BDR SEMINAR via Zoom

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14:00-15:00, 1F Auditorium, DB Building C, Kobe / Broadcast online via Zoom

※Zoom meeting URL will be announced on the event day by e-mail.

Representations of recent sensory experience by thalamocortical networks enable perceptual inference

While sensory information is often ambiguous and disconnected, our perception of the world (internal model) is stable and continuous. The relative insensitivity of perception to moment-by-moment changes in inputs suggests the existence of a "buffer" of stored information derived from recent sensory inputs (sensory history). Such short-term buffering of information is thought to underlie perceptual processes such as sensory inference that enable decision-making under conditions of uncertainty. In contrast, excessively strong history maintenance may contribute to biased decision-making in normal people as well as delusions and hallucinations in patients with disorders such as schizophrenia. Here I present evidence that thalamocortical interactions between the posterior parietal cortex (PPC) and its thalamic counterpart, the pulvinar (PUL) are essential to maintain and update representations of recent experiences that influences behavior in an auditory decision-making task. More specifically, we find that PPC and PUL neurons encode a representation of recent sensory history that predicts the history related bias, suggesting that these circuits could influence current decision-making based on patterns in past inputs. Consistent with this idea, suppression of PPC or PUL reduces the influence of previous inputs on decision-making and disrupts the ability to use sensory history to infer correct responses when stimuli are ambiguous. Together, these findings suggest that PPC/PUL are involved in establishing and updating models of the sensory environment based on ongoing experience that underlie bias and sensory inference.

Recruitment of fixed output populations into flexible task networks in the PFC

In constantly changing environments, animals must adapt their behaviors based on informative sensory stimuli. Because the meaning of a given sensory input can vary depending on the situation, the brain must flexibly map each stimulus to its appropriate output depending on internal goals. The prefrontal cortex (PFC) is known to be key area for the implementation of such flexible transformations but how the PFC supports adaptive processing of information across multiple tasks without interference remains unclear. An important step in understanding computations in the PFC is to examine how outputs (decoders) of this circuit are flexibly incorporated into their task-specific networks. To investigate this, I employed behavioral tasks that require cue to task-rule transformation in the PFC to both identify populations carrying relevant output information and examine task-related activity in this population. My findings demonstrated that PFC neurons projecting to different territories of the tail of striatum acted to decode rule information, providing outputs capable of differentially controlling the gain of sensory inputs depending on task-demands. These outputs were anatomically fixed, placing a fundamental constraint on the internal dynamics of the PFC. Overall, my results identify a key output of the PFC responsible for the control of sensory processing and introduce important principles that provide a framework for understanding how this circuit can remodel its internal network across dynamically changing behavioral conditions.

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