

RESEARCH HIGHLIGHTS

Deeper still and deeper

Proc. R. Soc. B doi:10.1098/rspb.2009.0102 (2009)

Darwin suggested that particularly long-tongued pollinators and long-tubed flowers are dancers in a sort of coevolutionary tango, each acting as selection pressure on the other. When faced with a flower that keeps its nectar at the end of a long tube, a nectar bat (*Anoura fistulata*, pictured) with a longer-than-average tongue has an advantage over its shorter-tongued conspecifics. Now, Nathan Muchhala and James Thomson of the University of Toronto, Canada, have shown that pressures run the other way as well.

The duo experimentally manipulated the length of the flower *Centropogon nigricans* and found that longer tubes delivered more pollen to bats in male flowers, and took more pollen from bats in female flowers. The exact mechanism, however, remains unknown.



N. MUCHHALA & J.D. THOMSON

MARINE BIOLOGY**Snotty sampling**

Mar. Mamm. Sci. doi:10.1111/j.1748-7692.2008.00277.x (2009)

Water ejected from whale blow holes can be used for research into the animals' hormonal state, and possibly gender.

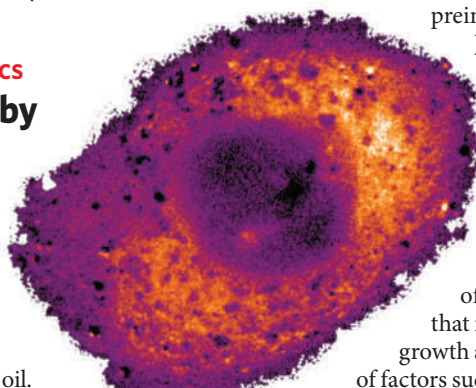
Researchers studying terrestrial mammals can measure hormone levels in faeces and urine; with aquatic mammals, such non-invasive monitoring is difficult. Using nylon stockings mounted on 13-metre carbon-fibre poles, Carolyn Hogg of the University of New South Wales in Sydney, Australia, and her colleagues sampled the exhalations of humpback and northern right whales they were following to see whether these might provide a source of hormonal data.

The team discovered progesterone and testosterone in some of the blows. Testosterone collected from single whales escorting female–calf pods supports theories that escorts are males waiting to breed. However, further testosterone/oestradiol tests are needed to definitively determine the whales' sex.

MOLECULAR DIAGNOSTICS**Like a record, baby**

Nature Chem. doi:10.1038/nchem.120 (2009)

The fluids in the different compartments inside cells vary in viscosity, with those in some parts as thin as water, and those in others more glutinous than olive oil.



Marina Kuimova of Imperial College London and her colleagues have now watched as a dying cell's fluids thicken. Their tool, and weapon, was a molecular rotor that gives off a fluorescent signal that varies according to its rotation rate and can be triggered with light to release reactive oxygen species, which harm the cell.

When the lights went on and the harmful oxygen species were released, the spin rates of the molecules slowed. The team thinks that the cell's internal fluids became drastically more viscous (shown as orange in picture, below) because the chemical assault increased crosslinking between molecules. Over time, the thickening slowed the rate at which further harmful reactions took place.

GEOSCIENCES**Reefless madness**

Geophys. Res. Lett. doi:10.1029/2008GL036282 (2009)

Say sayonara to coral reefs if carbon dioxide levels in the atmosphere reach 560 parts per million, roughly double their preindustrial level.

Jacob Silverman of the Carnegie Institution in Stanford, California, and his colleagues reached this conclusion on the basis of field studies that measured coral growth as a function of factors such as ocean

acidity and water temperature.

Those relationships suggest that at 560 parts per million of carbon dioxide the world's coral reefs cease to grow and start to dissolve. Unlike past studies, this one relied on measurements from actual coral reefs, rather than rates derived from studies in the lab or in large aquaria.

NEUROSCIENCE**Spinal zap**

Science 323, 1578–1582 (2009)

Electrical stimulation of the spinal cord can allow rodents with symptoms of Parkinson's disease to move normally.

This discovery suggests that spinal stimulation could eventually substitute for the risky 'deep-brain stimulation' (DBS) procedure offered to some patients with severe Parkinson's disease, according to Romulo Fuentes and his colleagues at Duke University in Durham, North Carolina, who carried out the studies. DBS is an effective therapy, but highly invasive, because stimulating electrodes must be implanted deep in the brain.

The scientists say the spinal stimulation probably works through nerves that link the spinal cord to the motor cortex, where intentions to move are processed.

For a News story on this research see <http://tinyurl.com/dl2zrl>

CONDENSED MATTER**Trolling for poles**

Nature Phys. doi:10.1038/nphys1227 (2009)

Might it be possible to have a north magnetic pole without a corresponding south? Despite three-quarters of a century of theoretical

investigation and occasional searches, such as unpaired poles or 'monopoles' have yet to be seen.

There is growing evidence that 'spin ices', materials containing rare-Earth ions locked into pyramidal lattices, could create something akin to monopoles as a result of the collective behaviour of their individual atoms. Ludovic Jaubert and Peter Holdsworth of the University of Lyon in France have added to that evidence. They show that experimental data for the dynamic magnetic properties of a spin ice are well interpreted in terms of the behaviour of monopoles.

BIOLOGY

Electric cows

Proc. Natl Acad. Sci. USA doi: 10.1073/pnas.0811194106 (2009)

Having previously shown statistically that cows and deer preferentially align their bodies north-south, Hynek Burda of the University of Duisburg-Essen in Germany and his colleagues now provide more evidence for these animals' magnetic sensing.

If this alignment is truly due to some sensing of the magnetic field, strong, nearby magnetic fields such as those from power lines should disrupt ruminant orientation.

Using satellite and aerial photographs, the researchers show that 1,699 cows grazing within 50 metres of overhead power lines at various European locations were randomly oriented. Field observations of 653 deer within 50 metres of power lines in the Czech Republic also revealed random orientation.

IMMUNOLOGY

Self help

J. Exp. Med. **206**, 549-559 (2009)

Dendritic cells, which present antigens to immature T cells to prime them for action against pathogens, seem to contribute to autoimmune disease. But recent findings suggest they can prevent autoimmunity as well. David Voehringer at the University of Munich in Germany and his colleagues have found that ridding mice of dendritic cells seems to cause a severe autoimmune reaction.

They created transgenic mice that selectively expressed a bacterial toxin in their dendritic cells, and had less than 10% of normal levels as a result. These mice were unable to mount an immune response to infections, but by six weeks of age their internal organs had been infiltrated by a large numbers of mature helper T cells, causing inflammation; by eight weeks this process was fatal in 40% of the mice.

ENTOMOLOGY

Sick bugs take drugs

PLoS ONE **4**, e4796 (2009)

The Very Hungry Caterpillar (pictured) in Eric Carle's children's book, which saw its fortieth anniversary this year, may have been hunting for drugs as well as food.

Woolly bear caterpillars (*Grammia incorrupta*) normally ingest small amounts of pyrrolizidine alkaloids to ward off parasites. Michael Singer of Wesleyan University in Middletown, Connecticut, and his team showed that the caterpillars ingested around twice as much of the drug when infected by maggots.

This finding suggests that self-medication is more widespread than previously thought — it has never been clearly demonstrated

E. CARLE/PUFFIN



in insects before. Previous studies by the team have shown that the taste receptors of infected woolly bears are altered to crave more alkaloids when they are infected.

BIOMIMETICS

Steel strong, air light

Science **323**, 1575-1578 (2009)

A research team led by Ray Baughman at the University of Texas at Dallas has created an artificial muscle from a ribbon of aerogel — a lightweight, sponge-like material consisting mostly of air — threaded with carbon nanotubes.

Applying a voltage across the width of the ribbon electrically charges the nanotubes; their mutual repulsion can increase the material's width by a factor of three in an instant. A voltage along the length of the ribbon triggers contraction, making the material dense and stiff. The muscles can be turned on and off 1,000 times a second. They can also be 'frozen' at any desired density, which might open up a range of applications depending on the optical and electronic properties of a specific arrangement of nanotubes.

For a News story on this research see <http://tinyurl.com/c68oum>

JOURNAL CLUB

Paul J. Dyson
Swiss Federal Institute of
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A chemist highlights promising organometallic drugs.

Traditionally, the compounds we use to fight cancer come in two flavours. Inorganic drugs, such as cisplatin — a small molecule with a platinum core — are the workhorses of chemotherapy. They are generally highly toxic to cells, not particularly selective, and are accompanied by side effects ranging from vomiting to kidney damage. Larger organic drugs offer a more targeted but weaker approach. They can selectively pick off key enzymes, but may work on only a narrow range of cancers.

In the search for more effective anticancer weaponry, hybrids of inorganic and organic components — organometallic drugs — are increasingly important. Once thought of as unstable, highly toxic species, these compounds are now being developed by chemists to treat a broad range of tumours and to overcome platinum-resistant cancer cells. Like organic drugs, they have a selective mode of action and so cause fewer side effects.

The dinuclear ruthenium-arene compounds trialled by Bernhard Keppler of the University of Vienna and his colleagues are promising examples (M. G. Mendoza-Ferri *et al. J. Med. Chem.* **52**, 916-925; 2009). These highly cytotoxic compounds contain two ruthenium centres, separated by an adjustable organic linker. By tweaking the length of this chain, the researchers produced compounds that are as active as established platinum-based drugs in human tumour-cell lines.

What's more, the ruthenium drugs could kill tumour cells that were resistant to oxoplatin, a drug related to cisplatin. They work by linking DNA duplexes together, and can also bind histone proteins to DNA.

The compounds have now progressed to experiments in animals. By reducing side effects, I hope the drugs can improve the quality of life for patients undergoing chemotherapy.

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