RESEARCH HIGHLIGHTS

Amazon given a good dust

Environ. Res. Lett. doi:10.1088/1748-9326/1/1/014005 (2006)

Millions of tonnes of dust from the Sahara blow across the Atlantic every year and fertilize the Amazon rainforest. Now the origin of much of that dust has been identified as a small region of northern Chad.

Ilan Koren of the Weizmann Institute in Rehovot, Israel, and his co-workers used satellite data to track the size and mass of dust plumes leaving the Sahara. They estimate that 56% of the 40 million tonnes that is deposited in the Amazon basin annually originates from the Bodélé depression, a region with an area of less than 45,000 square kilometres.

The Bodélé is a productive source because the region's fine diatomite soils are frequently eroded by winds channelled between a gap in two nearby mountain ranges.

J. GILES

IMMUNOLOGY

Hot-blooded

Nature Immunol. doi:10.1038/ni1406 (2006)

The next time you feel feverish, think twice before reaching for the aspirin. The febrile response has been conserved over 450 million years of evolution, and a new study reveals some of the physiological benefits that may explain why it persists.

Sharon Evans of the Roswell Park Cancer Institute in Buffalo, New York, and her colleagues show in mice that feverish temperatures may help white blood cells known as lymphocytes to reach lymph nodes. Here they are more likely to encounter, and deal with, troublesome pathogens. The team found that 'gatekeeper' cells that line blood vessels have more adhesion molecules on their surface when their temperature is raised. This would help the gatekeepers to grab blood-borne lymphocytes and pull them into the nodes.

ELECTROPHYSIOLOGY

Unusual suspects

J. Neurosci. **26,** 10992–11000 (2006)

The identity of the protein machine that detects sound in our ears has long been elusive. Now a team of researchers has composed the molecular equivalent of a photofit to narrow down the search.

Cells in the inner part of the mammalian ear detect sound when vibrations bend their tiny hair-like cilia. An ion channel (as yet unidentified at the molecular level) sits in the cilias' membranes and opens when the bending tugs on fine tethers called tip links roped between the cilia.

Robert Fettiplace of the University of Wisconsin Medical School in Madison and his colleagues studied the electrical conductance properties of individual channels in rats. They found that there are two channels per tip link, and suggest that the channels probably exist in several forms with different conductances. Few known channels on the 'suspect list' have similar properties.

ARCHAEOLOGY

Skull and crossed bones

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0608443103 (2006)

Ancient bones that show a mixture of modern human and Neanderthal features support the idea that the two groups interbred, argue Erik Trinkaus of Washington University in St Louis, Missouri, and his colleagues.

Trinkaus's team reanalysed 30,000-year-old remains that were unearthed in a Romanian cave more than 50 years ago. The remains include a skull (pictured below) that has the small brow bone of a modern human and a pronounced bump on the back that is more typical of Neanderthals.

Genetic studies have so far revealed no evidence of interbreeding between the groups. But Trinkaus points to these remains and two other sets that he interprets as hybrids, as proof that humans and Neanderthals did more than just live side-by-side.

CELL BIOLOGY

Fat and frizzled

Development **133,** 4561–4572 (2006)

Three scientists are challenging the prevailing molecular explanation for how cells in flat layers such as the skin arrange themselves.

Current theories hold that two sets of genes encoding different proteins act sequentially in a single pathway to line up, or polarize, the cells in planar epithelia.

But Peter Lawrence and José Casal of the Laboratory of Molecular Biology in Cambridge, UK, and Gary Struhl from the University of Columbia in New York show in the fruitfly *Drosophila* that the two sets of genes, exotically known as Dachsous/Fat and Starry night/Frizzled, operate independently of each other. They also show that either set alone is sufficient to ensure planar polarization.

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BIOPHYSICS

Kinky genes

Nature Nanotechnol. **1,** 137–141 (2006)

DNA is bendier than previously thought.

So say Philip Nelson of the University of Pennsylvania, Philadelphia, and his colleagues, who used an atomic-force microscope to look at a DNA double helix. They observed more sharp bends than are

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predicted by the usual 'worm-like chain' model of DNA elasticity, which assumes that the molecule deforms like a segmented elastic rod, obeying Hooke's law.

The discrepancy only shows up over distances of a few nanometres or so, but this is precisely the scale that is biologically relevant. One consequence is that, if a protein bends DNA when it binds, this should require less energy than the old picture would have implied.

ASTRONOMY

Radio collision report

Science **314,** 791–794 (2006)

Massive galactic clusters are thought to grow by accumulating smaller groups of galaxies, just as businesses grow through mergers. Now Joydeep Bagchi of the Inter-University Centre for Astronomy and Astrophysics in Pune, India, and his colleagues may have observed the after-effects of such a cosmic takeover.

The astronomers spotted two great arcs of radio emission around the galactic cluster Abell 3376. They suggest that these trace a shock front, where hot gas expelled from the cluster in a collision a billion years ago meets the colder intergalactic medium. X-ray observations show a bullet-shaped region of hot gas — remnants of the colliding galaxies — piercing the centre of the cluster.

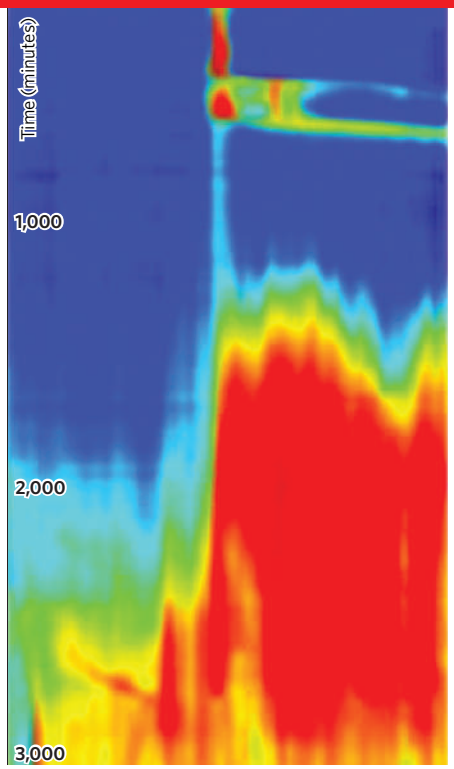
STEM CELLS

Library self-renewals

Proc. Natl Acad. Sci. USA doi:10.1073/pnas0608156103 (2006)

Chemical libraries can be an invaluable resource for stem-cell research, reports a team led by Peter Schultz and Sheng Ding at The Scripps Research Institute in La Jolla, California.

The researchers measured the effects



of different compounds from a library of 50,000 small molecules on mouse embryonic stem cells. They found one chemical, called SC1, that maintains stem cells in an undifferentiated state. These stem cells retained their full potential — they could later be differentiated into cells from all three primary layers of the developing embryo.

The team found that SC1 interacts with the protein kinase ERK1 and an enzyme-activating protein known as RasGAP. Further investigations of SC1's role may lend insight into the mechanisms of stem-cell self-renewal.

NUCLEAR PHYSICS

Stars in the lab

Phys. Rev. Lett. **97,** 173401 (2006)

Two theorists at Tel Aviv University in Israel calculate that a tabletop fusion scheme could reproduce the nuclear reactions that take place inside stars.

Isidore Last and Joshua Jortner propose using nanodroplets of methane (CH_4), water (H_2O) and ammonia (NH_3) as fuel for their nuclear-fusion device. Intense, femtosecond laser pulses would be used to completely ionize the molecular fuel. The hydrogen, nitrogen, carbon and oxygen nuclei should then fuse through a dynamic process known as 'Coulomb explosion'.

Laser-driven Coulomb explosion has previously been shown to trigger fusion of deuterium nuclei. If it also works for heavier nuclei, as Last and Jortner predict, the set-up would reproduce the nuclear reactions that go on inside so-called carbon–nitrogen–oxygen stars.

ECOLOGY

Evolution on a chip

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0607971103 (2006)

When evolutionary biologists talk of 'fitness landscapes', they are usually speaking metaphorically. But Robert Austin and his colleagues at Princeton University, New Jersey, have realized the concept.

The team made a row of microscopic chambers on a silicon chip in which *Escherichia coli* may grow. The bacteria can move between the chambers along narrow corridors. Adjusting the nutrient supply to each of these patches creates gradients in habitability, representing a fitness landscape that can be made arbitrarily 'smooth' or 'rugged'.

The bacteria form complex patterns as they colonize or abandon patches, adapting either genetically or physiologically to the different environments. The picture above shows how the density of bacteria in a row of 85 patches, increasing from blue through green to red, evolves over time. This ecosystem-on-a-chip should provide a useful tool for studying evolutionary dynamics.

JOURNAL CLUB

Frances Ashcroft
University of Oxford, UK

A physiologist discusses matters close to the heart.

This time last year my father was suffering from congestive heart failure. He became increasingly frail, slowing down like an unwound clockspring until, in February, his heart simply stopped.

As a physiologist, I had some idea of his condition, but I did not then realize how close it was to my own research area.

In 1983, ATP-sensitive potassium (K_{ATP}) channels were found in the heart. These channels are gated pores that control potassium fluxes across the cell membrane. However, their precise role in the heart was unclear.

One year later, I discovered that these channels are central to the mechanism by which glucose stimulates insulin secretion from the pancreas. Unravelling the role of K_{ATP} channels in diabetes, and the way in which channel structure influences function, has been an all-consuming passion for me ever since.

To my surprise, it now turns out that these channels also play a role in heart failure. Heart failure is usually caused by narrowing of the arteries, which increases the pressure against which the heart has to pump, making it work harder. Eventually, it fails.

Recently, Andre Terzic of the Mayo Clinic in Rochester, Minnesota, and his group showed that K_{ATP} channels confer protection against heart failure (S. Yamada *et al. J. Physiol. Lond.* published online doi:10.1113/jphysiol.2006.119511; 2006). In normal mice, cardiac K_{ATP} channels open in response to an increased pressure load, reducing stress on the heart. Mice lacking K_{ATP} channels rapidly develop heart failure and die.

In the pancreas, K_{ATP}-channel activity is finely balanced: too much causes diabetes and too little hyperinsulinism. But in the heart, as this paper shows, opening is almost always beneficial.