

## **Hippocampal theta phase coding for integrative memory encoding and its participation in a global brain network**

Yoko Yamaguchi, RIKEN Brain Science Institute

According to the cognitive map theory, individual on-going signals should be integrated into an internal map in the hippocampus. We hypothesized that theta phase precession provides selective temporal binding in an associative memory and proposed a hippocampal network model with theta phase coding. According to computational requirements, theta phase coding is assumed 1) at the entorhinal cortex that is either the entrance or exit of the hippocampus, 2) as neural oscillation with a gradually increasing intrinsic frequency phase-locked with local field potential theta.

Analyses of this network model indicate that hippocampal synaptic plasticity under theta phase coding ensures not only sequence memory encoding in a wide time range but also map formation such as object-place memory instantaneously. Comparison with rat experimental data suggests that theta phase dependent activities of place cells should be regulated through intra and extra hippocampal signals.

Recent elucidation on human brain enlightened the distribution of theta rhythm in the entire brain. Possible functional roles of theta for executive control in a temporal network of distant regions will be discussed.

### **reference:**

<http://www.dei.brain.riken.jp/pubs.htm>

### **Discussion points:**

How is phase precession different in different regions of the hippocampus and the entorhinal cortex? (to identify the neural mechanism of phase coding) How does phase precession depend on task conditions? (to enlighten the function and purposeful control of phase precession) What is the function of human theta? etc.