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IN BRIEF

SLEEP

Dissecting sleep circuits

Multiple brain regions have been implicated in the control of sleep, wakefulness and the transitions between rapid eye movement (REM) sleep and non-REM (NREM) sleep; however, the circuits involved are poorly understood. Two recent papers have combined optogenetics with neuronal activity recordings to investigate the cell types and pathways controlling sleep in the mouse. Xu *et al.* showed that three populations of basal forebrain neurons — namely, glutamatergic, cholinergic, and parvalbumin-expressing GABAergic neurons — are hierarchically connected and drive wakefulness. By contrast, somatostatin-expressing GABAergic basal forebrain neurons inhibited the wake-promoting neurons and induced NREM sleep. Weber *et al.* identified a GABAergic population of neurons in the ventral medulla that project rostrally to the pons and midbrain to drive NREM–REM sleep transitions and maintain REM sleep. These papers thus begin to dissect the complex circuitry mediating sleep control and may provide tools to evaluate sleep function.

ORIGINAL RESEARCH PAPERS Weber, F. *et al.* Control of REM sleep by ventral medulla GABAergic neurons. *Nature* **526**, 435–438 (2015) | Xu, M. *et al.* Basal forebrain circuit for sleep–wake control. *Nat. Neurosci.* http://dx.doi.org/10.1038/nn.4143 (2015)

MODELLING

First 'Blue Brain' results

Ten years ago, the 'Blue Brain Project' launched with the aim of producing a biologically accurate model of the brain by combining experimental data with powerful computer algorithms. Markram and collaborators now describe the project's first output: the digital reconstruction of the microcircuitry of a 0.29 mm^3 volume of juvenile rat somatosensory cortex. Sparse, experimentally measured information on neuronal morphology, physiology and organization was integrated into the 'first draft' digital reconstruction, the biological validity of which was tested by assessing its ability to reproduce several *in vitro* and *in vivo* experimental findings.

ORIGINAL RESEARCH PAPER Markram, H. *et al.* Reconstruction and simulation of neocortical microcircuitry. *Cell* **163**, 456–492 (2015)
FURTHER READING Markram, H. The Blue Brain Project. *Nat. Rev. Neurosci.* **7**, 153–160 (2006)

BRAIN–MACHINE INTERFACES

Creating a sensation

Developers of neural prosthetics are keen to devise ways to provide sensory feedback to the brain. Tee *et al.* now describe an 'organic digital mechanoreceptor' that mimics the characteristics of human cutaneous mechanoreceptors. The digital mechanoreceptor was composed of flexible organic electronic materials, including an oscillator circuit that generates voltage spikes and a carbon nanotube-based pressure sensor that modulates the spike frequency. The digital mechanoreceptor generated a signal with a range of 0–200 Hz, similar to that of a cutaneous mechanoreceptor. By coupling the mechanoreceptor to a light-emitting diode, the signal was transduced into light signal and used to optogenetically stimulate neurons in brain slices. Changes in pressure could thus be translated into changes in neuronal firing frequency. It is hoped that these devices may be used to provide prosthetic wearers with a sense of touch.

ORIGINAL RESEARCH PAPER Tee, B. C.-K. *et al.* A skin-inspired organic digital mechanoreceptor. *Science* **350**, 313–316 (2015)