

CHEMISTRY

Crystal harbours molecular shuttle

A ring-shaped molecule that hops between two sites inside a porous crystal is the first molecular shuttle to operate in a solid-state material.

Molecular shuttles could one day act as switches to store data if they are held in a well-ordered array. A team led by Stephen Loeb and Robert Schurko at the University of Windsor, Canada, built their shuttle inside a metal-organic framework (MOF): a crystalline scaffold made from metal-containing nodes connected by carbon-based struts. These struts bore a circular rotaxane molecule that moved back and forth 283 times per second at room temperature.

The estimated high density of shuttles in the MOF shows the potential for enormous data capacity if such switches can be controlled, the authors say.

Nature Chem. <http://doi.org/4f2> (2015)

MICROBIOLOGY

Gut biofilms could spur cancer

Chemicals secreted by gut bacteria are linked to human colon cancers.

Metabolites called polyamines are made by gut bacteria to help them to form sticky aggregates called biofilms, and are used by human cells to regulate proliferation. Cynthia Sears at Johns Hopkins University in Baltimore, Maryland, Gary Siuzdak at the Scripps Research Institute in La Jolla, California, and their colleagues compared tissue samples from human colon cancers to those from healthy people, both with and without biofilms.



PALAEONTOLOGY

Early modern bird

Two newly discovered fossils from China are the oldest relative of modern birds found so far, and had relatively few traits of their dinosaur ancestors.

Min Wang and Zhonghe Zhou at the Institute of Vertebrate Paleontology and Paleoanthropology in Beijing and their colleagues describe two fossils from northeast China dating to 130.7 million years ago. The new species, *Archaeornithura meemannae* (pictured), boasted elaborate plumage — including a fan-shaped tail — and other defining features of modern birds such as a wishbone. This suggests that even these early birds, which are six million years older than previously discovered bird fossils, had already shed key dinosaur traits.

A. meemannae belongs to a family of wading birds, hinting that modern birds originated near water, the team says.

Nature Commun. 6, 6987 (2015)

They found that cancer tissue with biofilms had 62 times more of the polyamine metabolite N^1, N^{12} -diacetylspermine than did healthy tissue with biofilms. Yet in samples that were biofilm-free, the cancer tissue contained only around 7 times more polyamine than the

healthy sample. Antibiotic treatment reduced levels of this metabolite, suggesting that it comes from bacteria.

Therapies that target polyamine formation and biofilms could be a way to treat colon cancer, the authors note. *Cell Metab.* <http://doi.org/4jz> (2015)

CLIMATE SCIENCE

Growing extremes in California rains

California's ongoing drought is a result of natural variability, at least for the 2013–14 period. But the state could see larger swings in wet and dry seasons by the end of this century owing to climate change.

Neil Berg and Alex Hall of the University of California, Los Angeles, used 34 climate models to study how precipitation extremes might change in California. They expect that between 2060 and 2100, the normally wet winter will be extremely dry twice as often as today, and extremely wet three times as often. The fluctuations could raise the risk of drought and flooding.

These changes could push the state's water supply to its limit.

J. Clim. <http://doi.org/4fz> (2015)

EVOLUTION

Bird beak to dinosaur snout

Chicken embryos with dinosaur-like faces provide clues as to how bird beaks evolved from dinosaur snouts.

Early in bird evolution, the twin bones that form the snout in dinosaurs and reptiles — the premaxillae — grew longer and joined together, eventually forming the beak. Bhart-Anjan Bhullar, now at the University of Chicago in Illinois, Arhat Abzhanov at Harvard University in Cambridge, Massachusetts, and their colleagues analysed the development of beaks in embryonic chickens and emus, and snout development in reptiles such as alligators.

They found that two proteins involved in facial development, FGF and Wnt, might have a role in beak evolution. When