RESEARCH HIGHLIGHTS

Selections from the scientific literature

ASTROPHYSICS

Mind the black-hole gap

What's the smallest a black hole can be? About 4.5 times the mass of the Sun, according to Will Farr of Northwestern University in Evanston, Illinois, and his colleagues.

Farr's team obtained data on the masses of 20 known black holes that are sucking gases away from their partners in binary star systems. Using these data, the researchers created an expected mass distribution for all stellar-mass black holes and found that 99% would have a mass greater than 4.5 solar masses.

This presents a problem for theories predicting a smooth distribution between black holes and neutron stars, which have a theoretical limit of three times the mass of the Sun.

Astrophys. J. 741, **103–122 (2011)**

MEDICINE

Safety switch for cell therapy

Cell therapies often induce harmful reactions in patients, so researchers have devised a 'safety switch' and tested it in a common procedure — the infusion of T cells in patients with blood cancers. Malcolm Brenner at Baylor College of Medicine in Houston, Texas, and his colleagues worked with T cells that are frequently given to reduce the risk of relapse and boost immune recovery after stem-cell transplantation. They modified the cells to include a gene that encodes an inducible protein crucial to cell death.

When the T cells provoked the dangerous graft-versus-host disease (GVHD) in four children with acute leukaemia, an otherwise inert drug was infused to activate the protein. Within 30 minutes, more than 90% of the T cells had been eliminated. The GVHD resolved within 24–48 hours and had not returned one year later.

N. Engl. J. Med. 365, **1673–1683 (2011)**

B&C ALEXANDER/ARCTICPHOTO

ARCTIC SCIENCE

More light under ice

In summer, Arctic waters become an ever-evolving mosaic of bare ice, meltwater ponds and open water. In June and July 2010, Bonnie Light of the University of Washington in Seattle and her colleagues measured the optical properties of ice floes formed during the previous winter in the Chukchi Sea to see how changes in ice cover affect the amount of solar radiation that reaches the ocean.

The transmission of sunlight through ice covered by meltwater ponds was generally an order of magnitude greater than that through thicker bare ice. But horizontal propagation of light in the vicinity of melt ponds, caused by scattering in the ice, led to unexpectedly high rates of light transmittance under the surface of bare ice.

Increased summer melting and thinning may substantially raise the amount of sunlight reaching the upper ocean, so this complexity could have profound effects on biological production and ocean chemistry.

Geophys. Res. Lett. **http://dx.doi.org/10.1029/2011GL049421 (2011)**

CHEMISTRY

Solar-cell progress

Dye-sensitized solar cells could offer a cheap alternative to conventional silicon devices, but are often hamstrung by the price of ruthenium, a component in their dye, and problems with the electron carriers used to complete the electrical circuit.

Michael Grätzel at the Swiss Federal Institute of Technology Lausanne (EPFL) and his colleagues report improvements in both these areas. They used a zinc-porphyrin dye called YD2-*o*-C8 to avoid the need for ruthenium. And, to overcome the voltage limit inherent in traditional electron carriers, they paired this dye with a cobalt polypyridyl electrolyte. The authors' system can generate about 1 volt and has an impressive efficiency of 12.3%.

Science 334, **629–634 (2011)**

BIOLOGY

Giant webs catch river insects

Darwin's bark spiders spin immensely tough silk into enormous webs across rivers and small lakes in Madagascar. Matjaž Gregorič at the Slovenian Academy of Sciences and Arts in Ljubljana and his colleagues report that the webs of this spider (*Caerostris darwini*) are the largest ever seen, with orbs spanning up to 2.76 square metres, and silk bridges as long as 25.5 metres. However, they might not be designed to

catch large prey.

After filming webs for hundreds of hours, the researchers found no evidence that they trapped flying vertebrates such as birds, and in experiments the webs were unable to retain frogs or very large insects. These huge structures have unusually open architectures, and effectively provide large surfaces to catch semi-aquatic flying insects. Mass emergences of such creatures might provide an amount of food equivalent to a larger prey.

J. Arachnol. 39, **287–295 (2011)**

MUSIC

Doctoring the beats

If you have endured much 1980s pop music, you might agree that drum machines (**pictured**) steal the soul from the beat. Their cold regularity is sometimes 'humanized' in the recording studio by the injection of random deviations from precise timing. But that's not good enough, according to Holger Hennig of the Max Planck Institute for Dynamics and Self-Organization in Göttingen, Germany, and his team, who analysed recordings of human drummers and singers performing simple rhythmic patterns.

D. PEARSON/ALAMY

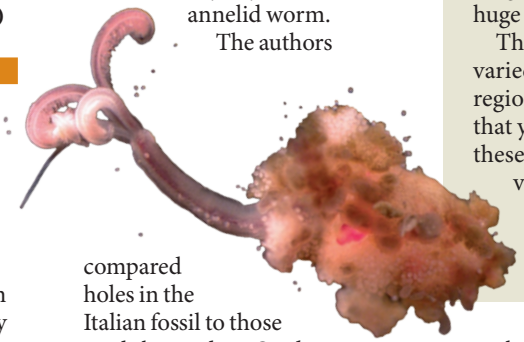
The researchers find that the rhythmic imperfections of human performers are not statistically independent, but show long-term correlations: one deviation can influence others for tens of seconds afterwards. What's more, listeners prefer rhythms with these correlated defects over those with pure white-noise fluctuations.

PLoS ONE 6, **e26457 (2011)**

PALAEONTOLOGY

Ancient whales were worm food

Whale-bone-eating worms that lack guts and rely on bacterial symbionts to eat may have been as widespread millions of years ago as they are today. Nicholas Higgs at the University of Leeds, UK, and his team report that a 3-million-year-old fossil from Italy, thought to be a beaked whale, contains bore-holes left by a type of annelid worm.



NATURAL HISTORY MUSEUM, LONDON/ALAMY

The authors compared holes in the Italian fossil to those made by modern *Osedax* worms (**pictured**) in several whale bones. They found that the holes bore distinguishing characteristics of *Osedax*-made canals. This is the second *Osedax*-eaten whale fossil to be identified — it follows a 30-million-year-old fossil from the northwestern United States — and the first discovery of *Osedax* in the Mediterranean, past or present, the authors say.

Histor. Biol. **http://dx.doi.org/10.1080/08912963.2011.621167 (2011)**

MATERIALS

3D ripples in a 2D layer

Two-dimensional single layers of carbon atoms known as graphene are thought to be stabilized by 'ripples' that deform the material into three dimensions. Andras Kis and his colleagues at the Swiss Federal Institute of Technology Lausanne (EPFL) report similar structures in molybdenum disulphide.

In the first transmission electron microscopy project to study single layers of MoS_2, the authors show that although the layers have long-range crystalline order, ripples of up to 1 nanometre in height can be observed. The team also identifies differences in the diffraction patterns of single- and multi-layer MoS_2, which could be used to identify single layers. This is the first electron-microscopy study of large MoS_2 sheets known to be just one layer thick. Moreover, MoS_2 is only the second material in which such ripples have been confirmed, say the authors.

Nano Lett. **http://dx.doi.org/10.1021/nl2022288 (2011)**

CANCER BIOLOGY

Fat fuels abdominal cancers

Fat-storing cells called adipocytes are major players in the spread of ovarian cancer to a fatty abdominal organ called the omentum.

Using cultured human adipocytes and ovarian cancer cells, Ernst Lengyel of the University of Chicago in Illinois and his colleagues found that hormonal signals from the omentum's adipocytes attract cancer cells. This could explain why ovarian cancers often metastasize to the omentum. In culture, adipocytes transfer lipids to ovarian cancer cells, which use them as an energy source and grow rapidly.

Blocking the fat-binding protein FABP4 reduces both lipid transfer to cancer cells and the number of invasive cancer cells. This suggests that FABP4 could be a target for fighting metastasizing abdominal tumours.

Nature Med. **http://dx.doi.org/10.1038/nm.2492 (2011)**

COMMUNITY CHOICE

The most viewed papers in science

COMMUNITY CHOICE

How Rover got his wrinkly skin

HIGHLY READ on www.plos.org in October

An analysis of several dozen dog breeds has yielded a genetic catalogue that can be used to search for information about complex canine traits and diseases.

Matthew Webster of Uppsala University in Sweden and his colleagues looked for single-base changes in the DNA of 509 dogs representing 46 breeds. The dogs spanned a wide range of shapes, colours and sizes, from tiny chihuahuas to huge Newfoundlands.

The researchers found 44 regions of the genome that varied widely between some breeds, and hundreds of regions that varied very little within breeds, suggesting that years of breeding have selected for traits based in these regions. Closer examination of such regions revealed various gene associations, including one that causes leg deformities in dachshunds and another for wrinkled skins in Shar Peis.

PLoS Genet. 7, **e1002316 (2011)**

CORRECTION

The bird pictured in the research highlight "Tools don't make for brainy birds" (*Nature* **478,** 431; 2011) was incorrectly identified as a small tree finch owing to an error from the picture's source. It is actually a vegetarian finch.

NATURE.COM

For the latest research published by *Nature* visit:
www.nature.com/latestresearch