WEB WATCH

Cognitive science goes live

There is an increasing trend for publishers of major reference works to offer them online. This approach has obvious advantages: articles can be linked to one another, readers can easily search for words or subjects, and information can be updated as a field moves on. The best known of these virtual tomes is probably the Encyclopaedia Britannica; but smaller, more focused publications are also to be found online.

Sharp-eyed readers may have noticed that some of our articles feature links to the Massachusetts Institute of Technology Encyclopedia of Cognitive Sciences. MITECS, as the online version is known, is a comprehensive reference work containing over 450 articles written by leading researchers on topics ranging from the philosopher René Descartes to neural development. Subscribers can access the full articles but non-subscribers can still read the abstracts and, of particular use, follow the links to other web-based resources related to each topic.

The design of the site is attractive and simple, and it is easy to find articles by author or subject area. Each abstract also includes links to other, related articles within MITECS, so that I found myself following a train of articles that began with dyslexia and ended with cultural symbolism. Articles are split into six broad areas: Psychology, Neuroscience, Philosophy, Linguistics and Language, Computational Intelligence, and Culture, Cognition and Evolution. So next time you see a link to MITECS at the end of a *Nature Reviews Neuroscience* article, why not follow it and see where you end up?

Rachel Jones

Courtesy of the Kobal Collection.

ADDICTION

A rewarding double act

Understanding the molecular basis of the rewarding and reinforcing effects of addictive drugs such as cocaine is important for developing therapies to combat addiction. Cocaine blocks the reuptake of dopamine, serotonin and noradrenaline from the synaptic cleft by inhibiting the corresponding neuronal transporters, DAT, SERT and NET. As with other drugs of abuse, the consequent increase in synaptic dopamine levels in the nucleus accumbens — a major brain reward centre — is thought to be a key factor behind cocaine reward. Surprisingly, however, cocaine reward was found to be intact in mice lacking DAT, indicating that blockade of this transporter is not the sole mechanism that mediates reward. Other experiments have implicated SERT blockade in cocaine reward, but reward is also intact in mice lacking this transporter. One possible explanation for these observations is that cocaine normally produces reward through simultaneous actions at both DAT and SERT, with sufficient redundancy in the mechanism to maintain reward in the absence of one or other transporter. By generating double-knockout mice with deletions of one or both copies of the *DAT* and *SERT* genes, Sora *et al.* have now provided strong evidence to support this idea, and also insights into the relative contributions of dopamine- and serotonin-mediated mechanisms to cocaine reward.

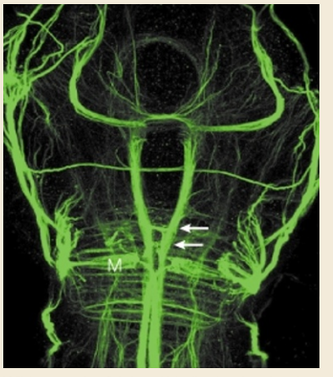
The authors used cocaine-conditioned place preference as a measure of cocaine reward/reinforcement. Mice with only a single copy of *DAT* and no copies of *SERT* showed near-wild-type levels of preference for places where they had received cocaine. However, mice lacking *DAT* and having either one or no copies of *SERT* no longer showed any such preference. Densities of DAT and SERT expression were reduced in a gene-dose-dependent manner,

MOTOR SYSTEMS

Lost in space

Different types of motor behaviour are regulated by specific neuronal circuits that are very precisely constructed during development. Although lesion and mutation studies have helped to identify some of these circuits in vertebrates, it has proved more difficult to elucidate the roles of individual neuronal components. The zebrafish is a useful model for analysing motor circuits, because its nervous system is assembled in a highly stereotypical manner and the locations of different neuronal subtypes are very well defined. As reported in *Development*, Lorent *et al.* have used this model to identify a gene that is required for one particular type of motor behaviour and seems to be essential for axonal pathfinding during development of the underlying neuronal circuit.

The *space cadet* gene emerged from a screen for mutations that affect specific aspects of motor behaviour in zebrafish. The mutation was initially characterized by the failure of larvae to show an escape response, which requires them to make a fast 180° turn. The main anatomical defect was the absence of two rhombomere 3 commissures. The authors showed that it was possible to generate a phenocopy of the *space cadet* mutant behaviour by severing the rhombomere 3 commissural tracts in wild-type larvae, confirming a causal relationship between the defects in commissure development and the behavioural phenotype. They narrowed the defect down further to a specific class of cell — the spiral fibre neurons. These neurons synapse onto Mauthner neurons, which were already known to be involved in regulating the escape response. By retrograde labelling of the Mauthner neurons with neurobiotin, which is able to pass through electrical synapses, they showed that the spiral fibre neurons failed to form synapses with the Mauthner neurons in the *space cadet* mutants.



Wild-type zebrafish larval hindbrain, showing the paired Mauthner cells (M) and the rhombomere 3 commissures (arrows). Image courtesy of Michael Granato, University of Pennsylvania School of Medicine, Philadelphia, USA.

What role does the *space cadet* gene play in neural development? One clue came from the observation that the pathfinding of another class of neuron was affected in the mutants — the retinal ganglion cells (RGCs). RGCs share certain features with spiral fibre neurons; for both cells, axonogenesis occurs relatively late