

## 【Grant-in-Aid for Specially Promoted Research】

### Biological Science



Title of Project : Mechanisms underlying information processing in idling brain

Kaoru Inokuchi  
(University of Toyama, Graduate School of Medicine and  
Pharmaceutical Sciences, Professor)

Research Project Number : 18H05213 Researcher Number : 20318827

Keyword : neuroscience, idling brain, memory engram, sleep, replay

#### 【Purpose and Background of the Research】

Recently it has been clarified that neurons in the brain are active even when animals sleep or rest, denoted in this proposal as “idling brain state”. Everybody has experiences where they suddenly get the answer on an unsolved issue after sleep or relaxation. We have recently found in mice that, among a number of cell assemblies that were activated during hippocampus-dependent learning, only cell assemblies that were reactivated during subsequent sleep (replay) were again activated during the subsequent retrieval session. These suggest strongly that idling activity of the brain plays important roles in information processing than previously thought. In this research project, we aim to clarify and characterize the cell assembly activities during idling state by means of live-calcium imaging with microendoscope. We will further clarify the functions of idling brain activities.

#### 【Research Methods】

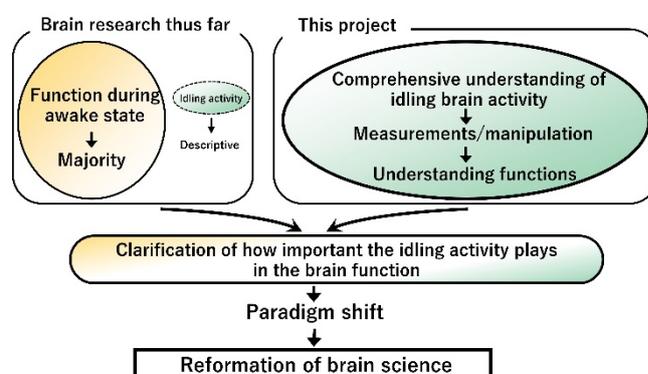
We will employ micro-endoscopes, nVista and nVoke, and in vivo calcium imaging with GCaMP to monitor neuronal activity in the brain during pre-learning idling state, learning, post-learning idling state, and retrieval. We will perform a series of experiments in which we will manipulate the activity of selected cell assemblies to elucidate the roles of idling activity. We will clarify 1) how memories are represented as cell assemblies during idling state, 2) how distinct memories are checked and integrated, if necessary, to create a new memory, 3) roles played by idling activity in the consolidation, selection, association, and dissociation of memories.

#### 【Expected Research Achievements and Scientific Significance】

This work will not only reveal the idling activity at the cell assembly level, but also elucidate the functional role of the idling activity in information processing by employing cutting-edge techniques.

Thus, this work will clarify latent abilities of the brain based on the scientific background. This work

would have an impact on the brain science as well as a wide variety of sciences and arts.



#### 【Publications Relevant to the Project】

1. Abdou, K, ....., and Inokuchi, K. Synapse-specific representation of the identity of overlapping memory engrams. *Science* 360: 1227-1231 (2018)
2. Yokose J, ....., and Inokuchi K. Overlapping memory trace indispensable for linking, but not recalling, individual memories. *Science* 355: 398-403 (2017)

【Term of Project】 FY2018-2022

【Budget Allocation】 427,200 Thousand Yen

#### 【Homepage Address and Other Contact Information】

<http://www.med.u-toyama.ac.jp/bmb/index-j.html>  
bmb@med.u-toyama.ac.jp