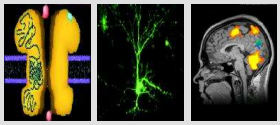

SENSORY ENCODING AND THE EMERGENCE OF MEMORY

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Session 2 **Microcircuit control of sensory information processing and behavior**

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Learning and meta-learning rules in the cerebellum

A key function of the brain is to learn about the statistical relationships between events in the world. A mechanism of this learning is associative neural plasticity, controlled by the timing between neural events. We found that experience can dramatically alter the timing contingencies governing associative plasticity to match to the functional requirements of a particular circuit and learning task, providing a candidate neural mechanism for meta-learning. In normal mice, the timing requirements for associative plasticity in the oculomotor cerebellum are precisely matched to the 120 ms delay for visual feedback about behavioral errors. This task-specific specialization of the timing rules for plasticity is acquired through experience; in dark-reared mice that never experienced visual feedback about oculomotor errors, plasticity defaulted to a coincidence-based rule. Computational modelling suggests two broad strategies for implementing adaptive tuning of the timing rules for associative plasticity, which tune plasticity to different features of the statistics of neural activity.