



BCL 2023

Edition IV



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10 Jan | 15:00-15:30 & 16:00-16:30

Non-invasive brain stimulation to impact neural circuits, sleep and cognition in Alzheimer's disease

Abstract: A mechanistic understanding of the impact of Alzheimer's disease (AD) on cognitive functions has been pursued across many levels of analysis; however, recent work has provided growing support for the view that it can be considered a large-scale synaptic and network disconnection disorder. For example, coherence and/or amplitude of gamma frequency neural oscillations (~30-100 Hz), which are implicated with numerous higher-order cognitive functions, are affected in various brain areas in AD. Moreover, neural circuit dysfunction plays a critical role in AD etiology; such disruptions have effects on several cell types. Thus, our working hypothesis is that correcting neuronal circuit alterations has the potential to feed back onto multiple cell populations to improve molecular and cellular pathologies. We have sought less invasive approaches for modifying neural activity and gamma oscillations. Our approach has been to harness patterned sensory and transcranial electrical stimuli, which are known to entrain network oscillations in human and animal models. I will briefly share some data which shows that non-invasive brain stimulations administered at gamma frequency improve episodic memory and gene expression programs in neurons and glial cells and impact neural oscillations and sleep.

Brief Bio: Chinna received his Ph.D. degree in neurobiology in 2016 from the University of Haifa, Israel. He carried out his Ph.D. thesis research at the University of Haifa and at the RIKEN Center for Brain Science, Japan. He uncovered the principles of associative taste aversion learning and memory. He pursued his postdoctoral research at the Picower Institute for Learning and Memory at the Massachusetts Institute of Technology, USA (2016-2020), where he continued to work as a research scientist (2021-2022). He demonstrated the neural circuit basis of cognitive dysfunctions in mouse models of Alzheimer's disease and how brain stimulation could modify Alzheimer's pathophysiology, learning & memory. In the summer of 2022, he joined as a faculty member at the Centre for Brain Research at the Indian Institute of Science.