

## Emergence of Consciousness

We can define consciousness in terms of awareness, self-awareness, goal-oriented behaviour, integrated information and experience (Malone, 2018). “Awareness” and its self-reflective variant “consciousness” are not static entities but ongoing processes (Torey, 2014).

We look at the emergent properties of consciousness in different ways. In Virginia Woolf’s literature it is as ‘emergent self’. Darwin and others show emergent of new species through evolutionary process. Physicist Krauss demonstrate the emergent of electron-positron pair from empty space near the nucleus of an atom. Francis crick shows how liquid benzene emerges from the combination of six carbon atoms and six hydrogen atoms. Penrose’s quantum cosmology model emerges from one cycle to the other cycle. Wheeler-Dewitt argues about how time emerges from entanglement like gravity emerges from space-time curvature. I argue about the emergence of consciousness as wave, where wave is a quantum field.

## Neuroscience

Neuroscientists have made incredible progress in understanding the biological basis of consciousness. Using technology we can now watch it in action in the brain. Different neuro-technologies such as Electroencephalogram (discovered neural oscillations), MRI (uses magnetic field and radio waves to give internal anatomical image), PET (observe physiological function), Magneto encephalography(MEG) (drawing a map of the brain-power to detect even faint neuronal activity) and fMRI (shows active areas of brain in real time and in three dimensions with milliseconds resolution) have been used for brain study. All experiments fall in to three categories: (a) From experiment to theory (b) From theory to experiment (c) investigation of individual consciousness as a variable (Greenfield, 2017)

Brain imaging studies show different waves inside brain from unconscious state to conscious state and has identified the different types and cycles of wave (du sautoy, 2016). Research carried out in the University of Parma, Italy suggests the existence of mirror neuron, which can influence other neuron in the brain at a distance. They thought that loops exist between brains. Current challenge is to understand the neural connections.

## Quantum Mechanics

Quantum mechanics plays a role in the brain, since quantum mechanics determines the shapes and properties of molecules like neurotransmitters and proteins, and these molecules affect how the brain works. Penrose and Hamerhoff scheme suggest that Tubulin inside neuron exist in a superposition states. Objective reduction of the superposition leads to consciousness (SEP, 2015). However, this was rejected by Max Tegmark by showing that quantum events in microtubules last only 10-13 s-10-20s (Tegmark, 1999).

Fisher (2015) explored the possibility that quantum processing with nuclear spins might be operative in the brain. Phosphorus is identified as the unique biological element with a nuclear spin that can serve as a qubit for such putative quantum processing.

Some researchers argued about the use of quantum Bayesianism (QBism) for interpreting the wave function of probabilities. They argued that quantum mechanics is a law of thought and QBism can take into account the subjective experiences.

## Concluding Remarks:

- Every part of our body is in connection with every other. Perhaps consciousness arises when the brain’s simulation of the world becomes so complete that it includes a model of itself;

## Quantum Mechanics, Neuroscience and Emergence – Dr Kanan Purkayastha

- Nuclear spin dynamics can explain the consciousness processing in the brain. The spin dynamics is not independent of other part of the body. A new discipline of quantum neuroscience needs to explore this matter further;
- The concept of entropy and QBism can be utilised for the neural connection modelling and interpretation;
- Some aspect of consciousness such as loss of consciousness can be explained by Tononi's ( $\phi$ ) approach of IIT;
- Theory of mirror neuron can explain some aspects of consciousness. Quantum entanglement and quantum tunnelling can explain the binding mechanism for it;
- Unconscious can spill over into conscious thoughts. Also conscious mind steps in only after unconscious processing has taken place. So, we need to understand more about the unconscious state of the brain, our silent thinking partner.
- Is reality intrinsically random or fundamentally interconnected? I argue that it is interconnected. I agree with Philosopher Heidegger that self doesn't exist in a vacuum.
- Hence, my hypothesis is-

*Consciousnesses, a self-reflective variant of awareness, emerges from the interaction of neurons and their electrical and chemical impulse governed by quantum spin dynamics. It emerges like waves emerge in a lake. The waves manifest itself as a field. The field can interact with other fields that generate from the whole system through quantum wave resonance and an effector is needed for its manifestation.*

However, I am aware of some challenges:

- Defining consciousness. What to look for if we go inside a brain?
- In order to understand 'what it is like' require a predictive model, which is based on all possible connections between 86 billion neurons. Counting 1 neuron per second will take approximately 2700 years. Each neuron is connected to 10000 other neurons. If we count one connection every second it would take three million years to complete the task. Our progress to date is 302 connections.
- Estimates of the human brain's memory capacity vary widely from 1 to 1000 terabytes. So, physiology of (objective perspective) brain is intrinsically subjective;
- There is a conceptual gap between science, which stands for objective measurement and the conclusion we can draw thereby, and consciousness, which is a synonym for subjective experience;
- Therefore, how the 'water' of objective brain events is transformed into the 'wine' of subjective consciousness is a question that will remain unanswered for a pretty long time.

### References

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