Archaeology

Magnetic murals in Central America

Geophys. Res. Lett. **31,** doi:10.1029/2004GL020065 (2004)

The history of Earth's magnetic field over the past few millennia is written on the walls of archaeological sites in Central America, according to Avto Goguitchaichvili and colleagues, who have measured the magnetism of pre-Columbian mural paintings in central Mexico.

Palaeomagnetic records are generally reconstructed by looking at ancient magnetic rocks, which 'freeze in' the prevailing orientation of the geomagnetic field when they solidify from lavas. But relatively recent records are hard to find. Goguitchaichvili *et al.* point out that Mesoamerican murals retain an imprint of the planet's magnetic field at the time they were painted, because the grains of iron oxide used as a red pigment were free to orient themselves before the paint dried.

The authors have taken pigment samples from wall paintings spanning the period of the Classic and early post-Classic Mesoamerican cultures (about AD 200–1200). The samples all show remanent magnetization, mostly due to the presence of small amounts of magnetites (ferrimagnetic) and haematites (antiferromagnetic). Such data can be used to document changes in the direction and intensity of the geomagnetic field. Conversely, if these changes have already been well characterized for a particular region, the magnetic record could be used to date the murals, at a fraction of the cost of radiometric methods. **Philip Ball**

Astronomy

Cool measurements

Astron. Astrophys. doi:10.1051/0004-6361:20040551 (2004)

Astronomers have made the first-ever measurement of the mass of an ultra-cool star and its companion brown dwarf. Stars generally create most of their light by fusing hydrogen in their cores, providing a direct relationship between their luminosity and their mass. But ultra-cool stars do not fuse hydrogen, and their mass–luminosity relationship is not a reliable way to measure their mass.

H. Bouy *et al.* now report the first step towards calibrating a separate mass–luminosity curve for these objects, which occupy a twilight zone between being stars and gas-giant planets. They collated four years of observations from various sources — the Hubble Space Telescope, the Very Large Telescope, the W. M. Keck Observatory and the Gemini North Telescope — to determine the dynamical mass and orbital period of a binary system that lies about 40 light years from Earth.

They report that the heavier star has about 8.5% of the mass of our Sun, whereas its brown dwarf companion has only 6.6% of the solar mass. Both objects have a surface temperature of about 1,500 °C, more than three times cooler than the Sun. Bouy *et al.* estimate that the stars are relatively young, at between 500 and 1,000 million years old, and that they orbit one another every ten years or so. **Mark Peplow**

Ecology

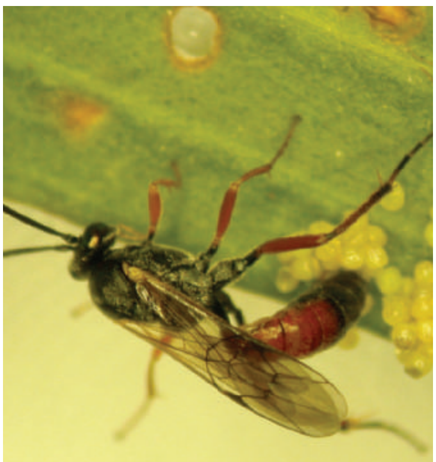
Waspish behaviour

Behav. Ecol. **15,** 661–665 (2004)

The butterfly *Melitaea cinxia* is parasitized by the wasp *Hyposoter horticola*, even though the host is susceptible for only a few hours each year. Saskya van Nouhuys and Johanna Ehrnsten conclude that the wasp achieves this feat by memorizing the locations of host eggs in advance. It then returns just before the butterfly larvae hatch, when the eggshells are weak enough for the wasp to penetrate and lay its own eggs inside (pictured).

Van Nouhuys and Ehrnsten made clusters of eggs available to the wasps for either two weeks before hatching or on the day of hatching. They found that the wasps parasitized a much greater proportion of the eggs that they had been able to identify on reconnaissance trips.

The authors point out that, as egg clusters are often hundreds of metres apart, it is unlikely that the wasps return to previously deposited chemical markers: known markers are short-range only. Instead, they think that the wasps are learning the spatial locations of the eggs. This would be a remarkable accomplishment — one that allows the parasite to rely on a single host species that is available for only a thousandth of that species' lifespan. **Patrick Stevenson**



S. VAN NOUHUYS

Neuroscience

Cocaine turn-off

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0403795101 (2004)

What is the best way to tackle cocaine addiction? Many think that removing the psychological effects — the main driving force for addiction — might make addicts less inclined to take the drug.

M. Rocio A. Carrera and colleagues set about mopping up cocaine molecules in the brains of rats. The drug can be removed from the rest of the bloodstream by using cocaine-seeking antibodies, but the blood–brain barrier makes the brain a difficult target.

Carrera *et al.* devised a novel carrier molecule for the cocaine antibodies: a virus that can enter the brain. The virus was modified to carry genes for the antibodies and was made safe by having harmful gene sequences removed.

The rats received the carrier virus by nasal injection for three days. For the next few days, this group and an untreated group were given a dose of cocaine.

The untreated group displayed characteristic behaviour associated with taking cocaine, such as sniffing and moving backwards and forwards, whereas the treated group did not. Carrera *et al.* conclude that the antibodies had sequestered the cocaine molecules, blocking their physical and, probably, mental effects. **Laura Nelson**

Metallurgy

A glass act

Phys. Rev. Lett. **92,** 245503 (2004)

Glassy steel promises to be a better engineering material than regular crystalline steel for certain applications — it can be harder, stronger, more corrosion-resistant and non-magnetic. But making it is not easy: previously, rods no more than 4 mm in diameter had been produced. Z. P. Lu *et al.* have found a recipe for making ingots of amorphous steel up to 12 mm in diameter, which should allow structural engineering components to be made using standard melting and casting techniques.

The group found that steel's ability to form a glass is enhanced by adding yttrium, together with small amounts of chromium, molybdenum, manganese and boron. Without yttrium, the alloy tends to crystallize; but mixtures with about 1.5% yttrium seem to be fully amorphous. The yttrium stabilizes the liquid phase relative to the crystal, and also slows the growth of iron carbide crystals — it makes an amorphous steel both thermodynamically and kinetically more favourable. The resulting material is twice as hard as standard steels, and is also harder and stronger than other (more expensive) amorphous alloys based on palladium and zirconium. **Philip Ball**