

Spatiotemporal Dynamics Role of Serotonin in Human Cognitive Functions

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Dear Editor,

The spatiotemporal morphology of Prefrontal Cortex (PFC) neural networks plays an important role in cognitive brain functions including self-awareness [1], working memory and cognitive flexibility [2]. Malfunction of this brain region may lead to brain disorders like schizophrenia, depression and addiction which all include ill self-mental model. Serotonin (5-hydroxytryptamine, 5-HT) contribute to the regulation of neural networks in PFC and other brain areas like hypothalamus. Serotonin is secreted by nuclei that originate in the median raphe of the brain stem and project to many brain neo-cortex and spinal cord areas. As a consequence, drugs that target certain serotonin receptors are useful in the treatment of a variety of diseases [3].

To clarify the role of serotonin as precursor of cognitive functions, we must examine biophysical processes which serotonin is involved in CNS and electro-chemical post-synaptic effects of it. In terms of chemical structure, serotonin is a derivative of the naturally occurring intrinsically fluorescent amino acid tryptophan [4]. Tryptophan (TRP) is the amino acid precursor of 5-HT, always played a critical role in life processes, because of its ability to convert solar energy (photons) into biological energy (secretion of ATP in plants). Plants are capable of limited movements by slowly rotating their leaves toward the source of light. The turning of the leaf to its source of energy depends on the rearrangement of the cell's cytoskeleton inside the leaf cells due to serotonin and other similar compounds such as auxin, which have tryptophan as their precursor molecule [1]. The action of serotonin on the cytoskeleton of plant cells, is a precursor of the action of serotonin in neural development and adult neuroplasticity in mammals [5]. Therefore, in much the same way as serotonin and its derivatives influence the process and organelles of photosynthesis to move in order to track the source of light [6], in mammals serotonin influences the morphology of neurons involved in neuronal networking in order to track the source of relevant stimuli" [7].

The cell membrane's fluidity seems to be strongly linked with the cell membrane serotonin receptors whereby according to the level of the cell membrane fluidity, the serotonin binding ability of receptors changes [6]. These acknowledgment leads to form hypothesis that serotonin is involved in integrative functions of nervous system in a gestalt manner that synchronizes neural networks in spatiotemporal manner in response to input stimuli by affecting post synaptic signals and cell membrane plasticity. The multidimensional nature of serotonin that acts as a bio factor for signal regulation and light and energy cycles, shows interconnecting role of serotonin between different cognitive levels (emotional, psychological etc.) of human brain. Involved in contradictory functions like sleep-wake cycle, learning (new stimuli) and memory (old saved stimuli), self-awareness and solved ego boundaries in different drug abused states, etc. points that 5-HT plays an important role in persons individual integrative perception of contradictions in different cognitive levels and disorders in which involve in serotonergic pathways contain unsolved contradiction in psychological and cognitive levels.

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Received Date: 04 Jan 2021

Accepted Date: 25 Jan 2021

Published Date: 29 Jan 2021

Citation: Salimi MA, Gharibzadeh S. Spatiotemporal Dynamics Role of Serotonin in Human Cognitive Functions. *J Neurol Forecast.* 2021; 4(1): 1014.

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