

# RESEARCH HIGHLIGHTS

Selections from the  
scientific literature

## IMMUNOLOGY

### Cross-reactions boost immunity

A memory of microbes may help the immune system to fight pathogens that it has never encountered before.

Mark Davis and his colleagues at Stanford University in California examined white blood cells called T cells that carry the CD4 antigen — which quickly rouse other cells into launching a robust immune attack — in blood samples of 26 healthy adults. Although all the blood donors tested negative for HIV, the researchers found unexpectedly high levels of the T cells that recognized the virus and were primed to launch an attack. When they analysed umbilical-cord blood from newborns, however, they found that these 'memory' cells were absent, which may explain why young children are so susceptible to infection. The researchers also showed that vaccination against flu activated cells that recognize proteins not just from flu, but other bacterial species.

These findings may help to explain why vaccinations against one disease can offer protection against other infections.

*Immunity* <http://dx.doi.org/10.1016/j.immuni.2012.10.021> (2013)

## NANOTECHNOLOGY

### Lasers tune tiny diamonds

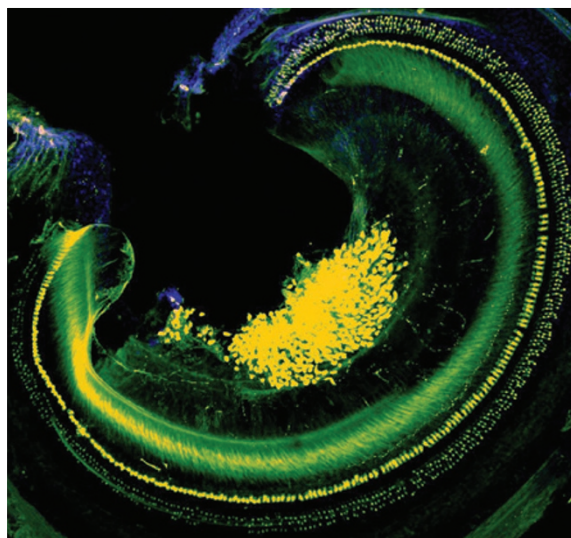
Minuscule diamond crystals show promise for applications that range from biological imaging to quantum computing, but they have been difficult to manipulate individually.

Romain Quidant of the Institute of Photonic Sciences in Barcelona, Spain, and

his colleagues developed a way to use infrared lasers to trap diamond nanocrystals with a single nitrogen atom inside. They could then change the polarization of the laser to twist and turn the nitrogen-atom axis and move individual nanodiamonds in

three dimensions. Because the technique worked for crystals suspended in solution, the researchers believe it could be used in biological systems.

*Nature Nanotechnol.* <http://dx.doi.org/10.1038/nnano.2012.259> (2013)



## MOLECULAR THERAPY

### Deafness diverted

Molecular therapy improves hearing and balance in a mouse model of a hereditary disease that causes deafness and balance disorders.

In humans, Usher syndrome is often caused by a mutation in the gene *USH1C* that results in the production of a truncated form of the protein harmonin — which normally guides development of the inner ear (pictured) — and leads to impaired hearing.

Jennifer Lentz at Louisiana State University in New Orleans, Michelle Hastings at Rosalind Franklin University in North Chicago, Illinois, and their collaborators injected newborn mice with DNA-like molecules that mask the mutation in the cell's protein-expression machinery, causing normal harmonin to be produced. This stopped the loss of inner-ear cells that respond to sound, improved low- and mid-frequency hearing and reduced behaviours associated with balance impairment such as head-tossing and circling. The effects lasted at least six months. The authors suggest that a similar approach may have therapeutic potential in human congenital deafness.

*Nature Med.* <http://dx.doi.org/10.1038/nm.3106> (2013)

## PALAEOANTHROPOLOGY

### New hominin wrist bones

Newly described wrist bones support the argument that *Homo floresiensis* is a distinct species, rather than a deformed *Homo sapiens*.

In 2003, scientists discovered parts of a skeleton (LB1) that is at least 17,000 years old in Liang Bua on the Indonesian island of Flores. The individual was described as a new hominin species, mostly based on analysis of features of its skull and lower body. The wrist bones of LB1 included features seen in many apes but not modern humans. Caley Orr, now at Midwestern University in Downers Grove, Illinois, and his colleagues have analysed wrist bones from other finds at Liang Bua and their conclusions support the original findings. The bones are smaller than those of LB1, but contain features not found in modern humans and Neanderthals.

The finding rebuts claims that the primitive features of LB1 bones were due to pathology, the authors say. *J. Hum. Evol.* 64, 109–129 (2013)

## ZOOLOGY

### Bats as disease reservoirs

Bats may be more likely than rodents to pass on a viral infection to other mammalian species, including humans, suggests a large-scale analysis.

Angela Luis of Colorado State University in Fort Collins and her colleagues searched the literature, counting and characterizing zoonotic viruses — those that can be transmitted to humans from other animals — that had been reported in bats

JENNIFER LENTZ



RAINA PLOWRIGHT

(pictured) or rodents. The authors found that bats, with an average of 1.79 viruses per species, host significantly more zoonotic viruses per species than rodents, with 1.48 viruses per species.

Bat species that live longer or produce more litters per year tended to harbour more zoonotic viruses, and a proclivity for living closely with related species was the biggest determinant of zoonotic-viral richness.

The transfer of viruses could occur more frequently between bat species, which tend to live close together, than rodent ones, and the authors suggest that this could partly explain the higher prevalence of viruses in bats. *Proc. R. Soc. B* 280, 20122753 (2013)

## LONGEVITY

## Fish oils turn on cellular recycling

The polyunsaturated fats found in fish oils may promote longevity by triggering autophagy, a process that helps cells to survive starvation conditions by degrading and recycling excess cell components.

A team led by Gary Ruvkun of Massachusetts General Hospital in Boston found that when they starved the nematode worm *Caenorhabditis elegans*, the creatures boosted their production of omega-6 polyunsaturated fatty acids — which are found in fish oils. Supplementing cells from *C. elegans* and humans with these fatty acids activated autophagy. Worms fed omega-6 fatty acids lived longer than those that did not receive the fats

— an effect erased by disabling the worms' autophagy machinery.

This mechanism could explain the health benefits that are seen in people who eat diets rich in fish oils, the researchers say.

*Genes Dev.* <http://dx.doi.org/10.1101/gad.205294.112> (2013)

## OPTOMECHANICS

## Measuring twist with light

A device that uses light to measure torsion — the amount of twist — of an object at the nanometre scale improves on the sensitivity of previous techniques.

Measuring torsion is key to studies of a wide range of forces, from gravity to electromagnetism. John Davis at the University of Alberta in Edmonton, Canada, and his colleagues have built a torsion detector consisting of a pair of paddles placed next to an optical cavity. Because the paddles' refractive index is higher than that in the cavity, their movement distorts light waves that are trapped within it. By measuring this distortion, the researchers were able to detect subtle torsional shifts in the paddle's positions with roughly 100-times greater sensitivity than other techniques that do not use light.

The researchers suggest that the technique could be useful for studying magnetic materials at the nanoscale. *Appl. Phys. Lett.* 102, 053102 (2013)

## EVOLUTION

## Symbiosis leads to diversity

Species interactions such as competition and predation spur on diversification — as can symbiotic relationships, a study of plant-invading insects has found.

Many species of a family of

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## MICROBIOLOGY

## Antibiotic strikes new target

**HIGHLY READ**  
on [aac.asm.org](http://aac.asm.org)  
in January

An antibiotic that disables protein synthesis seems to inhibit the growth of several strains of drug-resistant bacteria that are known to cause hospital infections.

Dickon Alley at Anacor Pharmaceuticals in Palo Alto, California, and his colleagues synthesized the antibacterial agent, which blocks the production of an enzyme that is essential for microbial protein synthesis and is designed to fight Gram-negative bacteria — which have an outer envelope that hampers the entry of antibiotics. The agent inhibited the growth of resistant bacteria — including the multidrug-resistant *Pseudomonas aeruginosa* — both *in vitro* and in a mouse model of infection. The properties of the antibacterial allow it to avoid the main mechanisms that Gram-negative bacteria use to fend off these drugs.

In a clinical trial, the antibiotic successfully cleared urinary-tract infections in some patients, but failed to do so in others because of bacterial resistance. The researchers say they are working to avoid this problem.

*Antimicrob. Agents Chemother.* <http://dx.doi.org/10.1128/AAC.02058-12> (2013)



JEFFREY JOY

insects known as gall midges (Cecidomyiidae) rely on fungi to help them break down plant tissues; in return, the female gall midges deposit the fungal spores along with their eggs when they move from plant to plant. In a survey of the literature, Jeffrey Joy at Simon Fraser University in Burnaby, British Columbia, Canada, found that gall midges that are associated with fungi tend to use a wider variety of host plants (pictured) compared with those with no association. Moreover, his analysis of gall-midge lineages revealed that symbiotic

insect species are more than 17 times as diverse as non-symbiotic ones.

Forming a relationship with plant-digesting fungi could allow for greater evolutionary diversity in other insect species by providing them with a greater number of potential hosts, Joy suggests.

*Proc. R. Soc. B* <http://dx.doi.org/10.1098/rspb.2012.2820> (2013)

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