RESEARCH HIGHLIGHTS

EVOLUTIONARY BIOLOGY

Lice in hiding

Am. Nat. doi:10.1086/656269 (2010)

Bird lice reduce their chances of being picked off by their hosts by evolving to match the colour of the birds' feathers.

Camouflage has been well documented in predator–prey relationships. Sarah Bush and her colleagues at the University of Utah in Salt Lake City now report that the same evolutionary trend exists between parasites and their hosts.

By comparing lice from species of dark- and light-coloured birds (pictured), the researchers found that 'feather' lice — which live on a bird's body — match the colour of their host's plumage (insets). However, 'head' lice do not necessarily blend in. This suggests that bird preening drives lice-colour evolution: birds cannot see or groom their heads, so there is no selective pressure for head lice to be camouflaged.

T. HAMPEL/UNIV. CHICAGO

APPLIED PHYSICS

Record data storage

Appl. Phys. Lett. doi:10.1063/1.3463470 (2010)

Data have been recorded on a tiny slice of a metal oxide at a density eight times that offered by today's most advanced magnetic disk drives.

In magnetic data storage, data are written to disk by a magnetic read-and-write head that changes the magnetization of a region a few hundred nanometres across. One option for boosting memory in ever-shrinking electronics is to use ferroelectric materials, in which data can be encoded in the polarization of smaller regions.

Kenkou Tanaka and Yasuo Cho at Tohoku University in Sendai, Japan, recorded 64 × 64 bits of real data at a spacing of 12.8 nanometres per bit on a crystalline slice of lithium tantalate. This amounts to a density of 0.6 trillion bits per square centimetre.

NEUROSCIENCE

Quick mood lift

Science **329,** 959–964 (2010)

Patients taking traditional antidepressants have to wait several weeks for the drugs to kick in. However, a few severely depressed patients taking ketamine, an anaesthetic and recreational drug, have shown improvement within hours. How does it act so quickly?

Ronald Duman and his team at Yale University in New Haven, Connecticut, show that the ketamine affects a brain signalling pathway called mTOR. Ketamine rapidly activated this pathway in the prefrontal cortex of healthy rats, resulting in the formation of more connections between neurons. Treated rats also showed improved performance in three behavioural tests that model depression. These responses were all lost when the scientists blocked the mTOR pathway biochemically.

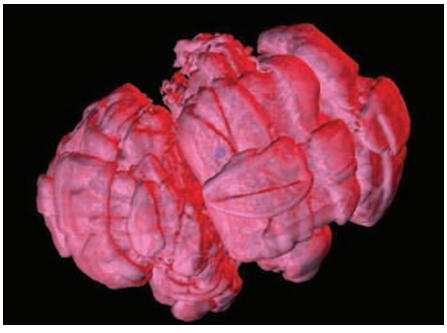
ASTRONOMY

Exploding computer models

Astrophys. J. **720,** 694–703 (2010)

When a star much more massive than the Sun runs out of fuel, its core collapses and sparks an enormous explosion, or supernova. Neutrinos in the core are believed to be key to triggering the blast, but observations of neutrinos from real explosions don't match up well with theoretical predictions.

Jason Nordhaus of Princeton University in New Jersey and his colleagues think the problem may be a dimensional one. Most supernova computer models are one- or two-dimensional, to expedite calculations. When the team used supercomputers to run a three-dimensional simulation of a supernova, they found that the extra degree of freedom led to a significantly more efficient and vigorous, and earlier explosion (pictured) — a result that more closely matches observations.



ANIMAL BEHAVIOUR

Genetics and culture clash

Proc. R. Soc. B doi:10.1098/rspb.2010.1112 (2010)

Culture may not be the only factor underlying differences in tool use and other behaviours across groups of wild chimpanzees — genetic variation may also play a part.

Primatologists have previously invoked culture to explain why, for instance, one chimpanzee community digs for termites and another does not, even when their ecological environments are similar. Kevin Langergraber at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, and his team analysed DNA from cell organelles called mitochondria for 246 chimps spanning nine groups in East and West Africa to determine how the groups were related to one another. They then compared these relationships with existing data on whether or not members from these sites display any of 38 different behaviours — many involving tool use. Genetically related communities often had a similar suite of behaviours.

ASTRONOMY

Brown dwarf spotted

Astrophys. J. **720,** L82–L87(2010)

Scientists have directly imaged a brown dwarf — an object too big to be a planet yet not massive enough to ignite into a star — travelling in a highly eccentric orbit around its parent star. At its closest approach the companion is within 9 astronomical units of the star, a distance similar to that between Saturn and the Sun, whereas its furthest reach is double that distance.

Beth Biller at the University of Hawaii in

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Honolulu and her colleagues used the Near-Infrared Coronagraphic Imager (NICI) to minimize the light of the glaring star and to spot the companion, which has a mass about 36 times that of Jupiter. Because the star is so young (around 12 million years old, compared with 4.5 billion for the Sun) the discovery helps to set constraints on our understanding of how brown dwarfs and planets formed.

DEVELOPMENTAL BIOLOGY

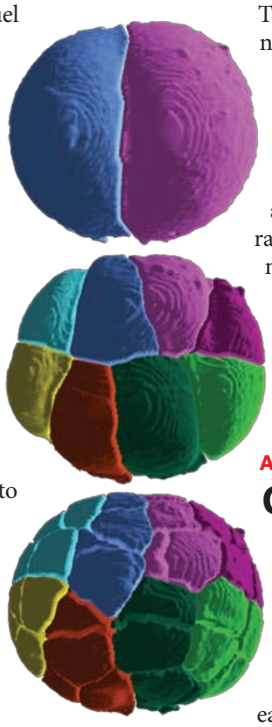
Live-action embryos

Science **329,** 967–971 (2010)

Time-lapse imaging has revealed new details about the zebrafish embryo as it undergoes its first ten cell-division cycles.

Nadine Peyriéras and Emmanuel Beaurepaire of the French National Centre for Scientific Research in Gif-sur-Yvette and Palaiseau, respectively, and their colleagues have developed a microscopy technique that visualizes protein tubules involved in cell division and cell boundaries in live embryos, with micrometre resolution. The method does not involve fluorescent dyes.

The team analysed three-dimensional images from six embryos and digitally reconstructed their growth (pictured). The authors were able to track the position and lineage of each cell and found, for example, that the cell-cycle duration was longer for cells deeper in the embryo, leading to a wave-like pattern of embryo development.



SCIENCE/AAAS

CANCER BIOLOGY

Muscling in on cancer

Cell **142,** 531–543 (2010)

Massive muscle wasting affects most patients with cancer, and is often implicated in deaths from the disease. It is thought that myostatin, a protein that inhibits muscle growth, and other molecules in the same biochemical pathway regulate this process, called muscle cachexia.

H.Q. Han at Amgen Research in Thousand Oaks, California, and his team tested whether a molecule that interferes with a receptor for myostatin could prevent muscle cachexia in mice. Mice with cancer that were given the compound showed a complete reversal in muscle loss, as well as prolonged survival.

For a longer story on this research, see go.nature.com/FKmBQu

NEURODEGENERATION

Cell respiration ruin

Neuron doi:10.1016/j.neuron.2010.07.019 (2010)

In some inherited forms of the neurodegenerative disease amyotrophic lateral sclerosis (ALS), the culprit is a mutated gene that encodes the enzyme SOD1. What hasn't been clear is how this molecule causes motor neurons in the brain and spinal cord to die.

Don Cleveland at the University of California, San Diego, and his colleagues show that a misfolded version of SOD1 binds to a protein channel in the outer membrane of mitochondria, the cell's energy-generating organelles. This protein, VDAC1, regulates the movement of ions and other molecules across the mitochondrial membrane.

The team isolated VDAC1 from normal rats and showed that mutated SOD1 binds to it, lowering VDAC1's electrical conductance, which indicates a hampered flow of ions through the channel. In addition, mitochondria from rats engineered to carry a human mutant *SOD1* gene took up less ADP, a molecule needed for cellular respiration. Such impairments, the authors suggest, lead to neuronal damage.

ASTRONOMY

Oldest rock

Nature Geosci. doi:10.1038/ngeo941 (2010)

The Solar System just got a little older. New information from a chondritic meteorite — a rocky artefact from the Solar System's earliest days — puts the age of the Solar System at about 4.5682 billion years, between 0.3 million and 1.9 million years older than previous estimates.

Audrey Bouvier and Meenakshi Wadhwa of Arizona State University in Tempe determined this age after measuring the ratios of different lead and magnesium isotopes inside the ancient rock. This also allowed them to estimate the initial abundance of an iron isotope often found in such meteorites. Because this iron probably formed within an ageing giant star, which then exploded as a supernova, the finding gives credence to the theory that a nearby supernova helped to trigger the formation of our Solar System.

For a longer story on this research, see go.nature.com/woXqM8

JOURNAL CLUB

Richard E. Zeebe
University of Hawaii, Honolulu

A physicist and biogeochemist gets a kick out of the problem of Brownian motion and diffusion.

The movement of a particle in a gas or fluid, known as Brownian motion, exhibits two different regimes: the ballistic and the diffusive. For illustration, imagine a drunken sailor staggering back to his ship. While taking a few rapid steps, his instantaneous velocity may be quite high (ballistic regime), but his average 'random walk' velocity may be rather low (diffusive regime). If we were to monitor the sailor with a coarse-resolution Global Positioning System device, we would conclude that he is walking leisurely towards the docks, but we wouldn't be able to detect his rapid motions on much shorter timescales.

Until recently, a similar problem applied to observing a Brownian particle's instantaneous velocity. Now, Mark Raizen and his colleagues at the University of Texas at Austin have followed the ballistic motion of micrometre-sized particles on microsecond timescales, using lasers (T. Li *et al. Science* **328,** 1673–1675; 2010). Their results not only confirm the equipartition theorem, but may also be critical to observing certain quantum effects.

My interest in the story is more practical. I am currently using molecular dynamics to calculate ionic diffusion coefficients. It was a great pleasure to see that the underlying theory and the new experimental results agree flawlessly.

In response to the authors' observation, the media stated that Einstein had been wrong because he had predicted such an observation to be impossible. He wasn't. As a German-speaker, I have been able to read the early landmark papers in physics, often originally in German. They include Einstein's 1907 paper on Brownian motion. He stated that observing the instantaneous velocity of ultra-microscopic particles is impossible. He didn't rule out the possibility of studying microscopic particles — as Li *et al.* have done.

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