IN THE NEWS

Turning left?
Ultrasound scanning is generally considered to be a safe procedure for monitoring the health of unborn babies. However, research published recently in the journal *Epidemiology* casts doubt on this assumption by hinting that ultrasound might affect brain development.

The study, from the Karolinska Institute, indicated that boys who are scanned in the womb are significantly more likely to be left handed than those who are not scanned. This might not sound like a big handicap in itself, and the *Independent*'s (UK, 10 December) assertion that left handedness is "recognized as a mild form of brain damage" is sure to offend many left-handed people. However, the switch in handedness could indicate more serious problems. As the *Sunday Telegraph* (UK, 9 December) points out, "these people face a higher risk of conditions ranging from learning difficulties to epilepsy", although it is worth mentioning that no such adverse effects have yet been reported.

So, should expectant mothers think twice before having a scan? Maternity service campaigner Beverly Beech thinks so: "I am not sure that all the benefits of ultrasound scans outweigh the downsides. We should be advising women to think very, very carefully before they have scans" (*Sunday Telegraph*). The researchers, on the other hand, were keen to play down the risks. One team member, Juni Palmgren, said "I would urge people not to refuse ultrasound scanning as the risk of brain damage is only a possibility — but this is an interesting finding and needs to be taken seriously" (*BBC News*, 9 December).

Not everyone was pessimistic however. The web site *Anything Left-Handed* commented "if having ultrasound tests encourages left-handedness, that seems to us to be a GOOD THING!"

Heather Wood

SIGNAL TRANSDUCTION

Top-Notch result

Notch signalling is probably best known for its pivotal role in neural cell fate choice through lateral inhibition. In the *Drosophila* neuroectoderm, for example, cells that are destined for a neural fate upregulate the Notch ligand Delta, which activates Notch signalling in neighbouring cells, causing them to adopt an epidermal fate through the repression of the *achaete/scute* proneural genes. However, as Ramain *et al.* have now shown, lateral inhibition is not the only pathway that Notch can use to prevent neural differentiation.

The small sensory bristles (microchaetae) on the fly thorax are known to be specified through lateral inhibition, and the authors screened for mutations that resulted in their loss. They identified several *Notch* mutant alleles that produced such a phenotype, and they named these alleles N^{Mcd} (Mcd stands for microchaetae defective). These were classed as gain-of-function mutations, because they seemed to enhance Notch's normal function in repressing neural cell fate. The authors reasoned that if the mutant forms of Notch acted through the lateral inhibition pathway, then inactivating downstream components of this pathway (such as Suppressor of Hairless (Su(H)) and Groucho) in the N^{Mcd} mutants should restore the development of microchaetae. However, no such effect was seen, indicating that another pathway must be involved.

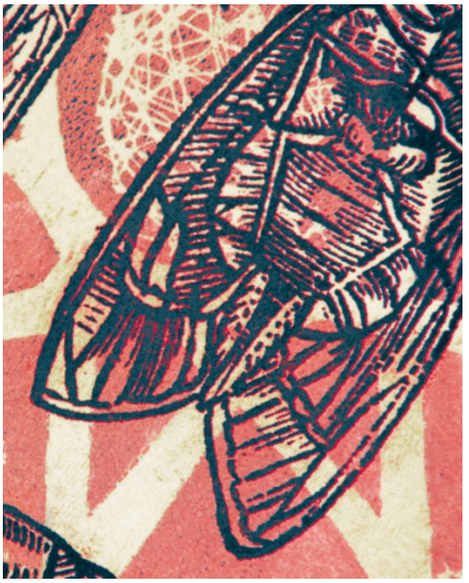
The adaptor protein Deltex has already been implicated in an alternative Notch signalling pathway that also represses *achaete/scute*, so Ramain *et al.* tried inactivating Deltex on an N^{Mcd} background. This time, the N^{Mcd} mutant phenotype was rescued, indicating that it was caused by abnormal activation of a Deltex-mediated pathway. Because the N^{Mcd} phenotype depends on Deltex activation, this pathway must presumably have to be repressed in order for microchaetae to develop. How might this be achieved? A clue

BEHAVIOURAL GENETICS

Ants and Bs

When trying to understand how complex social behaviour — as displayed by social insects, such as ants and bees, for example — evolved or is controlled, one problem is knowing where to start. It has been very difficult even to find examples of complex social traits that are clearly heritable, let alone ones in which the genetic basis of variation in behaviour can be indentified. But a striking exception to this rule has been described by Krieger and Ross in *Science*. They have identified a gene that determines whether a colony of fire ants (*Solenopsis invicta*) will have one queen (a monogynous colony) or many (polygynous). The identity of the gene gives us interesting clues as to the possible neural mechanisms of the control of queen number in fire ant colonies.

Red fire ants are native to South America, but were imported into the United States in the 1930s, and have since spread across much of the southeast United States. Colonies of red fire ants can be monogynous or polygynous, and it was previously shown that a single gene (*Gp-9*) controls the choice between the two. Colonies consisting of ants that are homozygous for the *B* allele at *Gp-9* are always monogynous, whereas



came the finding that the N^{Mcd} alleles produce truncated forms of Notch that lack an intracellular binding site for the Dishevelled protein, which can act as a Deltex antagonist. The authors also argue that Deltex and Su(H) antagonize one another, so the lateral inhibition and Deltex-mediated pathways cannot be active at the same time.

What are the implications of these findings? Ramain *et al.* suggest that the Deltex-dependent Notch signalling pathway might be active in all neuroectodermal cells early in development, perhaps preventing them from differentiating too early. For a cell to make a fate choice through lateral inhibition, it is necessary first to repress Deltex, and Dishevelled might be one of the factors responsible for this inhibition. This mechanism could be compared to releasing the handbrake on a car; although this allows the car to move, it does not determine where it will go. Similarly, repressing the Deltex-mediated pathway gives cells the freedom to choose their fate, but does not tell them what to become.

Heather Wood

References and links

ORIGINAL RESEARCH PAPER Ramain, P. *et al.* Novel Notch alleles reveal a Deltex-dependent pathway repressing neural fate. *Curr. Biol.* **11**, 1729–1738 (2001)

FURTHER READING

Artavanis-Tsakonas, S. *et al*. Notch signaling: cell fate control and signal integration in development. *Science* **284**, 770–776 (1999)

colonies in which ants have the *b* allele are polygynous.

Krieger and Ross have now sequenced *Gp-9* and found that it encodes a pheromone-binding protein. These proteins are crucial for chemical communication in insects — they transport odorant molecules from pores in the cuticle to receptors on sensory neurons. Worker ants control the number of egg-laying queens in their colony by recognizing their chemical signatures — carried by pheromones — and either accepting or destroying each queen. So the pheromone-binding protein encoded by *Gp-9* could be involved in the recognition of the chemical signature of queens by workers. Moreover, the nine-nucleotide difference between the two alleles could alter the ability of workers to recognize queens.

This study is the first to identify a single gene with such a fundamental and far-reaching effect on a complex social behaviour. The existence of such a gene is cause for hope that by combining genetic, behavioural and neurobiological techniques, it should be possible to elucidate details of the complete pathway by which queen number in fire ant colonies is controlled, from the gene to the behaviour. Study of this gene will also, as Krieger and Ross point out, allow greater understanding of the evolution of social behaviour.

Rachel Jones

References and links

ORIGINAL RESEARCH PAPER Krieger, M. J. B. & Ross, K. G. Identification of a major gene regulating complex social behaviour. *Science* 15 November 2001 (10.1126/science.1065247)

FURTHER READING Robinson, G. E. Integrative animal behaviour and sociogenomics. *Trends Ecol. Evol.* **14**, 202–205 (1999)

IN BRIEF

NEUROLOGICAL DISORDERS

Structure of human monoamine oxidase B, a drug target for the treatment of neurological disorders.

Binda, C. *et al. Nature Struct. Biol.* 26 November 2001 (10.1038/nsb732)

Monoamine oxidase B (MAO-B) hydrolyses catecholamines and is a common target of drugs for Parkinson's disease and depression. The authors solved the structure of MAO-B, determined the properties of its active site, and identified the residues involved in substrate recognition. Knowledge of this structure will lead to insights into the catalytic mechanism of MAO-B, explain the differences between MAO-B and MAO-A, and guide the development of MAO-B-specific drugs.

NEUROLOGICAL DISORDERS

Endogenous β-amyloid production in presenilin-deficient embryonic mouse fibroblasts.

Armogida, M. *et al. Nature Cell Biol.* **3**, 1030–1033 (2001)

Recent findings have questioned the idea that the presenilins are responsible for γ-secretase activity and the production of β-amyloid peptides in Alzheimer's disease. This paper shows that fibroblasts that lack presenilins produce Aβ40 and Aβ42. By contrast, processing of Notch, which also depends on γ-secretase, was abolished in these cells. These findings point to the existence of additional γ-secretases that are distinct from the presenilins.

DEVELOPMENT

The *Drosophila* neuregulin Vein maintains glial survival during axon guidance in the CNS.

Hidalgo, A. *et al*. *Dev. Cell* **1**, 679–690 (2001)

Glial cells contribute to axonal pathfinding by providing guidance cues and trophic support. This paper shows that the relationship is reciprocal: *Drosophila* neurons promote glial survival by expressing a protein called Vein. Vein shows homology to neuregulin, a molecule known to promote glial survival in vertebrates. The authors provide evidence that Vein expression prevents glial apoptosis, and that loss of Vein function induces glial cell death.

SYNAPTIC PLASTICITY

Remodeling of synaptic actin induced by photoconductive stimulation.

Colicos, M. A. *et al. Cell* **107**, 605–616 (2001)

This paper provides compelling evidence that synaptic activity is accompanied by structural changes. The authors used photoconductive neuronal stimulation, in which cells are cultured on a silicon chip and light is applied to single neurons. As the conductivity of silicon changes in response to light, it is possible to pair local illumination with subthreshold electrical stimulation of the whole culture, and detect changes solely in the illuminated neuron. This approach allowed the authors to show that pre- and postsynaptic actin reorganizes transiently in response to a train of stimuli, whereas repeated trains lead to stable actin redistribution and the formation of new synapses.