

RESEARCH HIGHLIGHTS

Selections from the scientific literature

ASTROPHYSICS

Rare element from space

The element tellurium probably originated in exploding stars, or supernovae, through a process by which nuclei rapidly capture neutrons and become heavier.

Ian Roederer of the Carnegie Observatories in Pasadena, California, and his colleagues used the Hubble Space Telescope to detect signs of tellurium in three ancient stars in the halo of the Milky Way. Tellurium is the heaviest element for which production by rapid neutron capture, called the *r*-process, can be predicted using laboratory data.

The authors report that the observed levels of tellurium match earlier predictions made for the *r*-process in the Solar System. They conclude that tellurium and other heavy elements are produced predominantly by this process. *Astrophys. J.* 747, L8 (2012)

BIODIVERSITY

New amphibians with no limbs

A family of limbless amphibians has been discovered in the soils of northeastern India.

Sathyabhama Das Biju at the University of Delhi and his colleagues unearthed more than 500 examples

encompassing seven new species of the caecilian order of amphibians. An analysis of the animals' genomes and cranial anatomy showed that these Chikilidae (pictured with a clutch of eggs) — which measure up to 25 centimetres in length — probably first appeared during the early Cretaceous period, about 140 million years ago.

The animals' closest known relatives are in Africa. The authors suggest that, historically, caecilians are likely to have been geographically restricted, with low rates of speciation.



A. TOENING/GETTY

CLIMATE SCIENCE

The extended reach of Australian drought

The Big Dry, a prolonged drought that affected southeast Australia from 1997 to 2011, was more extensive than previously thought.

Gavan McGrath at the University of Western Australia in Crawley and his colleagues analysed satellite data from across the continent and found evidence of decreased water storage, rainfall and plant growth throughout the country between 2002 and 2010. In the southeast, the drought correlated with an irregular Indian Ocean circulation,

whereas in the northwest it was associated with a decreased frequency of tropical cyclones. The authors say that the northwest drought coincided with and probably exacerbated the one in the southeast.

The findings suggest that distinct climatic factors such as decadal cyclone trends and changes in ocean circulation can combine to create a continental-scale drought.

Geophys. Res. Lett. <http://dx.doi.org/10.1029/2011GL050263> (2012)

They also warn that these and other creatures in this region of India are threatened by deforestation and rapid population growth.

Proc. R. Soc. B <http://dx.doi.org/10.1098/rspb.2012.0150> (2012)

EVOLUTION

Invasive mosquito adapts fast

Since arriving in the United States from Japan in 1985, the invasive Asian tiger mosquito has spread across the country's eastern reaches, providing a natural demonstration of

adaptive evolution. Peter Armbruster at Georgetown University in Washington DC and his colleagues report that over roughly 20 years, the insect (*Aedes albopictus*) has adapted to differences in the timing of winter onset across roughly 15° of latitude.

The authors measured the day length required to induce winter-time dormancy in mosquitoes across various latitudes in the US and Japan between 2005 and 2008, and compared the measurements with those taken about 20 years earlier. They found a response to seasonal change that is among the fastest documented

S. D. BIJU

adaptation in nature.

Other traits, such as body size, did not show a pattern of adaptation in either country. The findings support the idea that, in a changing climate, animals evolve mainly by adapting to changes in seasonal shifts.

Am. Nat. <http://dx.doi.org/10.1086/664709> (2012)

MICROBIOLOGY

New species spring forth

Microorganisms in a Siberian hot spring have been caught in the act of diverging to form two species.

Rachel Whitaker at the University of Illinois in Urbana-Champaign and her team sequenced the genomes of 12 strains of *Sulfolobus islandicus* — an archaeon living in hot springs around a volcano on Russia's Kamchatka Peninsula. The sequences show that the microbes belong to two groups — dubbed red and blue — and that genes are exchanged more readily within than between the groups. This means that each group of microbes meets the classic definition of a biological species.

The authors think that physiological differences between the two populations could be preventing gene flow. For instance, strains of the red group replicate faster and to higher densities than do those of the blue group.

PLoS Biol. 10, e1001265 (2012)

GEOLOGY

Stretch marks on the Moon

The Moon has been stretched within the past 50 million years — a surprising and relatively recent sign of extensional tectonics for a body that has been around for 4.5 billion years.

Using a camera on NASA's

Lunar Reconnaissance Orbiter, Thomas Watters of the Smithsonian Institution in Washington DC and his colleagues spotted graben — long, narrow blocks of rock that drop down and form trenches as the Moon's crust is stretched. Some of the graben are as shallow as one metre, suggesting that, in geological terms, they are fresh.

The authors suggest that their findings are inconsistent with models that predict that the primordial Moon

was completely molten and would have contracted so much that local extensional pressures would have been quashed. Instead, the graben may reflect an environment of

weaker contractions that resulted from the early Moon having only a molten exterior. *Nature Geosci.* <http://dx.doi.org/10.1038/ngeo1387> (2012)

NEUROSCIENCE

Cognitive boost to brain connections

By sensitizing the process by which neurons normally alter the strength of their connections, a molecule derived from a neuronal protein improves learning and memory in rats.

José Esteban at the Autonomous University of Madrid and his colleagues studied the effects of the molecule, FGL, on rats and on slices of the rat hippocampus, a brain region involved in learning and memory. They showed that FGL caused persistent activation of signalling molecules in hippocampal neurons. This set in motion a chain of molecular events that increased the efficiency with which a type of receptor called AMPA was inserted into neuronal connections, or synapses. The incorporation of additional AMPA receptors into synapses

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MOLECULAR BIOLOGY

Noncoding RNAs decapped

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Long RNA molecules have recently been discovered that seem to regulate genes rather than code for proteins, but little is known about how they do this. Loss of a protective cap from these long noncoding RNAs (lncRNAs) seems to be a crucial step in regulating a specific type of gene in yeast.

Like protein-encoding messenger RNAs, lncRNAs have a cap that protects the molecule from decomposing. By preventing loss of the cap in budding yeast, Jeff Collier and his colleagues at Case Western Reserve University in Cleveland, Ohio, found that many lncRNAs function at genomic regions near highly regulated genes that respond to specific environmental cues such as sugars and iron. One family of these 'inducible' genes — the GAL system, which enables cells to metabolize a sugar called galactose — is regulated by lncRNAs that must lose their caps for the cell to activate the sugar-processing genes.

Mol. Cell 45, 279–291 (2012)

is known to improve synaptic plasticity.

The authors hope that FGL could provide a starting point for the development of drugs that boost cognition.

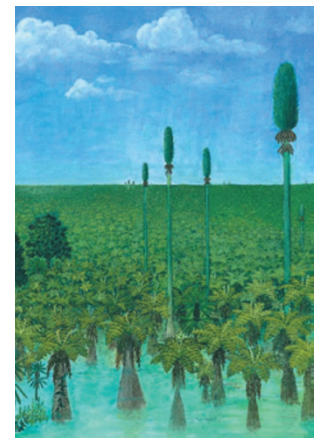
PLoS Biol. 10, e1001262 (2012)

PALAEOECOLOGY

Ancient forest preserved in ash

Volcanic ash buried a swampy forest roughly 298 million years ago, preserving a wealth of detail about the region's flora. Scientists have uncovered the fossilized plants in what is now northern China.

Jun Wang at the Chinese Academy of Sciences in Nanjing, Hermann Pfefferkorn at the University of Pennsylvania in Philadelphia and their team reconstructed the ancient ecosystem by analysing the positions of individual plants across three sites (an artist's impression **pictured**) that cover a combined area of more than 1,000 square metres. Besides sporting a broad, low canopy of tree ferns, the peat forest contained trees that



looked like feather dusters and reached heights of 25 metres or more. The team also found fossils of vines and three species of Noeggerathiales — small spore-bearing trees thought to be close relatives of the earliest ferns.

Proc. Natl Acad. Sci USA <http://dx.doi.org/10.1073/pnas.1115076109> (2012)

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

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