

IN BRIEF

CELLULAR IMAGING**A signal boost for GEVIs**

Researchers have long sought a method for non-invasively measuring changes in membrane potential; however, existing genetically encoded voltage indicators (GEVIs) generate weak signals that cannot be detected in intact tissues. The authors engineered a new GEVI, ArcLight, with an improved signal-to-noise ratio that enabled them to record from individual neurons in the intact *Drosophila melanogaster* brain. ArcLight can signal both subthreshold changes in membrane potential and action potentials, opening the door to further studies of electrical activity in intact neural circuits.

ORIGINAL RESEARCH PAPER Cao, G. *et al.* Genetically targeted optical electrophysiology in intact neural circuits. *Cell* **154**, 904–913 (2013)

NEURAL DEVELOPMENT**Coffee disrupts brain development**

Little is known about the effects of caffeine consumption during pregnancy on fetal brain development. Silva *et al.* now show that the pups of mice that consumed caffeine (equivalent to a human drinking three to four cups of coffee per day) throughout pregnancy and lactation exhibit delayed migration of hippocampal GABA neurons, hippocampal hyperexcitability and increased seizure susceptibility. Adult offspring had hippocampal neuronal loss and memory deficits. The findings suggest that further studies into the effects of moderate caffeine exposure in human pregnancy should be carried out.

ORIGINAL RESEARCH PAPER Silva, C. G. *et al.* Adenosine receptor antagonists including caffeine alter fetal brain development in mice. *Sci. Transl. Med.* **5**, 197ra104 (2013)

COGNITIVE NEUROSCIENCE**A functional gradient**

Recent work suggests that dopamine neurons have a role in cognitive processing that is distinct from their established role in reward prediction error coding. Here, the authors recorded from midbrain dopamine neurons in monkeys as they performed a task requiring working memory and visual search. Activity in dorsolateral ventral midbrain neurons correlated with working memory demand, whereas activity in ventromedial ventral midbrain neurons represented reward prediction, suggesting that the involvement of midbrain dopamine signalling in different aspects of a cognitive task varies along a dorsolateral–ventromedial axis.

ORIGINAL RESEARCH PAPER Matsumoto, M. & Takada, M. Distinct representations of cognitive and motivational signals in midbrain dopamine neurons. *Neuron* <http://dx.doi.org/10.1016/j.neuron.2013.07.002> (2013)

SENSORY SYSTEMS**Probing hot cell function**

Most animals avoid adverse temperatures; however, the molecular basis of this response is poorly understood. In *Drosophila melanogaster*, both internal and external 'warmth sensors' have been proposed. Here, the authors characterize the molecules that confer thermal sensitivity to hot cell (HC) neurons, the external warmth sensors. They found that the gustatory receptor Gr28b is expressed in HC neurons and is responsible for the rapid withdrawal of flies from a steep thermal gradient. This complements the function of Transient receptor potential A1, which is expressed in internal thermosensory neurons and controls the behavioural response to shallow thermal gradients.

ORIGINAL RESEARCH PAPER Ni, L. *et al.* A gustatory receptor paralogue controls rapid warmth avoidance in *Drosophila*. *Nature* <http://dx.doi.org/10.1038/nature12390> (2013)