FUNCTIONAL NEUROIMAGING

The mind of a child

A fundamental difficulty in using functional brain imaging to compare how children and adults perform a task is that both anatomy and performance on many tasks change with age. Schlaggar *et al.* have overcome these problems and find that, even when performance differences are compensated for, children and adults show different patterns of neural activation when doing simple verbal tasks.

The study involved adults and 7–10-year-old children who carried out word-generation tasks; for example, they might be asked to respond with a word that means the opposite of a cue word. Although the adults generally performed better and responded faster, there was sufficient overlap in performance to allow two 'matched' groups — one of children and one of adults — to be separated out for comparison.

While they performed the tasks, the subjects were scanned using functional magnetic resonance imaging (fMRI). A number of frontal and extrastriate brain areas showed differences in activation between children and adults, and some of these differences were related to age, rather than to differences in performance. Specifically, there was less activation in a left frontal region and greater activation in posterior left extrastriate cortex in children than in adults, even after they were matched for performance.

One possible explanation for these results is the relative maturity of different parts of the brain: the left frontal region might simply be immature in children, leading to an alternative strategy that produces more activation in extrastriate regions. Alternatively, more experience could be needed before the processing resources of this region are included in a strategy for verbal tasks. This kind of approach should help researchers to distinguish between performance- and age-related differences when using imaging for developmental studies, and provide us with more insight into the functional development of the brain.

Rachel Jones

References and links

ORIGINAL RESEARCH PAPER Schlaggar, B. L. *et al.* Functional neuroanatomical differences between adults and school-age children in the processing of single words. *Science* **296**, 1476–1479 (2002)

FURTHER READING Johnson, M. H. Functional brain development in humans. *Nature Rev. Neurosci.* **2**, 475–483 (2001)

IN BRIEF

CELL BIOLOGY OF THE NEURON

Extrasynaptic NMDARs oppose synaptic NMDARs by triggering CREB shut-off and cell death pathways.

Hardingham, G. E. *et al. Nature Neurosci.* **3**, 405–414 (2002)

A fascinating dissociation of the effects of synaptic and extrasynaptic NMDA receptors. Whereas activation of synaptic receptors increased the expression of the transcription factor CREB and of BDNF, and led to a reduction in apoptosis, the activation of extrasynaptic receptors had the opposite effects. This dissociation highlights the relevance of signalling microdomains in neuronal biology, and the potential of extrasynaptic receptors as therapeutic targets in conditions such as stroke.

NEURODEGENERATIVE DISEASES

A polymorphic gene nested within an intron of the *tau* gene: implications for Alzheimer's disease.

Conrad, C. *et al. Proc. Natl Acad. Sci. USA* **99**, 7751–7756 (2002)

Neurofibrillary tangles in the brains of Alzheimer's disease (AD) patients contain an insoluble form of the TAU protein. However, it is not clear how the protein becomes insoluble. Conrad *et al.* have now identified a new gene, saitohin (*STH*), which contains a point mutation in many patients with late-onset AD. Interestingly, *STH* lies within an intron of the *TAU* gene, and the authors speculate that it might act in the same pathway as TAU.

CIRCADIAN RHYTHMS

Prokineticin 2 transmits the behavioural circadian rhythm of the suprachiasmatic nucleus.

Cheng, M. Y. *et al. Nature* **417**, 405–410 (2002)

Cheng *et al.* show that prokineticin 2 (PK2) meets the criteria to act as an output molecule that transmits the circadian rhythm from the suprachiasmatic nucleus (SCN) to physiological and behavioural systems. Transcription of PK2 in the SCN is regulated by core clock genes and entrained by light; the receptors for PK2 are found in the main target areas of SCN output; and administration of PK2 at night (when endogenous levels are low) suppresses wheel-running behaviour.

LEARNING AND MEMORY

Operant reward learning in *Aplysia*: neuronal correlates and mechanisms.

Brembs, B. *et al. Science* **296**, 1706–1709 (2002)

In an *in vivo* operant-learning paradigm, spontaneous biting movements in *Aplysia* were followed by stimulation of the En_2 neuron (which normally fires during feeding and appears to act as a reinforcer). This led to an increase in spontaneous biting and in the excitability of a neuron, B51, in the buccal ganglion. In an *in vitro* analogue of the operant-learning system, plateau potentials in B51 were paired with puffs of dopamine (representing the reinforcing input from En_2), and this led to a decrease in the burst threshold and an increase in input resistance of B51. These changes seem to represent a cellular correlate of operant learning.