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

AARHUS UNIVERSITY

DANDRITE Lecture

Friday 14 June 2019
11.00 – 12.00

Aarhus University, Ny Munkegade, 8000 Aarhus C
Building 1532, room 116, Auditorium G1 (Aud. G1)

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A prefrontal-thalamic circuit for route planning

The hippocampus and associated parahippocampal structures are key elements of the brain circuit that enables animals to navigate to desired locations in space. Many neurons in this circuit, such as place cells or grid cells, fire when animals visit particular locations, suggesting that these neurons are part of an internal map of the environment. However, while place cells or grid cells provide information about the animal's instantaneous position, it is largely unclear how animals can plan an optimal route the destination. Our previous study has shown that information about upcoming trajectories in the CA1 area of the hippocampus is transferred from the medial prefrontal cortex (mPFC) through the thalamic nucleus reuniens (RE) that has strong projections to the CA1 region (Ito et al., 2015). Although this result implies that the mPFC-RE circuit likely plays a key role in navigation, lesions of RE did not necessarily impair the performance of navigation tasks.

We hypothesize that the mPFC-RE circuit may play a key role in planning of complex routes. We found that neurons in mPFC or RE represent the animal's next move direction relative to the animal's body axis (e.g. in an egocentric perspective). However, during navigation, the next movement must be evaluated based on an allocentric map of the environment that is thought to be represented in the hippocampus and parahippocampal regions. The communication between mPFC and the hippocampus through RE may therefore be necessary for route planning. We tested this idea by using a navigation task that requires not only the estimation of the goal location, but also planning of an optimal route to reach there. When RE neurons were inactivated using the DREADDs system, the animal's behavior was impaired when the animal was required to plan a complex route. We are currently investigating the activity of neurons in RE and the hippocampus to understand neural computation underlying route planning.

Host: Associate Professor and DANDRITE Team leader Tomonori Takeuchi, Department of Biomedicine, Aarhus University