IN BRIEF

LEARNING AND MEMORY

Engineering memories

In this study, optogenetic excitation of auditory inputs to the lateral amygdala was used as a conditioning stimulus instead of auditory tone presentation. Pairing the optical conditioning stimulus with footshock resulted in long-term potentiation (LTP) at stimulated lateral amygdala synapses. Optogenetic induction of long-term depression (LTD) inactivated this memory, which could be optogenetically reactivated by application of an LTP stimulation protocol. Thus, these data support a causal link between LTP, LTD and associative memory.

ORIGINAL RESEARCH PAPER Nabavi, S. *et al.* Engineering a memory with LTD and LTP. *Nature* http://dx.doi.org/10.1038/nature13294 (2014)

GLIA

A broader remit for leptin

Leptin receptors are expressed by certain hypothalamic neurons and are also present on hypothalamic astrocytes. Conditional deletion of these receptors in adult mice resulted in altered astrocyte morphology, fewer direct interactions between astrocytes and hypothalamic neurons, and altered feeding behaviour. In addition, the hypothalamic neurons formed increased numbers of synapses and showed an increase in miniature inhibitory postsynaptic potentials, suggesting that leptin receptors expressed by glia play an active part in leptin-regulated feeding.

ORIGINAL RESEARCH PAPER Kim, J. G. *et al.* Leptin signaling in astrocytes regulates hypothalamic neuronal circuits and feeding. *Nature Neurosci.* http://dx.doi.org/10.1038/nn.3725 (2014)

NEUROIMMUNOLOGY

Inflammation gets traffic moving

How the brain signals to the immune system during systemic inflammation is not known. Mice were engineered to express a reporter gene exclusively in haematopoietic cells (immune precursors). This reporter was found to be secreted by haematopoietic cells in the form of exosomes and taken up and expressed by Purkinje neurons. Purkinje cells that had taken up the mRNA-containing exosomes showed differences in microRNA profiles, suggesting that signalling between haematopoietic cells and Purkinje neurons has physiological consequences and might play a part in neuroimmune signalling during chronic inflammation.

ORIGINAL RESEARCH PAPER Ridder, K. *et al.* Extracellular vesicle-mediated transfer of genetic information between the hematopoietic system and the brain in response to inflammation. *PLoS Biol.* **12**, e1001874 (2014)

SLEEP AND MEMORY

To sleep and learn

It has been proposed that the increased network activity and, consequently, synaptic plasticity that occurs during sleep might play a part in memory consolidation, but this has been controversial. Transgenic mice that expressed yellow fluorescent protein in motor cortex neurons were trained to run forwards on an accelerating rotarod. Following sleep, these animals showed a marked increase in spine number, which was branch-specific. Neurons activated during the learning of a motor task were reactivated during non-rapid eye movement sleep, and disrupting this interfered with branch-specific spine formation, suggesting an involvement of sleep in learning-dependent synapse formation.

ORIGINAL RESEARCH PAPER Yang, G. *et al.* Sleep promotes branch-specific formation of dendritic spines after learning. *Science* **344**, 1173–1178 (2014)