Developmental biology

Control stems from microRNAs

Dev. Cell **5,** 351–358 (2003)

According to Hristo B. Houbaviy *et al.*, the ability of embryonic stem (ES) cells to produce virtually any body tissue may be partly controlled by strings of 20–24 nucleotides, called microRNAs (miRNAs).

By screening mouse ES cells for miRNAs, the authors identified 12 miRNA-encoding genes that are unlike any previously found. Six of these genes, which lie in a cluster in the mouse genome, are switched off when the ES cells differentiate into balls of tissue called embryoid bodies.

Although the exact function of these six miRNA genes is unknown, Houbaviy *et al.* suggest that they may turn off other genes that drive ES-cell differentiation. The miRNAs are not found in adult mammalian tissues so far examined; the group has not yet looked for them in other stem cells.

The authors also show that humans have three miRNA genes that are related to the mouse cluster. These and other genes that help ES cells retain their remarkable developmental versatility are of interest to researchers trying to manipulate stem cells for clinical applications. **Helen Pearson**

Archaeology

The dating game

New J. Phys. doi:10.1088/1367-2630/5/1/399 (2003)

The anti-corrosive properties of lead have made it a much-used material since antiquity — for pipes, for example. But the metal does degrade, if only very slowly, and S. Reich and colleagues have exploited that characteristic to propose a new dating method for archaeological artefacts.

Their method depends on the Meissner effect, the expulsion of magnetism when a metal becomes superconducting at very low temperatures. Lead becomes superconducting at 7.2 K. But the products of corrosion — principally lead oxide and lead carbonate — do not. Magnetic measurements can provide a figure for the mass of undecayed lead in an object, and if the total mass is known, the amount of corrosion product present can be estimated. Reich *et al.* tested this thinking on samples of objects of known age, from 2,500 years old (pictured) to 10 years old, and found that the mass of corrosion product is a direct reflection of how old they are.

The authors point out that the technique is non-destructive, as there is no need to separate the corroded content of an artefact from the pure metal. So, for instance, it could be used on coins made from another metal but with some lead content. The method depends on burial conditions remaining stable, however, especially pH. Lead degrades at slow and constant rates at pH values above 6.5, but much more quickly in more acidic environments. **Tim Lincoln**

PHOTOLAB WEIZMANN INST.

Time piece — 2,500-year-old lead remains that have been sampled by Reich *et al.*

Cancer

Hostile takeover

Cell **114,** 323–334 (2003)

The cyclin D1 protein is frequently found at high levels in a wide range of human tumours. Justin Lamb and colleagues propose a mechanism by which this may turn a normal cell into a malignant one.

Cyclin D1 stimulates cell division. It has often been assumed that at high levels it causes cells to divide uncontrollably and thus promotes tumour formation. But analyses of tumour material failed to deliver consistent evidence to support this idea. Cyclin D1 also affects proteins that regulate gene transcription, although the data left room for doubt. But it is precisely this activity that now appears to turn a good cell bad.

Lamb *et al.* compared gene expression patterns of hundreds of human tumour samples, and uncovered a gene expression 'signature' associated with elevated levels of cyclin D1: the same 20 or so genes are turned on in many of the tumours. The authors further show that the protein C/EBPβ, which has not previously been connected to cyclin D1, normally represses the expression of the signature genes. But cyclin D1 counteracts C/EBPβ, and at sufficiently high levels overrides its repressive activity. Lamb and colleagues propose that the gene products thereby unleashed engage in a hostile takeover of the cell, resulting in cancerous growth. **Marie-Thérèse Heemels**

Nonlinear physics

A brownian motor

Phys. Rev. Lett. **91,** 060602 (2003)

Thermal ratchets put noise to use by converting the randomness of thermal fluctuations to directional motion. This process has been proposed as a mechanism by which motor proteins transport molecules within biological cells, and it has been demonstrated as a way of transporting small particles. Andreas Engel and colleagues give the topic a new twist by harnessing brownian rotation of nanoscale particles suspended in a fluid to produce a macroscopic torque on the fluid.

Although at face value it seems unlikely, a thermal ratchet breaks no thermodynamic laws. The directionality comes from some asymmetry imposed on the system, for example particles displaying brownian motion in an asymmetric field. In the present case, the nanoparticles are ferromagnetic: the suspension is a ferrofluid. And the asymmetry is supplied by an anharmonically oscillating magnetic field, acting in conjunction with a static field. The oscillating field imposes a rotational bias on the particles, which makes the carrier fluid flow by hydrodynamic coupling. So a 16-mm ferrofluid-filled sphere hanging by a thread in the magnetic fields begins to rotate — a kind of noise-powered motor. **Philip Ball**

Neurobiology

Untangling tau

J. Neurosci. **23,** 6972–6981 (2003)

Hibernating animals that are in torpor — an inactive, hypothermic state — endure a rapid, reversible decline in the number of connections between certain types of nerve cell. Thomas Arendt and colleagues now show that this impressive structural plasticity is accompanied by changes in the phosphorylation of tau, a protein more commonly associated with neurodegenerative disorders.

Highly phosphorylated tau is the main component of the 'neurofibrillary tangles' that appear in the brains of patients with Alzheimer's disease and related conditions. The build-up of tangles is particularly pronounced in brain regions that enjoy a relatively high degree of structural plasticity, such as the hippocampus. But the process of tau phosphorylation and its potential involvement in neurodegeneration are not well understood.

Arendt *et al.* looked at the phosphorylation of tau in the hippocampi of ground squirrels during hibernation. In a region known as CA3, they found that synapses — the contacts between nerve cells — seemed to regress during torpor, but were re-established during periods of arousal. The decrease in connectivity was paralleled by the formation of highly phosphorylated tau.

The authors hope that hibernation will be a valuable model for studying the regulation of tau phosphorylation, and its potential link to synaptic plasticity and neurodegeneration. **Rebecca Craven**