technological evolution, there is fear that humans will be unable to compete with sentient machines. No wonder many prominent voices in the scientific and the tech worlds are claiming that artificial intelligence is leading humanity to a catastrophe. Stephen Hawking told the BBC in 2014[3], "I think the development of full artificial intelligence could spell the end of the human race." Speaking to the National Governors Association in 2017, Tesla CEO Elon Musk said that[4] "AI technology is a fundamental risk to the existence of human civilization."

IS CONSCIOUSNESS COMPUTABLE?

So what is going on? Can the "ghost of the self" in the body-machine be fully explained in terms of computation? Is it indeed inevitable that machines will become conscious unless AI is strictly regulated? Some futurists and sci-fi writers are imagining a marriage of sorts between AI and brains so that, someday, technology will make it possible for humans to become "posthuman,"[5] transcending the limits of the human condition. There are others who believe that the only way to make sense of all the scientific facts is to take reality as a simulation, an idea that was used by Hollywood in movies, such as The Matrix and Watch Gamer. Another scenario is to imagine that once humans learn how to completely characterize brains, they will be able to copy themselves into computers, creating their emulations, or *ems*, in the process. Such *ems* could be replicated easily and so they will quickly outnumber real people.

In any event, if and when artificial intelligence evolves into conscious machines, that will surely mean the end of the world as we know it. Conscious machines will most likely take over the world and enslave humans, if not worse[6]. Given this possibility, the prospect of machine consciousness is a most pressing challenge facing humanity at this time.

Some may quibble over the idea of "consciousness" in machines. If we agree to use it in the sense of "awareness" and "personhood", machines with it will have access to greater autonomy than machines that lack it and, therefore, they would potentially replace humans in most jobs and raise insoluble problems of ethics and morality. Even if each human is provided a universal basic income for food, shelter and entertainment, as is being proposed by many economists — and the machines leave us alone — it will be a dystopic life.

There are many arguments in support of the idea of an eventual evolution of consciousness in computers. Since we cannot deny that the brain is a machine, then other machines with appropriate architecture should also achieve consciousness. Some object and say that brains, unlike classical computers, perform quantum operations deep in the neural circuitry. However, one can postulate future quantum computers that mimic brain behaviour in all possible ways.

Now there are cognitive tasks during which the agent does not have a sense of subjective awareness. Such cognitive tasks are also being done by the machine, and it does so faster and with more reliability.

Awareness is something beyond computation for it is the ability to halt the processing in the brain machine at will to take stock of what is going on. Such a halting problem was considered by Alan Turing in 1936[7] and he showed that no algorithm can determine whether given a description of an arbitrary computer program and an input, the program will halt or continue to run forever.

If halting to an arbitrary input at randomly chosen time is impossible from a computability point of view, and the aware mind does it, then one may conclude that *consciousness is not computable*.

NATURE OF REALITY

In our intuition, consciousness is a category that is dual to physical reality. We apprehend reality in our mind and not in terms of space, time and matter. This experience varies based on brain states and one may conclude that non-humans experience it differently from us. It is also significant that in our conscious experience we are always outside of the physical world and witness ourselves as apart from our bodies. Even in scientific theory, as for example in classical mechanics, the observer is away from the system, even though there is no explanation of the observer within the theory.

To help answer the question whether machines will become conscious we must go back to the question of the nature of reality. Is the world a machine described by its parts and their interconnections, or is it fundamentally knowledge? The first view is called *ontic* (from ontological, that is related to structure), and the second is called *epistemic* (from epistemological, related to knowledge). In philosophy, these are the positions of two different schools, one believing that reality is *being*, and the other that it is *becoming*. The conception of the world as *being* is associated with materialism, while that of *becoming* assigns a more significant role to the observers.

THE CONCEPTION OF SELFHOOD IN A MACHINE PARADIGM

A few years ago, I was part of a series of weeklong workshops organized by SRI International, Menlo Park in different locations in the United States and Cambridge, UK to consider this question of whether machines at some future time will become conscious. The thirty-odd participants in these workshops included computer scientists, physicists, neuroscientists, philosophers, and strategic thinkers.

We took stock of the many difficulties with the conception of selfhood in a machine paradigm. Standard neuroscience accepts the doctrine of the identity of brain and mind. In this view, mind emerges from the complexity of the interconnections and its behaviour must be completely described by the corresponding brain function leaving no room for agency of the individual. But no specific neural correlate of consciousness has been found and consciousness cannot be localized.

The selfhood of humans leads to paradoxes related to autonomy and freedom. Humans reject the idea that they are mere machines, yet they often equate their “self” with the machinery of the body. On the other hand, the human’s self-image is that of the body, together with transient thoughts, which is overseen by an observing “I” within.

We make a distinction between the “autobiographical self” related to one’s memories and relationships, and the “core self”, which is rooted in the momentary present. The “autobiographical self” is partly the result of one’s imagination since it is an interpretation of the past and it includes hopes for the future. The “core self” is elusive; it is the light that shines on things around and associates with them in time and space.

The experiments of Benjamin Libet showed how decisions made by a subject arise first on a subconscious level and only afterward are translated into the conscious decision[8]. Upon a retrospective view of the event, the subject arrives at the belief that the decision occurred at the behest of his will. In Libet’s experiment the subject was to choose a random moment to flick the wrist while the associated activity in the motor cortex was measured. Libet found that the unconscious brain activity leading up to the conscious decision by the subject began

approximately half a second before the subject consciously felt that he had taken his decision. But this is not to be taken as an example of retrocausation; rather, this represents a lag in the operation of the conscious mind in which this construction of reality by the mind occurs.

The participants at the Workshops agreed that AI-machines of the future will be able to emulate all cognitive tasks and by implication able to replace humans at all kinds of jobs. But they were split on whether machines will be conscious like humans are. The split turned out to be based on the idea that the phenomenon of consciousness could come in two different varieties which I call little-C and big-C[9]. If all there is to consciousness is little-C then machines will be conscious. But if human consciousness is actually big-C, then machines will fall short.

LITTLE-C AND BIG-C

So what are these two conceptions of consciousness? Little-C is consciousness emerging out of the complexity of the brain processes. It is emergent in the same sense that biology is emergent on chemistry, which, in turn, is emergent on physics. It is similar to the thought, generally ascribed to Buddhism, that consciousness arises on ground that is emptiness (śūnyatā in Sanskrit). In this view, if a sufficiently complex machine is able to emulate the processes in the brain, it will be conscious.

On the other hand, big-C assumes consciousness is something that is apart from the physical reality. Philosophically, this is the position of Vedanta, in which the mental and the physical phenomena are two aspects of the same reality, like two sides of a coin. (As an aside, the Buddha declared on his deathbed that he agreed with the Vedic position.[10])

The pioneers of quantum theory used the so-called Orthodox Copenhagen Interpretation (CI) to understand the mathematical formalism of the theory, where the underlying idea is of big-C. CI assumes complementarity at different levels and this includes the duality of matter and mind or object and subject.

One may devise scientific experiments on creativity to further investigate the two views of consciousness. It appears that the creative moment is not at the end of a deliberate computation[11]. There are many autobiographical accounts of dreams or visions that preceded specific acts of creativity. Two famous examples of this are Elias Howe's 1845 design of the modern sewing machine, and August Kekulé's discovery of the structure of benzene in 1862.

The life of the self-taught Indian mathematician Srinivasa Ramanujan, who died in 1920 at the age of 32, is evidence in favor of big-C consciousness His long-forgotten notebook, which was published in 1988, contains several thousand formulas that were well ahead of their time, without explanation of how he had arrived at them. When he was alive, he claimed that formulas were revealed to him in his asleep.

But how might matter and mind mutually influence each other? One possibility is through the act of observation which causes the collapse of the state function in quantum theory. If the observation is made repeatedly, the system state will freeze. Called the Quantum Zeno Effect, it has been demonstrated in the laboratory[12].

IS INFORMATION AVAILABLE OUTSIDE THE REALM OF PHYSICS?

Even if one were to dismiss accounts of creativity as nothing but coincidence, the ontic understanding of reality becomes problematic when one brings in information into the mix, as is done extensively in modern physics. This is because information implies the existence of a mind, which category lies outside of the realm of physics.

Information or entropy cannot be reduced to local operations by any reductionist program. It requires the use of signs derived from global properties and the capacity to make choices which, in turn, implies agency. Entropy is a measure of disorder and in certain situations may be measured by temperature. This is how after determining the many different states associated with a black hole, Stephen Hawking was able to postulate a corresponding temperature and speak of radiation from it[13]. But temperature like entropy or information cannot be associated with a single particle.

Information in a communication involves two things: first, commonalities in the vocabulary of communication between the two parties; and second, the capacity to make choices. The common vocabulary requires that the underlying abstract signs used by the parties be shared, which stresses the social aspects of communication.

Schrödinger, one of the creators of quantum theory, stressed the epistemic nature of the state function. He was emphatic that [14]"Consciousness cannot be accounted for in physical terms. For consciousness is absolutely fundamental. It cannot be accounted for in terms of anything else."

MODELS OF CONSCIOUSNESS

The idea of consciousness requires not only an awareness of things but also the awareness that one is aware. If awareness is some kind of a measurement, it should have a reference. This, in turn, poses two problems: first, what is the reference for awareness; and, second, how does consciousness choose between various possibilities?

The problem of the referent in awareness is an old one. If we postulate a single universal, transcendental consciousness, the individual's empirical consciousness is a projection and the referent for it must be the universal. In Vedanta, the analogy of the same sun reflecting in a million different pots of water as little suns is provided to explain the empirical consciousness

of the individual. This is also similar to the view of Plato who invokes an abject in a cave that cannot be seen directly whose shadows on the wall are accessible.

In Western philosophy, René Descartes proposed that consciousness resides within an immaterial domain[15] called *res cogitans* (the realm of thought), to be contrasted from the domain of material things, called *res extensa* (the realm of extension), and he assumed that the two realms interact in the brain, but this Cartesian dualist position is no longer taken seriously. On the other hand, Immanuel Kant arrived at a resolution similar to that of the Vedic tradition by arguing that empirical consciousness must have a necessary reference to a transcendental consciousness[16] (a consciousness that precedes all particular experience). The universal or transcendental position is generally unacceptable to mainstream scientists who insist on reductionist models.

William James spoke of two kinds of selves[17]: the self as knower (the "I"), and the self as known (the "me"). Each person's self is partly subjective (as knower) and partly objective (as known). The objective self itself may be described in its three aspects: the material self, the social self, and the spiritual self. Narrative self-reference is in contrast to the immediate, knowing "I" that supports the notion of momentary experience as an expression of selfhood.

James believed that as knower, the self is comprised of different mental states. Thought has no constant elements and every perception is relative and contextualized. States of mind are never repeated, and whereas objects might be constant and discrete, thought is constantly changing and mental states arise out of choices that are made by the mind. James believed that thought flows, and thus he could speak of a stream of consciousness.

If one were to find the boundaries between the "me" and the "I" of consciousness, it becomes essential to find a "minimal" sense of self. It is easy to speak of the intuition that there is a basic or primitive something that is the true self, and much harder to provide evidence for such belief. Conceptually, there must be something permanent — a bed rock -– underlying the stream of consciousness.

To deal with the empirical pre-conscious or conscious awareness, one can postulate a hierarchical model of consciousness[18] with independent and distributed neural structures at the lowest level. The speed of the binding of the attributes would depend on the complexity of the communications and the relationships between the modules. Interference between various levels and the tangled nature of the information flow can help explain many illusions of perception.

MEMORY, AWARENESS AND CONSCIOUSNESS

Memory is one element that leads to the nature of the corresponding consciousness state. The mind must select from the pool of memories and this selection may not be made consciously

and it may be determined by the stream of previous consciousness states and the emotional state of the subject. It is to be expected that the executive control processes play an important role in the selection.

Furthermore, repeated selection of certain memories at the expense of others may affect the recall process, causing unwanted memories to be pushed back into the unconscious. Mechanisms can be recruited that prevent unwanted declarative memories from entering awareness, and that this cognitive act has enduring consequences for the rejected memories.

In the state called mindfulness, the executive control appears to be able to recruit memories with great ease. Some see mindfulness as meta-awareness (self-awareness) with ability to effectively modulate behaviour (self-regulation), and a positive relationship between the self and others.

Although awareness by itself is an all or nothing phenomenon, the state of consciousness depends on the degree to which preconscious and memory states are accessible to awareness. The uncoupling of perception from sensory inputs supports the idea of the disembodied consciousness state. A consciousness state that is decoupled from specific memories of the individual indicates that such states may be fundamental to reality and do form a part of the ontological reality.

CONCLUDING OBSERVATIONS

Many aspects of reality in the fields of physics, mathematics, and brain states either have paradoxical aspects or are not computable[19]. Therefore, to assume that machines based on logic and mathematics can emulate all natural systems fully is incorrect. To put it differently, the reality described by machines is of a kind different from that of natural systems.

But this does not mean that AI machines will not displace humans from most jobs. And even if machines did not become conscious, there will be increasing tendency on the part of humans to treat them *as if* they were conscious.

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Brief Profile of the Author:

Subhash Kak is an Indian-American computer scientist, an archaeoastronomer and a Vedic scholar. He is the Regents Professor of Electrical and Computer Engineering Department at Oklahoma State University–Stillwater, and a member of the Indian Prime Minister's Science, Technology and Innovation Advisory Council.

Born in Srinagar, Kashmir, he was educated in various places in Jammu & Kashmir and completed his PhD in Electrical Engineering from IIT, Delhi. His research has spanned the fields of information theory, cryptography, neural networks, and quantum theory. He has recently advanced a theory that physical space is *e*-dimensional and shown that this helps solve some problems of cosmology and that it explains certain features of the genetic code. He is the author of 30 books including technical works and books on Indian science, yoga and art. These include "The Nature of Physical Reality", "The Architecture of Knowledge", "Mind and Self", and "The Idea of India".

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References:

1. Baars, Bernard J. & Franklin, Stan (2009). Consciousness Is Computational: The Lida Model Of Global Workspace Theory. *International Journal of Machine Consciousness* 01(1), 23-32. https://doi.org/10.1142/S1793843009000050
2. https://www.technologyreview.com/2017/10/26/241792/could-we-build-a-machine-with-consciousness/
3. https://www.bbc.com/news/technology-30290540
4. https://www.cnbc.com/2017/07/16/musk-says-a-i-is-a-fundamental-risk-to-the-existence-of-human-civilization.html
5. https://posthumanism.com/
6. https://www.nbcnews.com/think/opinion/will-robots-take-your-job-humans-ignore-coming-ai-revolution-ncna845366
7. Turing, A. M. (1937). On Computable Numbers, with an Application to the Entscheidungsproblem. *Proceedings of the London Mathematical Society*, Volume s2-42, Issue 1, Pages 230–265. https://doi.org/10.1112/plms/s2-42.1.230
8. https://www.informationphilosopher.com/freedom/libet_experiments.html
9. Kak, Subhash (2022). The Limits to Machine Consciousness. *Journal of Artificial Intelligence and Consciousness*, 09(01), 59–72. https://doi.org/10.1142/S2705078521500193
10. https://subhashkak.medium.com/the-buddha-and-the-veda-4e0c3f798b20
11. https://journalofcosmology.com/consciousness160.html
12. https://phys.org/news/2015-10-zeno-effect-verifiedatoms-wont.html
13. https://en.wikipedia.org/wiki/Hawking_radiation
14. https://www.informationphilosopher.com/solutions/scientists/schrodinger/
15. https://iep.utm.edu/rene-descartes/

16. https://iep.utm.edu/kantview/
17. https://iep.utm.edu/james-o/
18. https://www.neuroquantology.com/
19. Kak, Subhash, *The Nature of Physical Reality*, 3rd edition. Mount Meru Publishing, Canada (2016)

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Overview of Proceedings of six selected Webinars Organized by GI4QC Forum

What is Consciousness? How do you perceive it?

This webinar, which was moderated by Mr. Anand Prakash of GI4QC Forum, had a happiness, wellness & spiritual life coach, Mr. Navneet Kumar, a management consultant specialising in business process improvements, Mr. Vinod Tiwari and a passionate techie & philosopher, Mr. Vinod Kulkarni sharing their thoughts on Consciousness.

Consciousness is that substratum or base which reveals all thoughts, perceptions and feelings and also itself. If we enquire about it diligently, we can actually experience Consciousness within ourselves. One way to experience or perceive Consciousness is meditation. In meditation the senses are inactive, object related thoughts cease, internal chatter ceases and there is nothing which is criss-crossing the mind. In such a state the subject shines as pure Consciousness or Consciousness reveals itself.

The realisation that Consciousness is our true nature results in experiencing a 'completeness' at all times. This gives so much energy and focus to whatever one is doing that the stress and strain of living just drops.

The knowledge that we are all connected and we can impact each other in terms of frequencies, vibrations, feelings, emotions etc. is the base for coaching process. It is this interconnection with the person you are coaching that makes coaching very different from consulting, training and even counselling. The consciousness aspect is the basis for relating to the coachee and encouraging him/her to look inwards and to do some introspection.

Although Consciousness seems so easy to access, most people are not able to relate to it. Most of us are somewhere in the spectrum that lies between Awareness (or Consciousness) on one side and a materialist mindset on the other side. The main problem is that we are conditioned to think in a certain way and we get so involved in all the material things that we forget our true nature and become a thing itself.

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Significance and Role of Mental & Spiritual Health in Overall Well-Being

This webinar, which was moderated by Mr. Anand Prakash of GI4QC Forum, had a holistic life alchemist, Mr. Kamakoty Krishnamoorthy, a scientist and psychologist, Dr. Jyotsna Singh, and a sanskrit professor specialising in vedic darshan and dharma shastra, Prof. Vinay Kumar Vidyalankar, sharing their views on mental & spiritual health.

We are all spiritual beings in a material body and we should remember this. We are essentially made of three bodies - Gross Body, Subtle Body and Causal Body. All the three aspects must be considered and a proper balance needs to be maintained amongst them for good health. Unfortunately, most of us are not awakened to our 'Godliness' or Divinity.

We keep gathering or accumulating sanskaric impressions or imprints in our subtle body due to our actions of thoughts, actions of words and actions of deeds. These sanskaric impressions or vrittis keep us mentally and emotionally occupied and we remain entangled in them.

Knowledge of the concepts of sanskars is important for mental well-being. Meditative practices help us navigate beyond these sanskars or vrittis and help us realise our true nature.

Our belief system is very important in not just shaping our emotional and mental life but also our physical life. As we know, our belief system impacts our thoughts & emotions. They, in turn, can have an influence on the gene expression and thus have an impact on our physical well-being as well. Hence, we should change our belief system and life by proper management of our thoughts and emotions if we want to enjoy good health.

Health is not just being disease-free. The Sanskrit term for health is swastha which comes from two root words - swa = one's own and stha = stabilize. Hence, swastha means to be stabilised or established in one's Self. A person who is swastha is one who has realised his true Self or true nature. Once you are stabilised in this knowledge you are no more disturbed by what is happening around you in this world. Nor are you affected by things or situations which are not under your control. In other words, our mental well-being is ensured when we are stabilised in the knowledge that this body is just a means for our 'real self' to experience the journey of life.

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"Science & Spirituality: Two sides of the same coin?" - Exploring prevalent worldviews

This webinar, which was moderated by Mr. Anish Rakheja, Founder, Krescon Coaches, had a Ph.D. (Quantum Optics), Prof. (Dr.) Jai Paul Dudeja, an IIT-IIM alumnus, Mr. Vijay Pandey, and a young MBBS doctor, Dr. Naman Jain, sharing their views on Science & Spirituality.

Science is the systematic study of the objective universe and Spirituality is the means to realise our true nature or to awaken to our inner reality. Consciousness Studies (which belongs to the intersecting domain of Science and Spirituality) is one of the hottest topics of study in the scientific community today. In simple terms, consciousness can be defined as awareness of reality. Neuroscientists, biologists, physicists, psychologists... everyone is trying to understand its nature and how it works.

Quantum physicists are exploring the role of consciousness in the measurement process. The existence of both potentiality and actuality in the subatomic world (wave particle duality) was revealed by the double slit experiments. While it is widely believed that consciousness has some role in converting the potentiality to actuality (wave to particle) the mechanism is not yet understood.

Everything in this universe exists in space and time. So, space and time must be there before the universe came into existence. Also, time, which is a concept needed to define any change, must have existed before space came into existence. We can say this because there would have been a moment when there was no concept of space and then space came into existence. This implies that time precedes space.

However, there should be "something or someone" who perceived or was aware of creation of space and time. This "something or someone" is consciousness and everything in this universe manifests in consciousness. Nothing can exist outside consciousness. This sequence of universe coming into existence after space, which in turn, came into existence after time and time was preceded by consciousness is very logical sequence of creation.

And, instead of asking the question whether Science and Spirituality are two sides of the same coin, the question to be asked is that if consciousness existed before everything else came into existence and everything manifests in it then can we say that consciousness is God (or Brahman, as mentioned in Upanishads). Also, we know that we are also consciousness. So, are we also God or Brahman?

Medical Science, on the other hand, holds a very different perspective on consciousness. It defines consciousness as responsiveness or decision-making power of a person in a given situation. Medical Science also believes that brain produces consciousness and considers mind and consciousness to be the same thing.

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Science & Spirituality: What is Reality?

This fireside chat was a conversation between Mr. Anish Rakheja, Founder, Krescon Coaches and Mr. Vinod Kulkarni, a computer engineer, passionate techie & philosopher. The session touched upon many concepts and questions related to Reality. Both the participants shared a lot of interesting insights and mentioned many philosophies and scientific findings to build up their arguments. They also explained why this seemingly simple question - What is Reality - has been a topic of debate for centuries and why a clear answer has not been found till date.

Before understanding what is Reality, we have to understand how we use reasoning to ascertain whether something is true. We try to gather information about that thing from multiple channels and if all channels reveal the same information, we decide that the information is true. However, there is a flaw in this methodology because this methodology only demonstrates that the information from various channels is consistent. Consistency does not imply truth.

As per advaita (non-dualistic) school of philosophy there are two aspects or parts of Reality (1) one which has existence as its intrinsic attribute and hence it always exists and is eternal or real or truth (2) one which does not have existence as its intrinsic attribute and it seems real only as long as it 'borrows' existence. In other words, it is an illusion or mithya or maya as its existence is only for a limited span of time.

If we delve deep into our world of experience we find that there are different kinds of realities - mathematical reality, abstract reality, physical reality, experiential reality, perceived reality,

mental reality and so on. For instance, mathematical reality is explored and analysed in exactly the same way by everyone and the results are same for everybody. Hence, this reality is unchanging. Physical reality, on the other hand, is how we perceive the world around us and it is dependent on our senses.

Science believes that there is a whole world which is out there and the shared or accumulated knowledge about what is out there is the reality. For example, the shared knowledge of the humanity tells us that the earth is round. This knowledge that the earth is round is part of our memory or mind and any knowledge that is there in our mind will affect what we believe earth to be. So even though we perceive that the earth is flat we accept the reality of earth to be different from our perception of earth.

Extending this argument to Reality, we can say that the model of Reality that we create is always going to be sort of a mixture of the perceived reality and what we think Reality is in terms of the knowledge that we have accumulated as an individual.

While Science provides very rich information about the behaviour of matter and answers how things work, it leaves us in the dark about the intrinsic nature of matter. Scientists are struggling to define what reality of matter is because as they explore deeper into matter they realise that it is all 'structure' with no 'stuff'. But that is so counter intuitive. How can a 'structure' exist without 'stuff' coming into picture.

We must ponder over these findings of Science and we should change the ground rules of how we look at Reality and how we model it.

The model or theory which best explains this observation of 'structure' with no associated 'stuff' is the Projection Theory. This is quite similar to the concept of Reality as explained by the advaita philosophy or some schools of Buddhism. However, the point to be appreciated here is that not all Indic philosophies believe in Projection Theory or Mithya or Illusion. Most of these philosophies/theories take the world to be real.

Irrespective of whether the world around us is abstract or real we agree on one thing. Any event is essentially some kind of an information change that is happening in the world. This information change has to be perceived by someone or something, because, if it is not sensed or perceived by anyone or anything, then, at the very fundamental level we can question whether that event actually happened or not. In other words, what is not perceived does not exist. Perception by someone or something is an essential requirement for existence.

This implies that we are looking at Reality from the platform called mind. The frame of reference from which we are experiencing Reality is 'we ourselves in this life time'.

We say a dream is an illusion only because we are able to appreciate that dreams come and go when we observe them from another level - the non-dream frame of reference (i.e. waking state). However, we call this life and world real as we are not able to appreciate it from another level with is outside our frame of reference.

The mechanism which creates Reality is quite different from the experience of that Reality. We need to understand that experiential or perceived Reality seems far more real than the mechanisms which generate it. Just like the data in a computer – what we see on the screen and how it is stored internally is very different.

In Projection Theory model there is an observer and the observed. The whole observed is just an arrangement. Our mind is doing pattern matching and categorising things, seeing logic in how things are arranged and seeing cause and effect. However, in Reality, everything is just an arrangement and 'I'ness is just pure observer. When this 'I'ness gets mixed with the contents of the world, it also starts "believing" that it is a thing in this world and all the transactional reality of the world starts to happen!

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High Energy Levels – Are they meant only for Rishis and Yogis or for commoners as well?

This fireside chat was a conversation between Mr. Anand Prakash of GI4QC Forum and Mr. Karthik Sundara Rajan who has been exploring the connect between Science and Yoga, meditation & other spiritual practices for over two decades and is eagerly working on identifying avenues for practical implementation of the spiritual knowledge.

In this session Karthik discussed the "Science of Dhyanam".

If something can be brought into the realm of cause and effect relationship and if this relationship is replicable then we call it Science. Objective science is the study of objects around us whereas subjective science is the study of our inner world.

Along with our physical body, we also have a mind which takes sensory inputs and is involved in processing the thoughts. However, when we observe the mind we find that for the same stimulus the response may be different from person to person and time to time. So, there are some discriminating faculties beyond the mind like emotions and intelligence which define us along with our body and mind.

And beyond these there is a kind of "power source" which makes the body, mind, intelligence and emotions work. And when it is absent the entire body-mind-intelligence-emotions system stops functioning. This "power house" cannot be perceived though senses or mind and is a formless presence. This formless presence is the quintessence of Spirituality.

Dhyanam or meditation is the process of connecting to this formless presence by dropping the mind, intelligence and emotions. It involves transcendence of mind, integrity of intelligence and equanimity of emotions.

*****

Consciousness, Randomness and Related Applications

This webinar, which was moderated by Mr. Vinod Kulkarni of GI4QC Forum, was an exclusive presentation by Mr. Kavan Ganapathy. Kavan is a consciousness researcher and parapsychologist with a background in physics and profound interest in mind-matter interactions.
Mind-matter interaction experiments show us the possibility that consciousness somehow 'lures

matter into sentience'. However, in spite of statistically significant results obtained in many scientifically conducted experiments on mind-matter interactions, this domain of research work is generally set aside as pseudoscience.

Kavan has worked on the replication of Global Consciousness Project and mind-matter interaction experiments in lab settings at CU Boulder as a Senior Professional Research Assistant. He is currently working on Remote Viewing research & its applications and is a professional remote viewer at the Hawaiin Remote Viewers Guild (HRVG).

In this presentation Kavan explained the setup and the methodology used in Global Consciousness Project using a true Random Number Generator called 'psyleron'. Kavan was also one of the participants in this experiment and he shared his experience of how he sat in front of a computer with a TRNG source and attempted to affect the quantum randomness arising from the psyleron device using his thoughts alone. He shared the results obtained and touched upon the significance of these results.

Remote viewing is a practice of seeking impressions of an object or event distant in both space and time (non-local) with the faculties of the mind, which otherwise is not accessible through our five sensory organs. Kavan explained the methodology of this practise, the science behind this and its potential practical applications.

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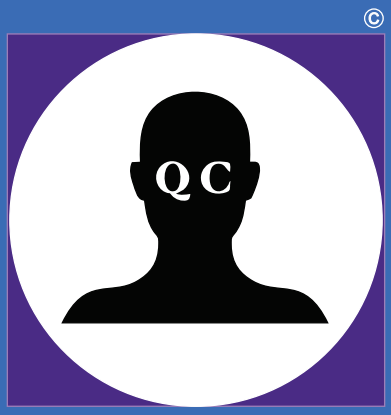

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