

RESEARCH HIGHLIGHTS

Fly, dragonfly

Proc. R. Soc. Lond. B

doi:10.1098/rsbl.2006.0487 (2006)

Dragonflies, like birds, fatten up and migrate south before winter arrives.

Martin Wikelski, an ecologist at Princeton University in New Jersey, and his colleagues went with them part of the way last autumn.

The team tracked — by aeroplane and car — 14 green darner dragonflies (*Anax junius*, pictured) to which they had glued radio transmitters. They discovered that the bugs' migration is governed by the same few rules as songbird migration: fly during the day, and when the wind is low; take regular days off to replenish your fat supplies; and fly if last night was colder than the night before because this predicts useful northerly winds. One difference, though, is that dragonflies are shorter-lived, so their trips may well be one-way.



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PHYSICAL CHEMISTRY

Water's tangled web

Proc. Natl Acad. Sci. USA

doi:10.1073/pnas.0510593103 (2006)

Do water molecules weave webs or just spin threads? The traditional picture of water has each molecule linked, on average, tetrahedrally to four others in a hydrogen-bonded network. But this model was challenged two years ago by spectroscopic measurements suggesting that the molecules have on average only two hydrogen-bonded neighbours, linking them in chains.

Using X-ray scattering, which probes a wide range of length scales, Teresa Head-Gordon and Margaret Johnson at the University of California, Berkeley, now offer a conciliatory resolution to the controversy. They say the instantaneous local structure

around a water molecule may indeed involve just two hydrogen bonds per molecule — but that this arrangement is constantly in flux, such that the persistent average structure is the standard tetrahedral one.

GEOLOGY

Break away

Geology **34**, 353–356 (2006)

Some geologists think that Russia's Kamchatka peninsula is part of North America. But the geological divide is as great as the cultural one, a new study suggests.

Two great plates of the Earth's crust — the Pacific and North American plates — come together in Russia's far east, but the details of what happens at the junction are murky. New geological studies of Kamchatka, including uplifted layers of ancient seashores (pictured

below), suggest that most of the peninsula rests on its own, separate crustal block.

Seismic data from two earthquakes that occurred in the region in late April could help to further clarify the picture, says the team that carried out the study, comprising researchers in China, the United States and Russia.

NANOTECHNOLOGY

Sort it out!

Science **312**, 910–914 (2006)

Tiny tubular proteins can now be sorted into different containers as they 'crowd surf' over the backs of kinesin motor proteins.

Cees Dekker and colleagues at Delft University of Technology, the Netherlands, coated sub-micrometre-sized channels running through a slice of silica with kinesins. These proteins, which normally carry cargo along microtubule filaments within cells, have been used to transport microtubules on chips before. But enclosing them in channels has offered new control: using a voltage, Dekker's group could direct the surfing microtubules down either the left or right fork of a Y-shaped junction into a collecting pool.

MICROBIOLOGY

Surprise attack

Proc. Natl Acad. Sci. USA **103**, 6724–6729 (2006)

The pneumonia-causing bug *Mycoplasma pneumoniae* uses an unsuspected weapon to attack the lungs.

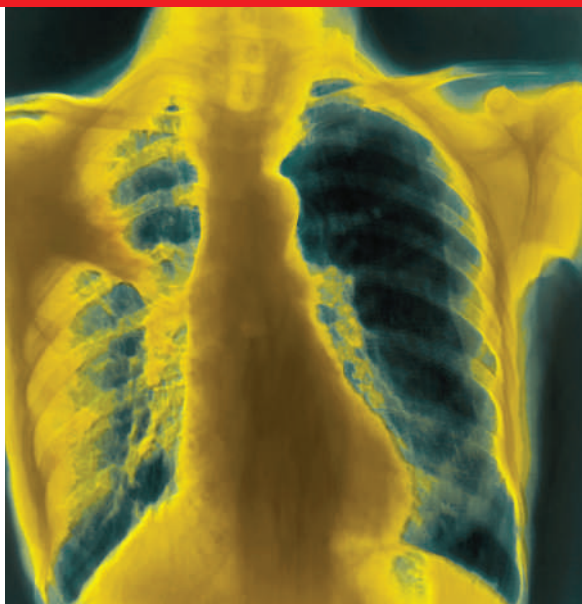
T. R. Kannan and Joel Baseman of the

J. BOURGEOIS



University of Texas Health Science Center in San Antonio show that *M. pneumoniae* produces a harmful cytotoxin. Previously it had been assumed that the lung damage typical of pneumonia (pictured right in X-ray) was caused by the body's immune response to the infection because there were no known mycoplasma toxins.

Kannan and Baseman identified the toxin, an ADP-ribosylating enzyme, using a human lung protein as bait to bind it. They showed that the toxin altered certain mammalian proteins, leading to vacuolization, or the formation of harmful membrane structures, inside cells. They also identified antibodies to the toxin in blood from pneumonia patients.



ECOLOGY

Present and correct?

Ecography 29, 129-151 (2006)

Ecologists need to model species' distributions to predict, among other things, the impact of climate change on biodiversity. Jane Elith of the University of Melbourne, Australia, and Catherine Graham of Stony Brook University, New York, and their colleagues provide tips for making the best use of limited data.

They evaluated the predictive ability of 16 different methods for modelling species' distributions, given data that say only where a species has been found, rather than where it has not. Such presence-only data can be gleaned from museum records.

They tested the models' predictions for 226 species against independent data sets containing both presence and absence information. They conclude that newer methods generally outperform established tools such as GARP and BIOCLIM.

NANOTECHNOLOGY

New ice age

Phys. Rev. Lett. 96, 166103 (2006)

Physicists investigating the effect of water vapour on friction at the nanoscale say that ice may form at room temperature.

The capillary forces caused by the condensation of water vapour are a major issue in many nanoelectromechanical systems. This motivated K. Jinesh and Joost Frenken from Leiden University in the Netherlands to explore the movement of a sharp tungsten tip across a graphite surface in a humid atmosphere. They noticed that the water was acting like glue rather than a lubricant.

The results can be explained in terms of the tip writing a temporary line of ice on the surface, but the substance differs from normal ice in ways that are not yet understood.

DRUG DISCOVERY

Seeing all sides

Nature Chem. Biol. doi:10.1038/nchembio790 (2006)

A new way to reveal unwanted or unexpected drug side effects has been demonstrated by Stephen Michnick of the University of

Montreal in Canada, John Westwick of Odyssey Thera in San Ramon, California, and their team.

The researchers used an assay in which two proteins, each fused to a fragment of a fluorescent protein, trigger a yellow signal when they come together. They created 49 such assays for proteins involved in diverse cellular processes and tested whether 107 known drugs interfere with these protein interactions.

The screen revealed that some drugs have a previously unrecognized ability to block cell proliferation — and identified a panel of tests that could predict whether a new drug can stop cell division and potentially fight cancer.

CELL BIOLOGY

Crosstalk

Nature Cell Biol. doi:10.1038/ncb1418 (2006)

The first large-scale, systematic analysis of interactions between the signalling pathways that mediate a cell's response to external signals has revealed extensive crosstalk. But the connections are not, as some people feared, so numerous that they will be impossible to unpick.

Rama Ranganathan and his colleagues at the University of Texas, who are part of the Alliance for Cellular Signalling, studied the effect of 22 extracellular signalling molecules, such as hormones and cytokines, on a macrophage cell line.

They measured crosstalk by monitoring, for all possible pairwise combinations of these ligands, various parameters in the signalling pathways downstream of the ligands' receptors. These parameters included calcium levels and the phosphorylation of signalling proteins.

JOURNAL CLUB

Albert Bosma
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An astronomer explains how galaxies keep him drawn in to the dark-matter debate.

Ours is a strange Universe. It seems to contain far more dark stuff than ordinary matter.

In the 1970s, when I was a PhD student, galactic dynamics played an important role in establishing the existence of dark matter. For

my thesis, I studied the rotation of spiral galaxies. The rotation profiles implied dark matter — some unseen thing exerting a gravitational pull kept the rotation speed high even beyond the galaxies' visible edges.

Today, rotation curves pose a strong challenge to the most popular model of how dark matter fits into the Universe, Λ cold dark matter (Λ CDM) theory. For galaxies, numerical simulations based on Λ CDM theory predict that their dark-matter density peaks towards the centre. But this doesn't

square with rotation data that suggest the dark matter in so-called 'low surface brightness' galaxies is distributed evenly through the core.

Some say the rotation data are problematic. Others suggest ways to reconcile the observations with theory — perhaps a bar of stars in the galactic disk somehow erases the central dark-matter peak.

We might see the kinematic effects of bar-like features with better rotation data and deep images of the faint disk. But so far, our newer results seem to uphold the discrepancy.

Recent galactic simulations with an impressive billion particles of dark matter (J. Diemand *et al.* *Mon. Not. R. Astron. Soc.* 364, 665-673; 2005) actually bolster the peak theory.

Yet, simulations are not theory. We don't really know what sets the dark-matter profile — it may be some interaction with real matter, with the gas and stars in a growing galaxy. We need far more elaborate modelling than is possible now. By the time it is, I hope to have even better data to keep up the challenge.