Neural Plasticity

Hindawi

Special Issue on

Optogenetics and Chemogenetics Approaches to Studying the Nature of Memory Representation

CALL FOR PAPERS

There is near consensus that memory relies upon changes in the synaptic strength between specific neurons that were active at the time of learning. This learning related neural plasticity theoretically permits stable brain states that can trigger appropriate behaviours. Despite decades of research, it is far from clear which features of neural activity constitute such a meaningful brain state; we do not know the language the brain uses to communicate with itself. Without knowing what counts as a neural code, it will be impossible to determine the laws that dictate how such a code changes with learning.

In the past decade, the extensive usage of optogenetics and chemogenetics to study memory processes has offered unprecedented opportunities to probe the precise mechanism of synaptic plasticity and how it contributes to learning and memory-driven behaviours in healthy or pathological conditions. The main advantage in using these technologies is the ability to target genetically defined subpopulations of neurons in specific regions and manipulate them in a temporally specific manner. This control allows for precise manipulation of neural activity in experimentally defined neuronal populations to study how neural activity and neural plasticity, change with experience. A striking and reliable result from so-called "engram" studies is that simple behaviours can be elicited in a contextually appropriate manner with rhythmic activation of sets of neurons that had been coactive on the minute to hour timescale. What can these findings tell us about the nature of neuronal representation, plasticity, and recall?

In this special issue, we invite researchers to contribute original research articles where the use of optogenetics and chemogenetics is key to the study of neural plasticity and memory or review articles that will help us better understand the contribution of these technologies to new discoveries of memory processes. We especially encourage works in which the artificial experimental manipulation is coupled with certain neural recording (e.g., calcium imaging and electrophysiology).

Potential topics include but are not limited to the following:

- Revealing a causal role of synaptic plasticity in memory
- Using optogenetics or chemogenetics to study the role of specific population of neurons in memory performances
- Probing how changes in different aspects of neural coding (firing rate, temporal order, and neuronal identity) contribute to successful recall
- Showing new regions or specific connections between regions that support memory
- Studying new pathways necessary during memory acquisition, consolidation, or recall
- Using optogenetics or chemogenetics to study mechanisms underlying memory deficits in disease models

Authors can submit their manuscripts through the Manuscript Tracking System at https://mts.hindawi.com/submit/journals/np/ocs/.

Papers are published upon acceptance, regardless of the Special Issue publication date.

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Submission Deadline
Friday, 2 February 2018

Publication Date
June 2018