RESEARCH HIGHLIGHTS

Selections from the scientific literature

PLANETARY SCIENCE

Mercury's ice is a recent arrival

Ice at Mercury's poles is a relatively new arrival — a finding that could help to resolve a debate about whether ice may have survived for billions of years on the planet closest to the Sun.

Using data from NASA's MESSENGER spacecraft, Nancy Chabot of the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, and her colleagues studied how light scattered inside dimly lit polar craters. They found that in a northern crater called Prokofiev, highly reflective ice drapes over the underlying topography. This suggests that the ice has appeared on the surface relatively recently.

This ice was either delivered to Mercury, perhaps by comets, or churned up from below by impacts battering its surface, the authors conclude.

Geology **http://doi.org/wjf (2014)**

GERRY ELLIS/MINDEN PICTURES/FLPA

EVOLUTION

Lizards adapt quickly to invaders

Lizards in Florida have rapidly evolved traits that make them better tree-climbers, probably in response to an invasive competitor.

Cuban brown anole lizards (*Anolis sagrei*) have spread over the past few decades across the southeastern United States, where they compete for territory and food with the native green anole (*Anolis carolinensis*; pictured). Yoel Stuart at the University of Texas, Austin, and his colleagues introduced small populations of the invader to three islands in a central Florida lagoon and found that the native green anoles perched higher in trees than native lizards on nearby islands that had not been invaded. After just 20 generations of anoles, the team found that native lizards on invaded islands had evolved larger toepads, probably to help them cling to less-secure branches farther up in trees.

Competition between closely related species can drive rapid, observable evolutionary change, the authors say.

Science 346, **463–466 (2014)**

MYCOLOGY

Teamwork helps yeast to infect

Immune responses that should combat a disease caused by yeast instead make the fungus grow, potentially worsening the infection.

Robin May at the University of Birmingham, UK, and his co-workers studied strains of *Cryptoccocus gattii*, which can cause meningitis and other problems.

They found that oxygen-containing molecules produced by the host as a defence mechanism cause some of the fungal cells to become quiescent and resist immune responses. The remaining cells proliferate quickly, resulting in an overall increase in cell numbers. The resistant cells contained energy-producing organelles called mitochondria that were tubular in shape.

The findings suggest that the fungal cells act as a team during infection, with non-dividing cells helping neighbouring ones to grow rapidly.

Nature Commun. 5, **5194 (2014)**

ASTRONOMY

Mysterious signals may be from Earth

Radio pulses that look like they came from deep space could actually have earthly origins.

A team led by Pascal Saint-Hilaire at the University of California, Berkeley, detected five short but intense radio bursts at the Bleien Radio Observatory in Switzerland. This is only the second location at which such pulses have been detected, and their origins are still unclear. Characteristics of the radio waves suggest that they were stretched after passing through vast amounts of plasma — usually indicating an origin outside of the Milky Way, such as exploding stars in other galaxies.

However, the pulses were detected only when the antenna was in a mode susceptible to ground interference, and all but one pulse occurred in the late morning. This suggests that the signals could actually be coming from sources on Earth.

Astrophys. J. 795, **19 (2014)**

CANCER

Tumours linked to cellular rubbish

Discarded rubbish from tumours could trigger nearby healthy cells to become malignant.

Many cells shed exosomes: membrane-bound packages of proteins, DNA and RNA that are thought to be a

waste-management system. Raghu Kalluri at the University of Texas MD Anderson Cancer Center in Houston and his colleagues found that exosomes from cancer cells contain the building blocks for short RNA fragments that can shut off gene expression. Healthy cells that were exposed to cancer exosomes in culture caused tumours when the cells were later injected into mice, whereas cells exposed to normal exosomes did not.

Samples of exosomes from people with breast cancer also caused tumours in 5 out of 11 mice treated. This finding could aid the discovery of markers for disease progression, or even represent a route to new cancer therapies.
Cancer Cell **http://doi.org/wkg (2014)**

CHEMISTRY

Molecular sponges store oxygen

An oxygen cylinder could hold even more gas if it were filled with sponge-like powders, chemists report.

The powders are a type of metal–organic framework (MOF): sponge-like materials in which metal atoms are connected by organic groups, creating a porous network with many promising applications including gas storage. Omar Farha of Northwestern University in Evanston, Illinois, and his colleagues simulated oxygen adsorption (**pictured**, yellow spheres) on 10,000 MOFs and selected two to test. They experimentally showed that the MOFs could store and release oxygen over 50 cycles and outperformed zeolites, another kind of chemical sponge.

The structures could allow soldiers or medical teams to carry oxygen using smaller, lighter containers that operate at lower pressures than cylinders, the team says.
Angew. Chem. Int. Edn **http://doi.org/f2vn85 (2014)**

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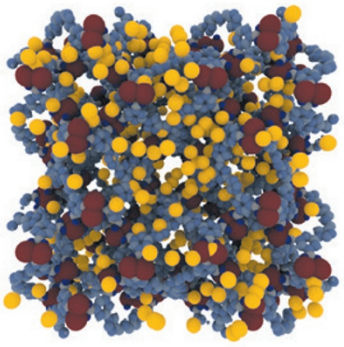


NUMAT TECHNOLOGIES

GLACIOLOGY

Channels hint at glacier hardiness

Ancient channels preserved beneath the West Antarctic Ice Sheet suggest that part of the glacier prevailed during warm periods more than two million years ago.

By combining radio-echo soundings of the landscape underneath the glacier with satellite images of the ice surface, Kathryn Rose of the Bristol Glaciology Centre, UK, Martin Siegert at Imperial College London and their colleagues discovered a series of ancient wide, shallow channels. These suggest that, historically, there was a large flow of meltwater from the ice surface. The most recent period that was warm enough to generate such melting was during the Pliocene, 5.3 million to 2.6 million years ago.

Parts of this ice sheet, which some studies have predicted will destabilize in a warmer climate, may have existed at intervals during a period that was 2 °C warmer than now, the authors say.
Geology **http://doi.org/wkt (2014)**

BIOTECHNOLOGY

Paper-based gene tools

Functional biological circuits can be printed on paper, reports a team led by James Collins at Boston University in Massachusetts.

The team synthesized cell-free gene networks from off-the-shelf parts and freeze-dried them on to paper. When later rehydrated, the networks worked as programmable *in vitro* diagnostics with a colorimetric output. The team demonstrated the technology by using the circuits to detect glucose and to distinguish between RNA fragments from two related virus species of the Ebolavirus genus, called Sudan and Zaire.

The paper technology should allow the easy and low-cost use of synthetic biology outside the lab, the team predicts.
Cell **http://doi.org/wkr (2014)**

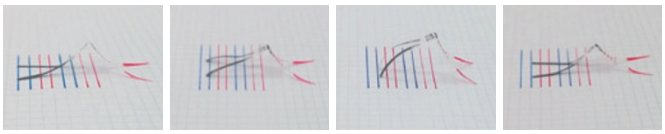
MATERIALS

Sunshine drives graphene machines

Machines that move by bending in response to moisture can be made by exposing thin sheets of graphene oxide to sunlight.

A team led by Hong-Bo Sun at Jilin University in Changchun, China, focused sunlight on one side of graphene oxide paper. The ultraviolet radiation induced a reaction that negatively charged the surface so that it repelled water more strongly than the layer below, causing the paper to curl in seconds on contact with moisture.

The team fashioned a claw from the paper that closes when approached by a sweaty finger, and a paper robot (**pictured**) that crawls when the humidity in its environment is raised and lowered. The authors say that the material could be used in devices including sensors and smart textiles.
Adv. Mater. **http://doi.org/wjj (2014)**



SOCIAL SELECTION

Popular articles on social media

Rules for reproducibility win support

Nearly a decade after writing a scathing critique of biomedical research, 'Why Most Published Research Findings Are False', Stanford University scientist John Ioannidis has published a follow-up. The health-policy researcher suggests a blueprint for making scientific results more reliable, including increasing the statistical certainty of discoveries, giving more weight to negative results and changing how researchers earn kudos.

Many commenters chimed in with support for his paper, even if they did not believe that change could come easily. Simon Wheeler, a public-health nutritionist at the University of Cambridge, UK, endorsed Ioannidis's suggestions, tweeting that scientists should be "creating a culture where these are norms and expectations, not just lofty ideals". Mick Watson, a computational biologist at the University of Edinburgh's Roslin Institute, UK, tweeted, "I'm totally with John Ioannidis when he says the scientific reward system needs to change."
PLoS Med. 11, **e1001747 (2014)**

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