Epilepsy

Mice with a cleaning issue

Genes Dev. **18,** 1397–1412 (2004)

In their studies of body-clock mechanisms in mice, Frédéric Gachon and colleagues have identified a set of genes that, when deleted, give rise to epilepsy. The researchers studied mutant mice that lack some or all of a set of three genes that encode a family of proteins called PAR bZip (proline- and acidic-amino-acid-rich basic leucine zipper). Concentrations of these proteins vary by up to 50-fold in the liver and parts of the brain during the 24-hour cycle.

In their attempts to decipher the functions of this family, the researchers noticed that death rates among mice lacking all three genes (triple-knockout mice) were markedly higher than those among the other knockout mice. Intriguingly, death rates were highest on Mondays and Thursdays, when the lab was cleaned. Under controlled conditions, Gachon *et al.* discovered that the noise of a vacuum cleaner induced spasms in the triple-knockout mice, showing that they had epilepsy.

The authors propose a mechanism that may account for epilepsy in mice lacking PAR bZip family members. These proteins regulate a gene involved in activating vitamin B6. The activated vitamin in turn plays a crucial role in neurotransmitter metabolism, and the brains of triple-knockout mice indeed show altered levels of various neurotransmitters. **Michael Hopkin**

Traffic flow

Cruising through congestion

Phys. Rev. E **69,** 066110 (2004)

Vehicles fitted with adaptive cruise control (ACC) systems are now reaching mainstream production. These systems use radar to automatically maintain a constant, safe distance between cars, which potentially keeps traffic flowing more smoothly. L. C. Davis has investigated how a gradual deployment of ACC vehicles onto the streets will affect congestion.

Earlier research had found that with 20% of cars fitted with ACC and the remainder under manual control, high-speed traffic flowed freely without jams. Davis reports that with only 10% ACC vehicles on the road, jams still form quickly in highway traffic moving at around 90 km per hour. But at around 13% ACC coverage, changing just one manual vehicle over to ACC stops the jam forming.

Davis suggests that this discontinuity is caused by the jam's strong dependence on the precise sequence of ACC and manual vehicles in the queue. At lower speeds, there

R. LANDAU/CORBIS

is no such critical concentration: increasing ACC vehicles on the road gradually reduces the likelihood of jamming. However, Davis warns that because ACC vehicles maintain precise distances between each other on the road, there are no obvious safe gaps for a manual driver wanting to join the traffic flow. This may result in increased congestion around motorway slip roads, for example. **Mark Peplow**

Medicine

Tumour tracking

Proc. Natl Acad. Sci. USA
doi:10.1073/pnas.0402993101 (2004)

Around a quarter of breast tumours acquire extra copies of a gene called *HER-2*. Although these tumours are linked to poor survival, the patient's prognosis can be improved with the drug herceptin. But most doctors test for the mutation only once, in the primary breast tumour, and assume that it does not crop up later on. Songdong Meng *et al.* now challenge that assumption. They found that 9 out of 24 patients who originally lacked the *HER-2* mutation developed it later. Of four of these placed on herceptin, three showed some degree of tumour remission.

To test repeatedly for the *HER-2* mutation, the group had adapted a non-invasive method in which antibodies bind to and extract rare cancerous cells that have been shed from the tumour and are circulating in the blood. They spread these cells on a slide, and tested them first for high levels of HER-2 protein and then for changes in the *HER-2* gene. They found that mutations in these circulating tumour cells correspond to mutations in the mother tumour. If the same holds true in larger studies, and if the technique can be automated, breast-cancer patients might be tested for this or other mutations throughout their disease, and treated appropriately. **Helen Pearson**

Cell signalling

Gut reaction

J. Biol. **3,** 11.1–11.17 (2004)

Signalling pathways that are activated by proteins of the Wnt family help to regulate cell proliferation, cell differentiation and organ formation. Tadashi Okubo and Brigid L. M. Hogan have found, for instance, that this pathway can steer cells that normally generate lung to form gut instead.

The authors studied the lungs of mouse fetuses that had been genetically altered to have artificially high levels of Wnt signalling activity. Externally the lungs looked normal, but internally they lacked the organ's typical branching, tree-like structure. They contained few mature lung cell types, but had many rapidly dividing cells that expressed a variety of genes known to regulate gut development.

The results suggest that immature lung cells can be coaxed to become intestinal cells through the effects of Wnt signalling — a finding that may help those wishing to control the behaviour of adult stem cells. It may also shed light on the medical condition Barrett's oesophagus, in which patches of cells lining the gullet become intestinal in nature. Higher levels of Wnt signalling in adult stem cells might be partly responsible for the condition, the authors suggest. **Helen R. Pilcher**

Chemistry

Under pressure

Chem. Commun. doi:10.1039/b404181j (2004)

Supercritical fluids have potential as environmentally friendly solvents in a variety of chemical reactions, because the products can be extracted from solution simply by reducing the pressure and removing the solvent as a gas. Jason R. Hyde and Martyn Poliakoff report a new method for adding hydrogen to organic molecules that starts, curiously, with reactant and supercritical solvent combined in a single compound: formic acid (HCO_2H). The pressurized liquid acid is easier to handle than high-pressure hydrogen and carbon dioxide gas.

A hot platinum catalyst breaks the molecule into a supercritical CO_2–H_2 mixture, which meets the organic molecules in a second catalytic chamber at a temperature of 80 °C and a pressure of 8 megapascals. The authors report good yields of various alkane products, which are collected when the pressure is released at the end of the process.

For versatility, the concentration of hydrogen in the system should be controllable. Hyde and Poliakoff show that this can be achieved by adding ethyl formate ($HCO_2CH_2CH_3$) to the original stream. After decomposition, this adds supercritical ethane (C_2H_6) and more CO_2 to the mixture, diluting the hydrogen content. **Mark Peplow**