RESEARCH HIGHLIGHTS

CANCER BIOLOGY

Persistent problem

Cancer Cell 8, 197–209 (2005)

The recurrence of a tumour after what intitially seemed successful treatment is the leading cause of death from breast cancer. A gene that plays a causal role in tumour recurrence has now been identified by Lewis Chodosh of the University of Pennsylvania School of Medicine and colleagues.

Working in mice, the team found that a gene called *Snail*, which normally helps cells change shape and migrate in embryos, was abnormally active in recurring breast tumours. Engineering tumours to express *Snail* strongly promoted their ability to recur.

Studying primary breast tumours in women, the team found that high levels of *Snail* expression were associated with an increased risk of a patient having a tumour reappear within five years. As well as being important for prognosis, *Snail* could be a useful target for cancer-fighting drugs.

GEOLOGY

Basalts flow slow

Geology 33, 745–748 (2005)

Some 180 million years ago, the southern continent of Gondwana ruptured and the Indian Ocean began to form. Into this mighty rift flowed the massive Karoo–Ferrar flood basalts, which are preserved today in southern Africa, Antarctica, Australia and New Zealand.

Such flood basalts have been linked to mass extinction events. Earlier studies have proposed that the Karoo rocks flowed on to the Earth's surface in less than a million years — a short enough time to have constituted a massive environmental disruption.

But Fred Jourdan of the Berkeley Geochronology Center in California and colleagues think it took much longer. Using argon isotopes to date 38 rock samples taken from southern Africa, they have established that the basalts were put in place over eight million years — which might explain why there seems to be no associated mass extinction during this period.

ASTROPHYSICS

Parting stars

Astrophys. J. (in the press); preprint at xxx.arxiv.org/abs/astro-ph/0509201 (2005)

Stars that are born together may not stay together, say Laura Gómez of the Centre for Radioastronomy and Astrophysics in Morelia, Mexico, and her co-workers.

The Trapezium is a star cluster embedded in the star-forming region known as the Orion nebula (pictured). By fixing a background frame of reference for the nebula, Gómez and her team find that three radio sources in the Trapezium seem to be moving away from the spot where they were all located about 500 years ago. These objects may be young stars emerging from a multiple-star system that tore itself apart.

NASA, C.R. O'DELL & S.K. WONG (RICE UNIVERSITY)

Queen's move

Proc. R. Soc. Lond. B doi:10.1098/rspb.2005.3234 (2005)

When a colony of social insects reproduces, queens are expected to want an equal number of sons and daughters — to maximize their genetic contribution to the next generation. But sterile female workers, being more closely related to the queen's daughters, want more females.

A mathematical model from Ido Pen of the University of Groningen, the Netherlands, and Peter Taylor of Queen's University in Ontario considers the outcome if queens and workers execute their sex-control strategies simultaneously and independently. In such a case, the ratio of males is midway between the 50% favoured by queens and the 25% favoured by workers.

But the ratio in real colonies can be nearer the queen's ideal. This is explained by a second model in which the queen acts first and the workers observe her decision. The queen places the workers in a bind by announcing her intent — once she declares that she will produce mostly males, the workers must simply favour females as much as they can. This means the queen can declare an initial position that ends up with her preferred ratio.

C. KÖNG

The queen ant must outwit her diminutive workers to produce enough sons.

BIOCHEMISTRY

Predictable proteins

Science 309, 1868–1871 (2005)

Predicting a protein's structure from its amino-acid sequence is not an easy task. Still, scientists can now calculate the structure of small proteins accurately enough to get all atoms — including amino-acid side chains — in the right places.

The predicted structures are less than 2 angstroms off the native protein structure. This is a marked improvement on previous attempts.

To get this close to the real structure, researchers led by David Baker of the University of Washington, Seattle, calculated approximate structures for the protein in which they were interested and for related proteins. The team then had enough candidate structures to start detailed atomic modelling.

So far, their method only works for proteins smaller than 100 amino acids. But with more computer power, the researchers hope to accurately predict the structures of entire protein domains.

CELL BIOLOGY

Freeing steroids

Cell 122, 751–762 (2005)

Steroid sex hormones were once assumed to enter all cells by diffusing freely through cell membranes, modifying gene transcription only in those cells geared up to respond to them. But, puzzlingly, nearly all oestrogens and androgens circulating in the blood are bound to large proteins, and so apparently not free to diffuse.

Anders Nykjaer of the University of Aarhus, Denmark, and Thomas Willnow from the Max Delbrück Center for Molecular Medicine in Berlin and their colleagues now demonstrate the presence of a receptor called megalin on the surface of cells of reproductive tissues. This receptor causes the protein–steroid complexes to be engulfed into the cell, where the binding protein is recycled and the steroids released to do their jobs. Mice whose *megalin* gene is knocked out have impaired sexual development.

IMAGING TECHNIQUES

A good tip

Appl. Phys. Lett. **87**, 111901 (2005)

Extremely small, short-range forces can be detected using only the thermal oscillations of a minuscule cantilever tip, say Murti Salapaka of Iowa State University, Ames, and his colleagues. The finding is useful for frequency-modulation atomic-force microscopy, which uses variations in interaction strength between a probe and a surface to non-invasively image materials at the atomic scale.

It is difficult to produce and maintain forced vibrations of the subnanometre amplitudes necessary for accurate imaging at such a scale. The thermal oscillation amplitude of the authors' probe was 0.06 nm, and they report that it could be held less than 2 nm from a sample for up to 30 minutes. This could be useful for documenting forces, such as those on cell membranes, that evolve over time.

MATERIALS SCIENCE

Shocking strength

Science **309**, 1838–1841 (2005)

Ductile metals can be made harder by making their crystalline grains smaller, because the defects that move while a metal is deforming get stuck at the grain boundaries. But this works only up to a point. Eventually, nanometre-scale grains start to slide over one another. Eduardo Bringa of Lawrence Livermore National Laboratory in California and his colleagues may have found a way to put a stop to that.

Their computer simulations show that, by passing a shock wave through a nanocrystalline metal, they can suppress grain sliding and introduce defects into the crystal lattice that cause the grains to lock together. This should make the shocked metal harder and stronger. Preliminary experiments on nanocrystalline nickel seem to bear out the idea.

VIROLOGY

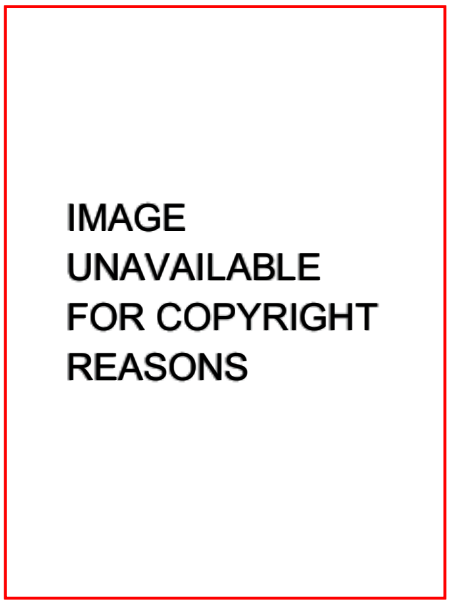
Crowning achievement

PLoS Biol. **3**, e324 (2005)

Drugs to tackle coronaviruses (pictured), which include the severe acute respiratory syndrome (SARS) virus, could be on the cards thanks to an international team led by Chinese scientists.

Coronaviruses cause a number of severe infections in humans and animals, notably in the respiratory tract. Developing effective drugs and vaccines is difficult as the viruses change rapidly and species differ markedly in their protein structures. Dawei Ma of the Shanghai Institute of Organic Chemistry, Zihe Rao of Tsinghua University in Beijing, and colleagues studied the structure of a key viral enzyme, called M^{pro}, in different coronaviruses. The researchers identified a common element in this enzyme whose structure was conserved across the different viruses, then identified compounds that block it.

One compound was particularly effective at protecting cells; the team suggests that drugs developed from this compound could form a first line of defence against emerging coronavirus diseases.



L. STANNARD/UCT/SPL

JOURNAL CLUB

Sandra Knapp
Natural History Museum, London, UK

Take a leaf out of a taxonomist's book and read about development pathways in plants.

Taxonomists in general are obsessed with the diversity of living things. The organisms we work with, be they tomatoes, dinosaurs or tiny parasitic wasps, have such a range of shape and form that they keep us endlessly fascinated.

Plants, for example, are incredible creatures. We tend to think of them in terms of flowers or fruits; those are, after all, the bits we most obviously use. But it is leaves that really drive life on Earth. And from the underwater threads of a bladderwort to the giant umbrellas of the titan arum, their diversity boggles the mind.

Finding some order in this abundance, Paolo Piazza, Sophie Jasinski and Miltos Tsiantis of the University of Oxford have reviewed the evolution of leaves in the *New Phytologist* (167, 693–710; 2005). They pull together the many studies on developmental pathways in model organisms such as thale cress, snapdragons, tomato and maize.

Thinking about how leaf form is regulated through wildly complex networks of transcription factors, proteins and plant hormones can be daunting. But the conceptual framework into which the work is set makes this paper accessible to those like me, whose grasp of the mechanistic details is a little bit fuzzy.

This paper gives new perspectives on my own taxonomic work on *Solanum* — with its leaves that are sometimes spiny, sometimes dissected (as in tomatoes and potatoes) and sometimes different in juveniles and adults. That does not mean I am now tempted to become a developmental biologist though. The mechanisms they review have generated much variation, which means there is a lot of taxonomy to do.