

NANOTECHNOLOGY

Synthetic vaccines fight infection

Nanoparticle-encased vaccines can fend off lethal pathogens in animals, and could allow for a swift response to disease outbreaks.

Vaccines made from live virus can elicit long-lasting immunity, but most are slow and laborious to make. Daniel Anderson at the Massachusetts Institute of Technology in Cambridge and his colleagues instead made a fully synthetic vaccine by encasing antigen RNA in a modified-polymer nanoparticle that protected the RNA from degradation.

Single injections of such vaccines against the Ebola virus and the influenza virus, as well as the parasite *Toxoplasma gondii*, were sufficient to generate immune responses in mice and to protect the animals against otherwise lethal doses of the pathogens.

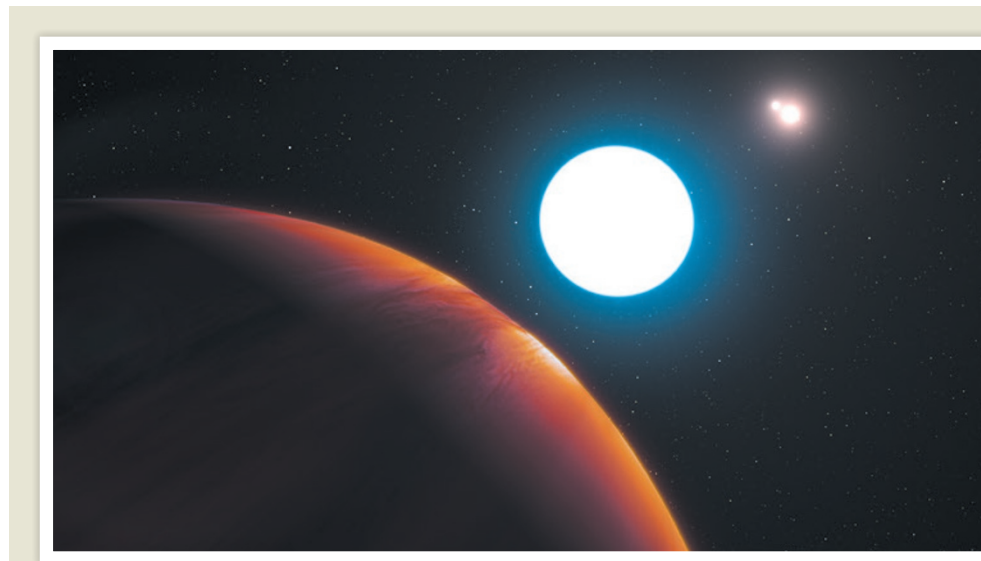
Proc. Natl Acad. Sci. USA
<http://doi.org/bk45> (2016).

EVOLUTION

Double disaster killed dinosaurs

The extinction of the dinosaurs some 66 million years ago was triggered by massive volcanic eruptions in India, and cemented by the arrival of the Chicxulub meteorite in Mexico.

The two events occurred within a few hundred thousand years of one another, making it difficult to tell which drove three-quarters of life on Earth — including the dinosaurs — to extinction. Sierra Petersen at the University of Michigan in Ann Arbor and her co-workers studied a fossil record of mollusc shells from Seymour Island in Antarctica, and used isotope analysis to estimate past temperature



PLANETARY SCIENCE

Triple star hosts stable planet

An extrasolar planet in an exotic triple-star system lives in surprising harmony with the three suns hanging in its sky.

Kevin Wagner of the University of Arizona in Tucson and his colleagues used the European Southern Observatory's Very Large Telescope in Chile to study the star system HD 131399, which lies about 98 parsecs from Earth in the constellation Centaurus.

Few exoplanets have been imaged directly, but the scientists took a series of pictures of a gas-giant planet roughly four times the mass of Jupiter, orbiting the brightest of the three stars. Simulations suggest that it is in a wide, stable orbit, rather than being in the process of being tossed out of the system by gravitational interactions between the stars.

Science <http://doi.org/bk47> (2016)

change. An 8°C spike marking the onset of the Deccan Traps volcanic eruptions is followed by a smaller spike some 150,000 years later, coinciding with the Chicxulub impact.

The scientists conclude that the meteorite delivered the final blow to ecosystems already weakened by the eruptions.

Nature Commun. 7, 12079 (2016)

OCEAN SCIENCE

Ice extent changes with the wind

The rate and pattern of summer sea-ice retreat in the Arctic vary markedly from year to year and are driven by multiple atmospheric trends.

Amanda Lynch of Brown University in Providence, Rhode Island, and her team compared atmospheric circulation and Arctic sea-ice trends from 1979 to 2014. Mild summers with warm winds out of Canada and Alaska were associated with marked sea-ice retreat. During cooler summers, warm southerly winds from Siberia tended to favour sea-ice accumulation in the Beaufort Sea and the Canadian Archipelago. In other years, cold winds from the north continually replenished melting sea ice along the southern fringes of the Arctic Ocean.

Understanding how sea ice responds to atmospheric

patterns might help navigation and exploration in the warming Arctic.

J. Geophys. Res. Atmos.
<http://doi.org/bksf> (2016)

HEALTH

Poor child growth cements poverty

Stunted childhood growth in developing countries results in educational deficits and substantial economic losses.

Using published data on early-childhood growth and the financial benefits of education for 137 developing nations, Günther Fink at the Harvard T. H. Chan School of Public Health in

LUCA ANTONIO MARINO/ETHOCEBUS PROJECT

Boston, Massachusetts, and his colleagues calculated the effects of growth delays on children born in 2010. About one-third of the 122.9 million children experienced stunted growth, resulting in the overall projected loss of half a year of educational attainment per child. Globally, early growth delays were projected to cost a total of US\$176.8 billion in lost income each year.

If growth delays were eliminated worldwide, the authors estimated, India would benefit the most, with a projected economic gain of \$37.9 billion per year. *Am. J. Clin. Nutr.* 104, 104–112 (2016)

ROBOTICS

Robotic stingray follows the light

A miniature robotic stingray powered by rat heart-muscle cells can swim in a physiological salt solution, guided by light.

Kit Parker at Harvard University in Cambridge, Massachusetts, and his collaborators created the 16-millimetre-long mock-up, weighing just 10 grams, by encasing a gold skeleton mimicking a stingray's shape in an elastic polymer (**pictured**). The stingray can be remotely controlled thanks to a light-activated muscle layer, made from genetically engineered rat cells, which responds to light-pulse frequency.

The artificial fish represents a step towards the development



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of adaptive robots with capabilities inspired by nature, the researchers say.

Science 353, 158–162 (2016)

CHEMISTRY

Cosmic rays breed organics in space

Cosmic rays help to form the Universe's complex organic molecules — the building blocks of life on Earth.

The interstellar gas clouds that give birth to stars and planets are rich in organic molecules, but scientists have struggled to explain how these formed. A team led by Ralf Kaiser at the University of Hawaii at Manoa in Honolulu looked into it in the lab, using supercold ices to approximate conditions found in space. They showed that cosmic rays can trigger previously unknown chemical reactions that form sugars and other organic compounds in ice as cold as 10 kelvin. These compounds could sublime into the gas clouds that become stellar nurseries, and eventually lead to the formation of biological molecules.

The discovery should help to explain the origin and evolution of the molecular make-up of the Universe. *Proc. Natl Acad. Sci. USA* <http://doi.org/bk46> (2016)

PRIMATOLOGY

Ancient monkeys used stone tools

Worn rocks may have been used by Brazilian bearded capuchin monkeys hundreds of years ago, marking the earliest evidence for stone-tool use by a species other than humans or chimpanzees.

The oldest stone tools made by ancient human relatives date to 3 million years ago, but the archaeological record for tool use among other primates is scant. Bearded capuchins (*Sapajus libidinosus*; **pictured**) are known to wield rock anvils to rid cashew nuts of their foul-tasting skin. To determine the antiquity of this behaviour,



Michael Haslam at the University of Oxford, UK, and his colleagues excavated a small area in a Brazilian national park populated by capuchins known to use stone anvils.

They found 69 buried stones with surface cut marks similar to those seen on anvil stones. Carbon dating suggested that some of the tools were buried as many as 750 years ago. *Curr. Biol.* 26, R515–R522 (2016)

DEVELOPMENTAL BIOLOGY

Mum's diet affects offspring's genes

Poor nutrition during pregnancy stunts the growth of young mice by modifying their gene expression.

Michelle Holland and Vardhman Rakyen at Queen Mary University of London and their colleagues fed female mice diets containing either 8% or 20% protein throughout pregnancy and until weaning. They analysed patterns of methylation — which can influence gene expression — on the DNA of the rodents' offspring.

Pups from mothers fed the low-protein diet were, on average, 25% smaller at weaning. This effect was further influenced by variation within an animal's many gene copies for ribosomes, the cell's protein-construction machines. The extent of growth restriction depended on the proportion an individual had of a particular gene variant.

Studying the effects of methylation and other chemical marks on ribosomal genes may shed light on some human diseases, the authors say. *Science* <http://doi.org/bk5b> (2016)

METABOLISM

Sweetness–energy mismatch

Regular consumption of the artificial, calorie-free sweetener sucralose causes animals to overeat.

Greg Neely at the University of Sydney in Australia, Herbert Herzog at the Garvan Institute of Medical Research, also in Sydney, and their colleagues fed fruit flies a sucralose-enriched diet for between one and six days. After five days or longer on the sucralose diet, the flies ingested up to 30% more calories than did flies fed a normal diet throughout. The insects also became hyperactive and glucose intolerant.

The group discovered that a neural circuit was activated in the brains of sucralose-fed flies that is normally switched on during fasting, and is known to control hunger and sweet-taste intensity. They found similar responses in mice fed sucralose. *Cell Metab.* <http://dx.doi.org/10.1016/j.cmet.2016.06.010> (2016)

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