Astrophysics

Planetary orbits do the time warp

Astrophys. J. (in the press); Preprint at <http://arXiv.org/astro-ph/0308112> (2003)

The orbits of Jupiter-like planets — or 'gas giants', which are known to exist in stellar systems other than our own — should often be tilted, instead of lying in a flat plane. So predict Edward W. Thommes and Jack J. Lissauer, using three-dimensional simulations of the motions of newly formed 'solar systems' of giant planets.

Systems of planets in orbit around a star feel resonant kicks as they are tugged repeatedly by each other's gravity, and the authors show that this can eventually cause the planets' orbits to misalign by tens of degrees relative to each other. The orbits are forced to change because the outermost giant planet gradually spirals in towards the central star, losing energy as it passes through the debris left over from the gas disk that spawned the system. As the outer planet migrates inwards, it influences the orbits of the inner planets, causing them to distort, synchronize and eventually oscillate far out of the system's original plane.

The authors predict that many 'exoplanet' systems around stars will turn out not to be coplanar, as this resonance-driven twisting of orbits should be widespread. **Joanne Baker**

Cancer

Location, location, location

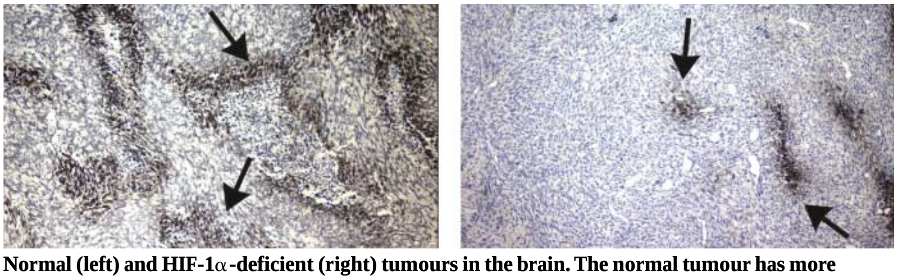
Cancer Cell **4,** 133–146 (2003)

When tumours outgrow their oxygen supply they activate a 'hypoxic' response — controlled by the protein HIF — to stimulate new blood-vessel growth. Targeting HIF would seem to be a promising antitumour strategy. But according to Barbara Blouw *et al.*, the importance of this protein for tumour survival depends on where the tumour is located.

The authors looked at a class of malignant tumour called astrocytoma. The natural environment of this form of cancer is the brain, but many studies of astrocytoma development involve mouse models in which the tumours are grown under the skin. To investigate whether the hypoxic response differs in these two environments, Blouw *et al.* implanted 'normal' cancerous astrocytes or cells genetically engineered to lack HIF-1α under the skin or in the brains of mice.

Under the skin, the HIF-1α-deficient tumours grew more slowly than the normal tumours. But the reverse occurred in the brain — here, loss of HIF-1α caused the tumours to develop faster than usual and to invade more regions of the brain (see picture below). These tumours also possessed about 50% more blood vessels than the normal tumours.

So it seems that when studying the hypoxic response of tumours — like so much else in life — the choice of location is crucial. **Clare Thomas**



Normal (left) and HIF-1α-deficient (right) tumours in the brain. The normal tumour has more oxygen-starved regions (arrows).

Immunology

Arresting asthma

J. Clin. Invest. **112,** 566–574 (2003)

Asthma is characterized by inflammation of the airways: it causes them to tighten, and airflow to be blocked. In people with allergic asthma, these events are triggered by allergens such as pollen or dust, which stimulate certain of the immune system's T cells to migrate to the lungs, proliferate, and release inflammatory chemicals.

T cells that lack the protein β-arrestin-2 show defects in migration *in vitro*, so Julia K. L. Walker *et al.* decided to study the protein's effects *in vivo*. They experimentally induced allergic asthma in normal mice and mice without β-arrestin-2, and found that healthy controls overreacted to the allergen and became asthmatic, whereas the mutant mice remained asthma-free — their lungs were devoid of T cells, and their airways were normal.

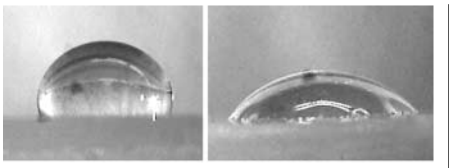
This suggests that the lack of β-arrestin-2 impairs the ability of T cells to migrate to the lungs, nipping inflammation in the bud and preventing mice from developing allergic asthma. The authors speculate that the protein could become an attractive drug target. **Helen R. Pilcher**

Surface science

What's cooking?

Langmuir doi:10.1021/la034138h (2003)

Once, scientists might only have used microwave ovens to heat up their lunch. But, more and more, researchers are moving their kitchen appliances into the lab and coming up with inventive new uses for them. Brent T. Ginn and Oliver Steinbock have now shown that a microwave oven can generate a plasma that chemically and structurally modifies the surface of a polymer.



Better wetting the microwave way.

Polydimethylsiloxane (PDMS) is placed inside a pristine vacuum desiccator that contains a small piece of steel wire. The desiccator is purged with oxygen, evacuated and cooked at maximum power for up to 25 seconds. Sparks from the metal wire ignite the plasma. After this treatment, the PDMS surface is less rough (measured through profilometry) but more 'wettable' (measured using contact angles). The PDMS sample becomes less wettable over time, but there is a lasting improvement in its hydrophilicity.

The microwave technique is unlikely to deliver the kind of surface chemical control that can be achieved with more sophisticated plasma rigs. But this cheap and cheerful method of increasing surface wettability could be practical when only simple surface modification is required. **Rosamund Daw**

Evolutionary biology

Loss for profit

Genetics **164,** 1271–1277 (2003)

According to Erik R. Zinser and colleagues, natural selection sometimes favours the loss of beneficial genes. They have found that one such gene can be switched off when the genetic element that regulates it is expropriated by another gene.

Zinser and colleagues subjected cultures of the bacterium *Escherichia coli* to prolonged starvation. In one bacterium, a transposable element — a mobile stretch of genomic DNA — inserted itself into the regulatory region for a gene involved in processing peptides. This inactivated the gene, even though it is beneficial under starvation conditions. The gene's regulatory region then moved to another part of the genome, leading to another set of genes, useful for amino-acid consumption, being switched on — and allowing the mutant bacterium to prosper.

The researchers suggest that the mutant may have been aided by its initial rarity, allowing it to exploit a niche underused by the rest of the population. In this way, different bacterial strains might become specialized to take advantage of particular environmental conditions. **John Whitfield**