RESEARCH HIGHLIGHTS

Nosing around

J. Exp. Biol. **211,** 921–934 (2008)

The elephant nose fish uses its eponymous if misnamed adaptation — actually a protuberant chin appendage — as an electrical 'flashlight', and Jacob Engelmann at the University of Bonn in Germany and his colleagues have shown how.

Gnathonemus petersii senses objects through the distortions they cause in an electric field that it creates.

The researchers confirm that elephant noses have two different high-acuity sensory regions, known as foveae. One is the actual nasal region, and the other is in its characteristic chin, called a Schnauzenorgan. The highest density of electrical receptors is at the tip of this appendage.

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EVOLUTION

Streetwise weeds

Proc. Natl Acad. Sci. USA **105,** 3796–3799 (2008)

City weeds are adapting to their urban environment at a staggering rate, suggests a research team in France.

Pierre-Olivier Cheptou and his colleagues at the CNRS, France's basic-research agency, in Montpellier analysed the dispersal of the weed *Crepis sancta*, which produces two types of seed — a light, feathery, wind-dispersed one and a heavy one. The researchers found that feathery seeds dispersed along Montpellier's city streets have a 55% lower chance of successfully settling in their parent's local patch than heavy seeds. In patchy, pavement-dense habitats, weeds release a significantly higher proportion of heavy seeds than do their country counterparts.

Genetic evaluations suggest that short-term evolution has taken place during a mere 5–12 generations.

ASTRONOMY

Magnetic flux

Mon. Not. R. Astron. Soc. doi:10.1111/j.1365-2966.2008.12946.x (2008)

The Sun's magnetic poles are known to reverse their polarity every 11 years, but it is not alone — another 'flip-flopper' has been identified. Recent mapping of the magnetic field around nearby star Tau Bootis shows that its polarity has reversed since the last observation in 2006.

Measurements of the polarization of the light emitted by Tau Bootis allow its complicated magnetic structure to be calculated. Astronomers expect that many stars periodically reverse their magnetic polarity, but so far only about 20 stars have had magnetic polarization measurements taken more than once.

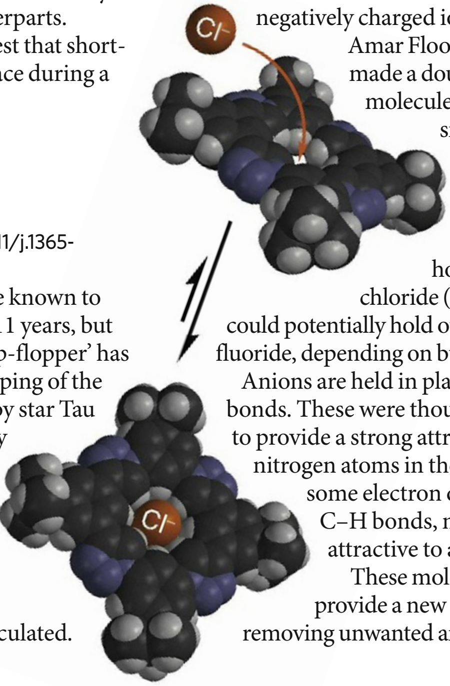
Jean-François Donati of France's CNRS and his colleagues, who made the discovery, estimate that Tau Bootis's poles flip every year or so.

CHEMISTRY

A ring-side seat for chloride

Angew. Chem. Int. Edn doi:10.1002/anie.200704717 (2008)

Normally, opposites attract, but chemists at Indiana University in Bloomington have designed an uncharged organic molecule that can nevertheless attract and hold negatively charged ions.



Amar Flood and Yongjun Li made a doughnut-shaped molecule from a number of small building-block molecules, using a technique called 'click chemistry'. The doughnut's hole snugly fits a chloride (pictured left), and could potentially hold other anions such as fluoride, depending on building-block size.

Anions are held in place by hydrogen bonds. These were thought to be too weak to provide a strong attractive pull, but nitrogen atoms in the doughnut draw some electron density out of the C–H bonds, making it more attractive to a negative ion.

These molecules could provide a new regime for removing unwanted anions from solution.

THEORETICAL PHYSICS

Holographic memory

Phys. Rev. A **77,** 020302 (2008)

A special type of hologram may provide a way to store light's quantum information.

Regular holograms store three-dimensional information in an interference pattern, often etched on a glass surface. But such a system won't work for quantum information, which includes fundamental uncertainties that cannot be held in a classical medium.

Eugene Polzik of the Danish Research Center for Quantum Optics in Copenhagen and his colleagues at St Petersburg University in Russia determined a way to store light's quantum properties in a cloud of atoms. By entangling the light with atoms at a temperature close to absolute zero, it should be possible to store the quantum features of the light in the atoms' collective spins. The information can then be read from the atoms by reversing the process.

CHEMICAL BIOLOGY

Fixing fragile flies

Nature Chem. Biol. doi:10.1038/nchembio.78 (2008)

A fruitfly model of fragile X syndrome, a common cause of mental retardation in humans, has unveiled possible therapeutic targets to combat the condition.

Flies lacking a gene called *Fmr1* exhibit some physical and behavioural features of fragile X syndrome. Stephen Warren at Emory University School of Medicine in Atlanta, Georgia, and his colleagues found that food enriched with glutamate, which functions as an excitatory neurotransmitter, kills mutant embryos.

The researchers screened a library of 2,000 compounds and characterized nine that allowed *Fmr1* mutants to survive a high-glutamate diet. Three of the compounds affect the inhibitory neurotransmitter, GABA. Treating mutants with GABA relieved glutamate toxicity, and restored several features, including normal courtship behaviour and some brain morphology.

FOOD SCIENCE

The origins of *la louche*

Langmuir **24,** 1701–1706 (2008)

Part of the allure of aniseed-flavoured spirits such as absinthe (pictured below), ouzo and pastis is the mysterious 'louche' — their transformation from clear to cloudy and opalescent with the addition of water. The effect comes from the formation of insoluble, milky droplets of anise-flavoured oil.

Details of the process are murky, however. Erik van der Linden of Wageningen University in the Netherlands and his colleagues made the first direct measurement of the oil droplets' interfacial tension, which determines how fast they grow. These rates, and their dependence on ethanol concentration, differ from those predicted by conventional theory.

Because this 'spontaneous emulsification' is being explored for various purposes, including the production of drug-loaded nanoparticles and microcapsules, the discrepancy is more than just a puzzle for barflies.

GEOLOGY

Glacier slimming

Geology **36,** 223–226 (2008)

Satellites have documented the rapid decline of the West Antarctic ice sheet during the past two decades, with thinning of more than a metre per year. But pre-satellite — let alone prehistoric — data are harder to come by.

Joanne Johnson from the British Antarctic Survey in Cambridge, UK, and her colleagues used rocks to gain insight into the history of glaciers by the Amundsen Sea Embayment. They suggest that, for most of the past 10,000 years, these glaciers have been thinning at rates of just a few centimetres per year.

The team took samples from nunataks — rocky peaks that poke through the ice and sometimes, like dipsticks, contain evidence of historical glacier heights. The thinning rates, which the researchers established by isotopic dating of quartz grains from within seven rock samples, suggest a lower boundary for long-term ice loss. In this context, contemporary loss rates are catastrophic.

STRUCTURAL BIOLOGY

Into the groove

Mol. Cell **29,** 525–531 (2008)

Genes are often marked for silencing by the addition of methyl groups to DNA. This type of modification is recognized by transcriptional regulators such as the repressor MeCP2, but not in the way generally predicted, according to research by Adrian Bird and Malcolm Walkinshaw at the University of Edinburgh, UK, and their collaborators.

Previous studies predicted that a hydrophobic patch in the MeCP2 protein made contact with methylated DNA. However, structural analysis of how the two molecules bind together suggests that hydrogen bonding of MeCP2 with the water-containing groove in the DNA double helix is crucial.

The research also reveals how a mutation common in Rett syndrome, an autism spectrum disorder, might disrupt this binding.

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OPTICS

How to make a black hole

Science **319,** 1367–1370 (2008)

Researchers have created an analogue of a black hole in a lab, using light trapped in an optical fibre. This optical black hole affects light in ways equivalent to the intense gravity at a black hole's 'event horizon', beyond which no light can escape.

Pulses of light travelling down the fibre affect the fibre's light-carrying properties in a manner analogous to the bending of space-time by gravity. The leading edge of a pulse then acts like an event horizon when it catches up with slower light up ahead. Meanwhile, the pulse's trailing edge becomes equivalent to a white-hole event horizon, where no light can enter. Here, a faster-moving stream of light behind the pulse is reflected back, and shifted in frequency, just as is predicted for a real white hole.

JOURNAL CLUB

John Church
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An oceanographer ponders the difficulty of accurately estimating abyssal-ocean warming.

Estimating how much oceans are warming and where within them heat is stored is a fascinating challenge for me and my fellow oceanographers. So far, most studies comparing observations and models of changing ocean temperatures have focused on the upper 1 kilometre of water. But what about the abyssal depths, from about 3,000 metres to the bottom? Are changes in those waters really so slow as to be essentially irrelevant to atmospheric warming?

The most comprehensive surface-to-bottom measurements of ocean temperature were collected by research ships over many months during the World Ocean Circulation Experiment in the 1990s. By comparing these observations with more recent ones from the World Climate Research Programme's CLIVAR Project, Greg Johnson and his colleagues have shown that the Pacific Ocean's abyssal waters have warmed during the past two decades (G. C. Johnson *et al. J. Clim.* **20,** 5365–5375; 2007).

Although the temperature increase is small — up to about 0.01 °C — compared with the much larger changes in the upper 1,000 metres of the ocean, it has occurred over a thickness of several kilometres, implying a huge quantity of heat storage. The deep warming is strongest in the south-west Pacific, where newly ventilated abyssal waters enter from the south.

The Pacific warming, and abyssal warming elsewhere, means that we should start considering abyssal waters when estimating sea-level rise and the climate's sensitivity to increasing greenhouse-gas concentrations. There is plenty to find out: how does the heat reach abyssal waters? Is the warming human-induced? Designing and implementing an adequate abyssal-water-observing system is a high priority.

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