RESEARCH HIGHLIGHTS

Selections from the scientific literature

VISION

Dopamine loss hurts diabetic eye

A decrease in the amount of dopamine in the retina could explain why people with diabetes often have visual problems or even go blind.

Reduced levels of this brain-signalling molecule have been seen in diabetes before, so Machelle Pardue at Emory University in Atlanta, Georgia, and her colleagues gave a dopamine precursor called L-DOPA to rat and mouse models of type 1 diabetes. They found that the molecule delayed the onset and slowed down the progression of early visual dysfunction, and improved the responses of the retina's light-sensing cells.

Treating dopamine deficiency could be a way to combat vision loss associated with type 1 diabetes, the authors say.

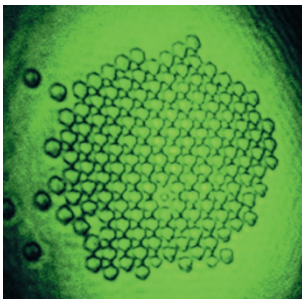
J. Neurosci. 34, **726–736 (2014)**

OPTICS

Laser power makes a mirror

Physicists have created a mirror by using a laser to herd tiny particles into a continuous reflective surface.

Optical forces from laser beams have already been used to manipulate single particles. Now, Tomasz Grzegorczyk at BAE Systems in Burlington, Massachusetts, and his colleagues have used a green laser to organize about 150 polystyrene spheres suspended in water. The three-micrometre-wide beads interacted with each other to form a crystal-like membrane configuration (**pictured**), and a camera was used to capture an image reflected off the membrane surface.



T. M. GRZEGORCZYK (BAE SYSTEMS/MIT)/J. ROHNER/J.-M. FOURNIER (EPFL)

The method gives the membrane self-healing properties, and one day could be used to build ultralight mirrors with a large surface area for space telescopes, the authors suggest.

Phys. Rev. Lett. 112, **023902 (2014)**

JORGE GONZALEZ VARGAS PHOTOGRAPHY/GETTY

OCEANOGRAPHY

Climate change spawns bigger waves

Taller ocean waves could slam coastal regions in the tropics and in parts of the Southern Hemisphere this century, thanks to faster surface winds.

Xiaolan Wang and her colleagues at Environment Canada in Toronto developed statistical models that use sea-level pressure data from multiple global climate model simulations to predict changes in the height of ocean waves. The authors found that the frequency of extremely high waves that now occur roughly once a decade could double or triple by the end of this century in some coastal regions, including Chile (pictured) and Mexico's Baja peninsula. Surface wind speeds are affected by changing air temperature and sea-level pressure.

Rising sea levels could worsen the impacts of bigger waves, such as coastal flooding and erosion, the authors say.

Geophys. Res. Lett. **http://doi.org/q2c (2014)**

MICROBIOLOGY

How antibiotics boost infection

Antibiotics alter the bacterial community in the mouse gut in ways that might make the animal more susceptible to infections from the dangerous, diarrhoea-causing bacterium *Clostridium difficile*.

Vincent Young and his team at the University of Michigan in Ann Arbor analysed the molecules produced by gut microbes and found that antibiotics shifted the levels of carbohydrates and other metabolites.

Compounds that became more abundant with antibiotic treatment such as the sugar alcohols mannitol and sorbitol boosted the growth of *C. difficile* cells in culture. A bile acid that also increased in treated mice triggered spores of the bacterium to germinate. Moreover, the

intestinal contents from mice given antibiotics promoted the growth of *C. difficile*, whereas those from untreated mice did not.

The results could explain why people taking antibiotics have a high risk of *C. difficile* infection.

Nature Commun. 5, **3114 (2014)**

NEUROSCIENCE

Drugs help to dull bad memories

A drug can improve the effectiveness of a behavioural treatment for fearful memories, at least in mice.

Long-term memories of traumatic events, which can result in anxiety disorders, are difficult to treat, in part because they leave epigenetic, or chemical, marks in the genome. Li-Huei Tsai at the Massachusetts Institute of Technology in Cambridge and her colleagues tested an HDAC inhibitor, a drug that clears epigenetic markers, on mice that were conditioned to freeze in fear when they heard a loud sound. Conditioned mice given the drug, and then exposed to the sound in a safe environment, froze much less frequently than mice that did not receive the drug. The inhibitor made it easier to replace the bad memory with a less fearful one by changing the expression of the genes involved in rewiring the brain, the authors say.

Cell 156, **261–276 (2014)**

ENTOMOLOGY

Parasite drives host to nectar

Mosquitoes carrying a malaria-causing parasite develop an increased desire for sugar.

Baldwyn Torto of the International Centre of Insect Physiology and Ecology in Nairobi and his colleagues monitored the attraction of *Anopheles gambiae* mosquitoes (**pictured**) to plant odours and the investigative behaviour of the insects around nectar sources. In laboratory experiments, the authors showed that insects infected with *Plasmodium falciparum* parasites were more attracted to plant odours and demonstrated increased pre-feeding probing activity compared with uninfected individuals.

Plant odours could be used to trap parasite-infected mosquitoes, the authors suggest.

Curr. Biol. **http://doi.org/qww (2014)**

KALLISTA IMAGES/GETTY

CLIMATE CHANGE

Strong storms shift landwards

Cyclone activity has shifted towards the coasts in east Asia in recent decades, resulting in storms of greater intensity making landfall over eastern China, Korea and Japan.

Chang-Hoi Ho of Seoul National University and his colleagues analysed east Asian storm data from 1977 to 2010. The frequency of intense storms that hit northerly areas has increased, but the intensity of cyclones making landfall farther south — from Vietnam to Taiwan — has not measurably changed.

The researchers suggest that changing atmospheric-circulation patterns resulting from a gradual warming of the western Pacific Ocean have shifted the areas where cyclones develop, moving them to the north and west.

Environ. Res. Lett. 9, **014008 (2014)**

IMMUNOLOGY

Microbes control immune cells

Beneficial gut bacteria secrete compounds that rein in a group of immune cells that are involved in inflammatory disorders.

Microbes in the gut help to keep immune responses in check, but how they do this has not been clear. To find out, Richard Blumberg and Dennis Kasper of Harvard Medical School in Boston, Massachusetts, and their team studied a helpful intestinal bacterium, *Bacteroides fragilis*.

Mice colonized with *B. fragilis* had fewer 'natural killer T cells' than did mice without the bacterium. But that effect was reduced in mice harbouring *B. fragilis* that lacked a gene responsible for making fatty compounds called sphingolipids.

Treating these mice with a purified *B. fragilis* sphingolipid restored normal natural killer T-cell inhibition and protected the mice from chemically induced colitis. Animals exposed to the microbe early in life were more protected than those exposed later.

Cell 156, **123–133 (2014)**

CHEMISTRY

Molecules built in a bubble

Chemical synthesis occurs more readily if the reaction takes place inside micrometre-sized compartments.

In theory, it is difficult to merge two molecules into one because of the decrease in entropy as the reaction proceeds. To overcome this hurdle, Andrew Griffiths at Strasbourg University in France and his colleagues studied chemical reactions occurring inside tiny water droplets suspended in oil.

They found that a fluorescent molecule built from two reagents formed more quickly in smaller droplets of water. A mathematical model indicated that molecules landing on a droplet's internal surface are more likely to merge with each other because the surface limits the available space and constrains the reactants' freedom of movement.

The results suggest that compartments, such as aerosol droplets or the pores in hydrothermal vents, could have assisted the organic reactions that are thought to have led to the origin of life.

Phys. Rev. Lett. 112, **028310 (2014)**

COMMUNITY CHOICE

The most viewed papers in science

APPLIED PHYSICS

Device harvests power from the air

HIGHLY READ on scitation.aip.org in December

Researchers have built a metamaterial device that captures microwaves and turns them into electrical power.

Metamaterials are made up of structures that are smaller than a given wavelength of electromagnetic radiation. When arranged in arrays, these structures can tune waves of that radiation in novel ways. Allen Hawkes and his colleagues at Duke University in Durham, North Carolina, used an array of five metamaterial cells, made from split copper circuits, to harvest microwave energy.

The microwaves cause an oscillating current in the material, and the copper circuits convert part of that current into usable power. When high-power microwaves were applied, the array produced enough direct current to charge a mobile phone.

Such a material could one day be built into devices and generate power by picking up energy from a mobile phone or Wi-Fi signals, the authors say.

Appl. Phys. Lett. 103, **163901 (2013)**

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