DANDRITE
Danish Research Institute of Translational Neuroscience
Nordic EMBL Partnership for Molecular Medicine

AARHUS UNIVERSITY

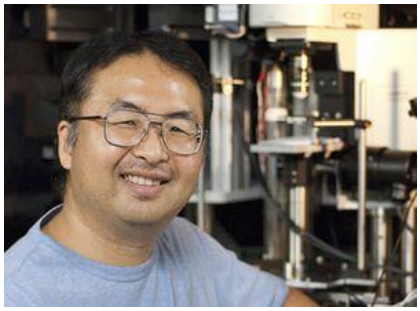
Virtual DANDRITE Lecture

Friday 10th June 2022

11.00 – 12.00

Online via Zoom

Please find Zoom link via the Outlook calendar invitation. If you have not received this, please write an e-mail to Astrid: asmu@dandrite.au.dk



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Synaptic plasticity during sleep is required for memory

Memories are initially formed in the hippocampus but subsequently transferred to the rest of brain for a long-term storage. This phenomenon is called "memory consolidation," but the cellular mechanism responsible for it has not been fully elucidated. Long-term potentiation (LTP) of synaptic transmission, which increases the efficiency of the transmission of neural activity between cells for long-term, is known as a cellular phenomenon of memory. If we can determine when and where LTP occurs, we can dissect out the cellular process responsible for the memory consolidation. We first developed a technique to detect when and where LTP is occurring. We employed SuperNova, a fluorescent protein derived from sea anemones to accomplish this. Upon illumination, SuperNova releases reactive oxygen species (ROS), which then inactivates the surrounding proteins. We connected SuperNova with cofilin, an actin binding protein specifically accumulates at the synapse after LTP induction. Illumination of cofilin-SuperNova caused an erasure of LTP only within 20 min after the induction. We found light irradiation into the hippocampus immediately after learning or during sleep after learning leads to erasure of the memories in both cases. This indicates that two waves of LTP occurred in the hippocampus immediately after learning and during sleep afterwards, and that these stepwise LTP events shape memories in the hippocampus. To further understand the time window in which memories are transferred to the cortex, we examined the time window of LTP in the anterior cingulate cortex, a cortical region implicated in the recall of old memory and found that LTP was induced in the anterior cingulate cortex during sleep the day after learning but not on the same day. This technology has the potential to elucidate many brain functions involved in memory at the cellular level.

Host

Tomonori Takeuchi, Team Leader at DANDRITE