

RESEARCH HIGHLIGHTS

Selections from the scientific literature

PHOTONICS

Water lens with adjustable focus

Researchers have developed a microscopic lens with a focal length that can be controlled in less than a millisecond.

Controlling the focus of an optical lens is useful for microscopy and photography, but existing reconfigurable lenses are often bulky or slow to adjust. Romain Quidant and his colleagues at the Institute of Photonic Sciences in Barcelona, Spain, created a controllable lens by placing a disc of gold nanorods inside a thin chamber of water and putting it on top of a conventional lens.

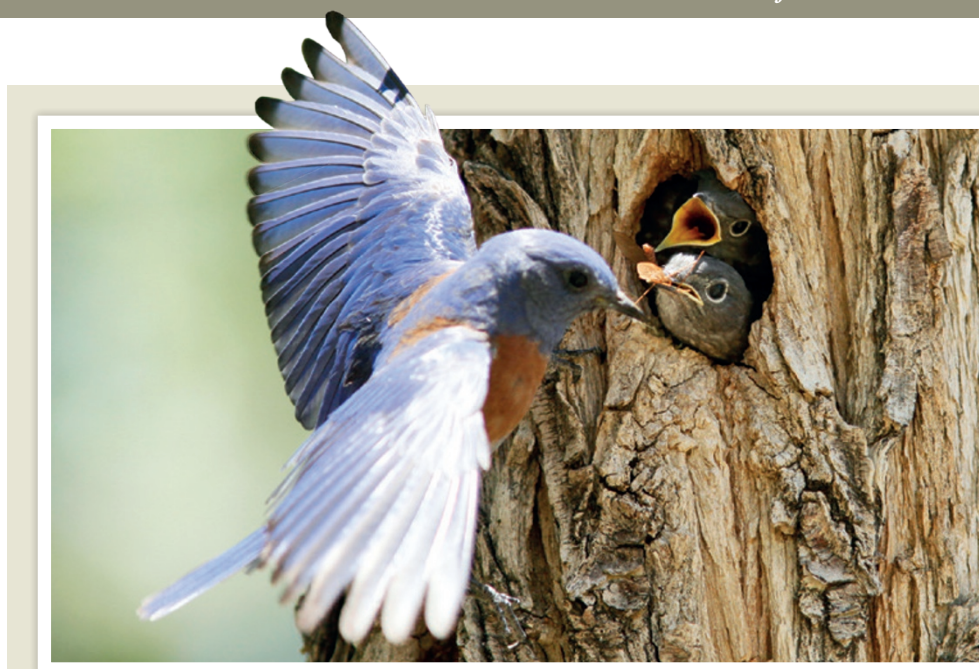
They used a laser to excite the electrons in the nanorods, heating the water and changing its refractive index to create a lens-like effect. The team was able to vary the focal distance of the lens by tens of micrometres with sub-nanometre accuracy, and in only 200 microseconds. *ACS Photonics* <http://doi.org/2cd> (2015)

BIOMATERIALS

DNA-based gel for printing organs

A gel that can be infused with live cells and nutrients makes a promising material for printing three-dimensional tissues such as artificial organs.

Dongsheng Liu at Tsinghua University in Beijing, Wenmiao Shu at Heriot-Watt University in Edinburgh, UK, and their team made two water-based inks from peptides and synthetic DNA strands



ECOLOGY

Competing bluebirds make tougher sons

Female western bluebirds that have to compete for nesting sites produce more early-hatching male chicks than do females with fewer competitors. The chicks are also likely to be more aggressive. This has long-term effects on the range and behaviour of subsequent generations.

Renée Duckworth and her colleagues at the University of Arizona in Tucson discovered that female western bluebirds (*Sialia mexicana*; pictured) that live in areas with many neighbours and few nesting sites laid eggs containing more androgen — a hormone that boosts aggression

in the offspring — than females facing less competitive pressure. Those first eggs also tended to produce more males, which can compete for and colonize new territory. When the researchers increased the number of nesting sites in study areas in western Montana, however, the females produced eggs with less androgen, and fewer male offspring in the early eggs.

This eventually allowed the western bluebird to boost its numbers and displace its competitor, the mountain bluebird (*S. currucoides*).

Science 347, 875–877 (2015)

that form a stable hydrogel when mixed. The team printed layers of the gel to build up millimetre-scale structures (pictured). They also infused their inks with live mouse cells and showed that the cells survived the printing process and remained functional.

Unlike some previous biocompatible scaffolds, the hydrogel is strong enough to keep its shape without swelling or shrinking, but it can also be broken down easily by DNA-digesting enzymes. *Angew. Chem. Int. Edn* <http://doi.org/f24b2n> (2015)

VOLCANOLOGY

Sulfur in magma gets a lift

Sulfur and metals can hitch a ride on bubbles rising in molten magma. This could explain why some volcanoes spew out more sulfur than expected, and how metal ores can form in the crust nearby.

Sulfur-rich magma normally sinks to the bottom of magma chambers. A team led by Jim Mungall at the University of Toronto in Canada used lab studies and

mathematical modelling to show that magma droplets, which contain metals, can form on the surface of vapour bubbles. Droplets that do not reach the surface cool and form rocks that are rich in sulfur, copper and gold.

In another study, Jon Blundy and his team at the University of Bristol, UK, used lab experiments to conclude that sulfur-rich gases interact with salty, copper-rich fluids inside a magma chamber to form thick deposits of copper-based minerals — similar to those that provide three-quarters of

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DONGSHENG LIU AND WENMIAO SHU, ANGEW. CHEM. INT. EDN

the world's copper.
Nature Geosci. <http://dx.doi.org/10.1038/ngeo2373>;
<http://dx.doi.org/10.1038/ngeo2351> (2015)

EPIDEMIOLOGY

Plague came to Europe in waves

The bacterium that causes the plague, which killed millions of Europeans over four centuries from the 1350s, was repeatedly reintroduced from Asia and did not establish itself in European rodents as was thought.

Yersinia pestis bacteria live in wild rodents and can infect humans when climate changes cause rodent populations to collapse, triggering plague-carrying fleas to find alternative hosts. To locate plague reservoirs in Europe, Nils Christian Stenseth at the University of Oslo and his colleagues analysed historical outbreaks along with tree-ring-based records of climate. They found no connection between fluctuations in European climate and plague outbreaks, but did find links between Asian climate changes and outbreaks at European trade harbours.

The authors conclude that the plague took about 15 years to travel overland to Europe. *Proc. Natl Acad. Sci. USA* <http://dx.doi.org/10.1073/pnas.1412887112> (2015)

BIOCHEMISTRY

Sunlight damages DNA in the dark

Sunlight can cause cancer-related DNA damage hours after light exposure, owing to a skin pigment that was largely thought to be protective.

Douglas Brash at Yale University School of Medicine in New Haven, Connecticut, and his team studied how the pigment melanin in mouse skin cells responds to ultraviolet (UV) light. They found that UVA radiation, the main type of UV light that comes from the Sun and from tanning beds,

creates melanin by-products that damage DNA, generating DNA derivatives called cyclobutane pyrimidine dimers (CPDs) for up to three hours after light exposure.

CPDs are associated with the skin cancer melanoma, so blocking their formation could be a way to develop sunscreens that can be used after exposure to sunlight, the team says. *Science* 347, 842–847 (2015)

CANCER

Bacteria protect tumours

Bacteria hiding out in tumours can shield them from attack by the immune system.

The oral bacterium *Fusobacterium nucleatum* has been linked to premature birth, rheumatoid arthritis and colon cancer. Gilad Bachrach and Ofer Mandelboim at the Hebrew University of Jerusalem and their colleagues studied the impact of the bacterium on cancer cells. They found that *F. nucleatum* sticks to tumour cells grown in culture and inhibits immune cells by activating an immune-cell receptor called TIGIT. Many immune-cell types found in human colon cancer and melanoma samples also expressed TIGIT, and were inhibited by *F. nucleatum*.

The results could explain why certain tumours, especially intestinal ones, seem to have high levels of bacteria. *Immunity* 42, 344–355 (2015)

PLANT SCIENCE

Nectar fends off bee parasites

Floral nectar helps to control parasites in bumblebees.

Plants produce molecules called secondary metabolites that are harmful to herbivores but in some cases can also protect animals from parasites. To see whether such metabolites in nectar similarly affect pollinators, Leif Richardson at Dartmouth College in Hanover, New Hampshire, and his team

SOCIAL SELECTION

Popular articles on social media

Scientists cautious about outreach

Scientists think that they should actively participate in public debates about science and technology — but many have misgivings about doing so, according to a survey of nearly 4,000 US researchers. The results of the poll, by the Pew Research Center, inspired a fresh online conversation about the use of social media in public engagement. “Been saying for years scientists need to come down from ‘ivory tower’ and engage public,” tweeted Caleph Wilson, a cancer researcher at the University of Pennsylvania in Philadelphia. Ajinkya Kamat, a physics PhD student at the University of Virginia in Charlottesville, tweeted: “We need more avenues, better incentive structure to get scientists in all career stages involved in science outreach.”

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infected eastern bumblebees (*Bombus impatiens*) with an intestinal parasite and gave the bees one of eight different nectar compounds. Four of the metabolites reduced the load of parasites by 60–80%.

The compound with the strongest effect on parasites, anabasine, did not seem to boost bumblebee survival, but the team says that these chemicals in nectar could benefit the bee colony as a whole by reducing parasite spread.

Proc. R. Soc. B 282, 20142471 (2015)

PALAEOECOLOGY

Coral growth shut down for millennia

Coral reefs in the eastern Pacific Ocean stopped growing for 2,500 years, probably because of a change in climate four millennia ago.

Lauren Toth at the Florida Institute of Technology

in Melbourne and her colleagues extracted a 2.68-metre core from a reef in the Gulf of Panama (pictured), representing 6,750 years of growth. They analysed the chemical composition of 133 skeletons of *Pocillopora* corals in the sample to assess coral health, local temperature, ocean currents and rainfall. They found that roughly 4,100 years ago, cooler temperatures and greater rainfall — similar to today's La Niña weather systems — were associated with the beginning of a 2,500-year pause in coral growth. The health of the corals seems to have declined at the start of this hiatus.

The samples also suggest that temperature is a key factor affecting coral growth. *Nature Clim. Change* <http://dx.doi.org/10.1038/nclimate2541> (2015)

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