

RESEARCH HIGHLIGHTS

Selections from the scientific literature

ZOOLOGY

Bee trade spreads parasites

The international trade in beehives distributes dangerous parasites around the world.

William Hughes at the University of Sussex, UK, and his colleagues investigated 48 commercially produced hives of buff-tailed bumblebees (*Bombus terrestris*). Despite being certified as parasite-free by their producers, more than 75% of the hives carried microbial parasites. Uninfected bees that were fed faeces or pollen collected from the commercial hives subsequently tested positive for parasites and had shorter lifespans.

Worldwide, more than one million bumblebee hives are shipped every year, and the authors suggest that imported hives could infect native pollinators.

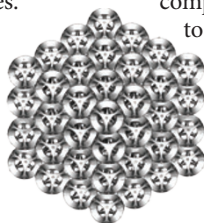
J. Appl. Ecol. <http://dx.doi.org/10.1111/1365-2664.12134> (2013)

MATERIALS SCIENCE

Odd performance under pressure

When squashed down, most materials expand outwards, but one class of 'metamaterials' gets narrower instead.

Katia Bertoldi at Harvard University in Cambridge, Massachusetts, and her colleagues crafted several structures using arrangements of spherical shells with regularly spaced holes. Whereas most structures are engineered to avoid mechanical instabilities, this metamaterial exploits them

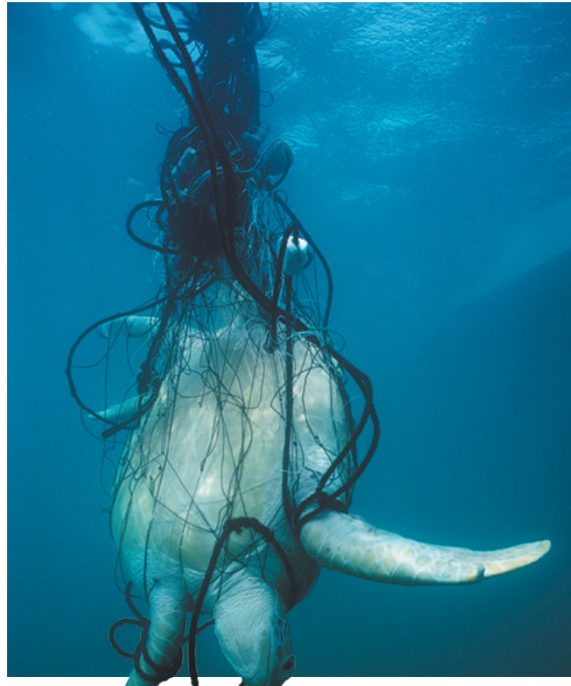


by buckling and folding to become narrower under compression before returning to its original shape after the pressure is removed. X-ray images and numerical simulations showed how the holes in the structures (one example pictured)

distort under increasing strain.

These reversible architectures could be useful in applications such as energy-absorbing materials or acoustic dampeners, the authors suggest.

Adv. Mater. <http://dx.doi.org/10.1002/adma.201301986> (2013)



FISHERIES

Hazard lights for turtles

Nets that are lit by ultraviolet lights deter turtles but catch just as many fish as unlit nets.

Vulnerable sea-turtle species are often caught unintentionally in nets set out by fisheries (pictured). Many commercial fish species cannot see ultraviolet light, but several types of sea turtle can, so a team of researchers led by John Wang at the University of Hawaii in Honolulu tested whether visual cues stopped turtles from being trapped. The group placed ultraviolet lights every 5 metres along net floatlines and compared catches to those from unlit nets. The lights reduced the capture rate of green sea turtles (*Chelonia mydas*) by 40% and, in separate studies in a commercial fishery, did not significantly alter the value or number of marketable fish caught.

Biol. Lett. 9, 20130383 (2013)

REMOTE SENSING

Counting carbon from above

An airborne method for measuring biomass in forests and other ecosystems is as accurate as ground-based studies and can be used to create a national carbon map.

Gregory Asner at the Carnegie Institution for Science in Stanford, California, and his colleagues measured vegetation across 2.4% of Panama using an aeroplane equipped with a laser-based surface-detection system. They calibrated results by comparing data with 228 field plots and scaled up their analysis using satellite observations.

This produced the first high-fidelity map of carbon stocks across an entire country. The map has an uncertainty of 10% in areas measured from the plane, and 20% on average in other areas. The authors suggest that laser-based data can fill in gaps where there are no field data.

Carbon Balance Mgmt. 8, 7 (2013)

IMMUNOLOGY

Antibody tutors travel

A group of specialized white blood cells migrates back and forth through lymph nodes to teach other immune cells how to make a greater variety of antibodies against invading bacteria and viruses.

A team led by Michel Nussenzweig at the Rockefeller University in New York City and Gabriel Victora at the Whitehead Institute for Biomedical Research in Cambridge, Massachusetts, used fluorescence microscopy to monitor the behaviour of specialized T cells in lymph

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JAMES WEAVER

nodes in live mice. These T cells guide other white blood cells, known as B cells, to manufacture antibodies. The team found, unexpectedly, that the specialized T cells continually travelled between the structures in which B cells mature. This constant movement exposes stationary B cells to diverse T cells and might result in B cells producing a wider range of pathogen-specific antibodies, the authors say.

Science <http://dx.doi.org/10.1126/science.1241680> (2013)

PALAEOANTHROPOLOGY

Sex determination for the Stone Age

A DNA-sequencing method reliably reveals the sex of ancient human remains.

A team led by Pontus Skoglund at Uppsala University in Sweden analysed high-throughput-sequencing data from 14 modern humans and from the remains of 16 individuals up to 70,000 years old. By comparing the number of sequences that matched the X or Y chromosome, the team could identify males and females. This approach worked even when the sequence data were deliberately 'contaminated' by adding present-day DNA sequences of the opposite sex.

The technique determined the sex of 14 out of 16 ancient individuals studied, including several Neanderthals and a 5,300-year-old mummy (pictured). Two Neolithic individuals who had been classified as females on the basis of their morphology were identified as males.



The method could be useful for determining the sex of juvenile or highly degraded specimens, the researchers say. **J. Archaeol. Sci.** <http://dx.doi.org/10.1016/j.jas.2013.07.004> (2013)

OPTICAL PHYSICS

Images on a subatomic scale

High-speed videos of nuclear reactions with frames lasting less than one-billionth of one-billionth of a second may eventually be possible, owing to a theoretical scheme for making ultrashort laser pulses.

Longer pulses of light lasting several attoseconds (10^{-18} seconds) are already used to capture high-resolution films of atomic and electronic processes. The pulses are typically generated from X-rays that are emitted when electrons are scattered by infrared lasers and then recombine with parent atoms.

Carlos Hernández-García of the University of Colorado Boulder and his colleagues suggest an even more sensitive technique that involves measuring the interference pattern between X-ray pulses emitted from electrons that have been scattered and recombined multiple times, potentially generating pulses that last only hundreds of zeptoseconds (1 zeptosecond is 10^{-21} seconds). Such a timescale could be used to image subatomic processes. **Phys. Rev. Lett.** 111, 033002 (2013)

BIOLOGICAL MATERIALS

How mussels flex for impact

The thin threads that attach mussels to rocks and fast-moving ships have the perfect ratio of components to absorb the battering forces of the sea.

Civil engineers Markus Buehler and Zhao Qin of the Massachusetts Institute of Technology in Cambridge measured the strength of the mollusc's 'byssal threads',

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GENETICS

Mice screened gene by gene

★ **HIGHLY READ**
on www.cellpress.com in July

A systematic screen of engineered mouse lines found that mutations in previously unstudied genes were just as likely to produce effects as those in genes that had already been explored in other scientific publications.

Karen Steel at the Wellcome Trust Sanger Institute in Cambridge, UK, and her colleagues analysed 489 genes by systematically disabling each one in a separate mouse line. More than 40% of these genes were found to be essential for survival.

Adult mice from 250 of the lines were run through a wide range of tests, revealing traits such as reduced grip strength, fused joints, delayed response to heat, impaired hearing and altered blood chemistry.

Many results were unexpected: for example, disabling a gene that is thought to be involved in hearing led instead to increased body weight. Both the data and mutants are publicly available, and multiple groups are working together to perform similar tests on thousands more genes.

Cell 154, 452–464 (2013)

secreted protein fibres that extend from its shell to a hard surface. Using computer simulations, they found that the 4:1 ratio of soft to stiff material in natural threads minimizes the force experienced where threads join the shell, allowing the attachment to withstand crashing wave forces up to nine times the strength of the threads as measured with a stationary load.

The authors suggest that the insights could help researchers to design earthquake-resistant buildings, which, like mussels, must withstand fluctuating forces.

Nature Commun. 4, 2187 (2013)

PHYSIOLOGY

Temperature fits the bill

In baby birds, ambient temperature can set beak size.

Gary Burness of Trent University in Peterborough, Canada, and his colleagues raised 40 Japanese quail hatchlings (*Coturnix*



japonica; pictured) at high (30°C) or low (15°C) temperatures. After 51 days, the hatchlings raised in warm conditions had longer bills than the chilled chicks. Beak growth in cold-reared chicks caught up after all birds were moved to an intermediate temperature, but the surface temperature of their beaks was, on average, 7.4°C lower than that of birds reared at warmer temperatures, suggesting less blood flow.

Cold conditions soon after hatching may irreversibly inhibit blood flow or blood-vessel development in beaks. **Proc. R. Soc. B.** 280, 20131436 (2013)

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