# IN BRIEF

VISUAL PROCESSING

## Local-feature assembling in visual pattern recognition and generalization in honeybees.

Stach, S. *et al. Nature* **429**, 758–761 (2004)

Continuing on a theme of recent years in demonstrating increasingly complex sensory and cognitive abilities in the tiny brains of bees, the authors show that honeybees can link different features in learning a visual pattern, and can generalize their responses to novel stimuli that share the layout of the trained stimuli. Generalization depended on the number of edges that were the same between two layouts. The pattern recognition required stimulation of the achromatic L-photoreceptor system.

DEVELOPMENT

## *In vivo* convergence of BMP and MAPK signaling pathways: impact of differential Smad1 phosphorylation on development and homeostasis.

Aubin, J. *et al. Genes Dev.* **18**, 1482–1494 (2004)

Effector molecules called Smads integrate signalling pathways that are important during development and in homeostasis. Aubin *et al.* show that a carboxy-terminal mutant Smad that cannot undergo transcriptional activation by BMP (bone morphogenetic protein) recapitulates many of the features of a Smad-null mutant, whereas a mutant in which Smad cannot be phosphorylated by MAPK (mitogen-activated protein kinase) has various other phenotypes. It seems that signalling by BMP and MAPK through Smads needs to be precisely balanced.

NEUROTECHNIQUES

## Localized chemical release from an artificial synapse chip.

Peterman, M. C. *et al. Proc. Natl Acad. Sci. USA* **101**, 9951–9954 (2004)

The authors have developed a chip that uses electro-osmosis to deliver tiny quantities of chemical compounds through 5-μm apertures. They cultured PC12 cells on this 'artificial synapse chip' and can stimulate individual cells by controlled release of bradykinin. As a prototype neural interface, the chip could have many applications in basic research and clinical treatments.

COGNITION

## Matching behavior and the representation of value in the parietal cortex.

Sugrue, L. P. *et al. Science* **304**, 1782–1787 (2004)

Both reward history and reward probability influence decision making. To investigate how these factors are represented by neurons, Sugrue *et al.* used an eye-movement task in which monkeys were rewarded with different probability for choosing different targets. The behaviour of the monkeys tracked changing reward probabilities and could be predicted by a simple model. The authors found that neurons in the parietal cortex represented the relative value of available choices as predicted by the model.

Image by S. Fenwick.

BEHAVIOUR

# Loving mothers ease stress through epigenetics

**'Bad mothers' have long been held responsible for behavioural problems in their children; remember, for example, the now disgraced idea that 'refrigerator mothers' bear the blame for children's autism. In rats, we know that the amount of nursing care a dam lavishes on her pups influences their adult response to stress. New work from Michael Meaney's group, published in *Nature Neuroscience*, indicates a plausible mechanism to explain how early maternal behaviour might wield such long-term influence over the offspring.**

**Stress activates the hypothalamic–pituitary–adrenal (HPA) axis, which increases plasma glucocorticoid levels. By means of a negative-feedback loop, glucocorticoids dampen the HPA response. In adult rats that enjoyed high levels of maternal care in their first week of life, glucocorticoid receptor (GR) expression in the hippocampus is increased, making the whole HPA axis more sensitive to glucocorticoid feedback. Possible mechanisms have been suggested for how maternal care might acutely increase GR expression, but how this effect is maintained throughout life remains a mystery.**

**The regulation of gene transcription is highly complex, and one mechanism that is involved is DNA methylation. Weaver *et al.* compared methylation of the GR promoter in the adult offspring of high-caring and low-caring dams. In the 'high-care' group, methylation of a particular cytosine in the binding site for the transcription factor NGFI-A was 90% less than in the 'low-care' group. This cytosine is highly methylated in newborn pups of either high- or low-caring dams, but in pups that were nursed (not necessarily born) by a high-caring dam, methylation dropped within six days, and remained low thereafter. Reduced methylation correlated with increased NGFI-A binding to the promoter, which is expected to increase GR transcription.**

**To perturb the system, the authors infused trichostatin A (TSA), an inhibitor that should indirectly reduce DNA methylation, into the brains of adult rats. As hypothesized, TSA treatment of 'low-care' rats decreased methylation of the vital cytosine, increased NGFI-A binding, and increased GR expression in the hippocampus. Finally, TSA treatment of 'low-care' rats reduced their plasma levels of the glucocorticoid corticosterone under both basal and stressed conditions, implying normalized HPA axis function.**

**DNA methylation patterns tend to be stable over time in postmitotic cells. Indeed, one of the questions arising from the Weaver *et al.* study is how exactly the de-methylation of the GR promotor cytosine is accomplished in 'high-care' pups. But the very stability of methylation also offers an intriguing explanation for how the effects of maternal care might last throughout a rat's lifespan.**

***Annette Markus, Associate Editor,* Nature Neuroscience**

## References and links

**ORIGINAL RESEARCH PAPER** Weaver, I. C. G. *et al.* Epigenetic programming by maternal behavior. *Nature Neuroscience* 27 June 2004 (doi:10.1038/nn1276)

**FURTHER READING** Meaney, M. J. Maternal care, gene expression, and the transmission of individual differences in stress reactivity across generations. *Annu. Rev. Neurosci.* **24**, 1161–1192 (2001) | Gross, C. & Hen, R. The developmental origins of anxiety. *Nature Rev. Neurosci.* **5**, 545–552 (2004)