

RESEARCH HIGHLIGHTS

Selections from the scientific literature

BIOCHEMISTRY

Machine mimics ribosome

The cell's protein-building complex has inspired the development of a molecular machine that links amino acids together.

David Leigh at the University of Manchester, UK, and his colleagues based their 'nanomachine' on the ribosome, a complex of proteins and RNA that translates the genetic code into proteins. But, compared with the ribosome, their machine is primitive and slow, and can assemble only very short protein chains called peptides. The nanomachine is based on a rotaxane, which is a large molecular ring threaded onto a molecule that acts as an axle. In the experiment, the axle is lined with three amino acids, and a chain of three amino acids hangs from the outer edge of the ring. When the machine is heated, an amino acid from the axle is transferred to the end of the hanging chain. The ring can then move along the axle, repeating the reaction.

Running about 10^{18} molecular machines at once produces tens of milligrams of peptide.

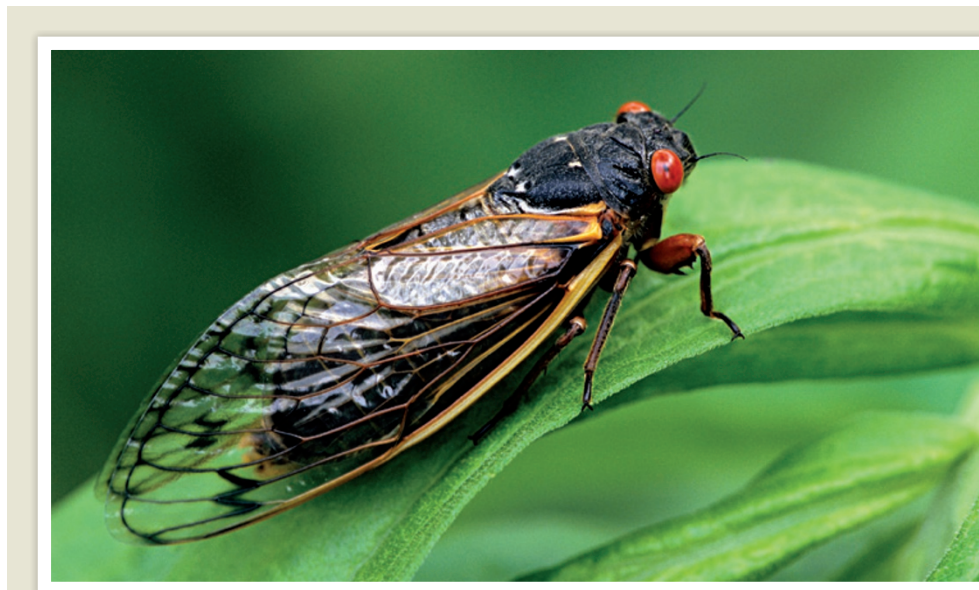
Science 339, 189–193 (2013)

For a longer story on this research, see go.nature.com/p3rtai

HUMAN EVOLUTION

Migration from India to Australia

A genetic analysis indicates that humans migrated from India to Australia around 4,000 years ago. This contradicts the prevailing view that, after its initial colonization, Australia had little contact with the rest of the world before the late



ED RESCHKE/PETER ARNOLD/GETTY

ECOLOGY

Cicadas emerge when predators decline

Periodical cicadas, which spend most of their lives underground and occasionally emerge en masse, may time their appearances with periodic dips in predator numbers.

Why several species of the insect (*Magicicada* spp; pictured) surge to the surface of North American forests after 13 or 17 years underground has been a mystery. Walt Koenig at Cornell University in Ithaca, New York, and Andrew Liebhold of the US Department of Agriculture Forest Service in Morgantown, West Virginia, analysed data on the population

sizes of 15 bird species between 1966 and 2010 to estimate the predation pressure on the insects. They conclude that the cicadas somehow set their predators' populations into cycles that reduce bird numbers during their next foray above ground.

This could be explained by the insects' long-lasting effect on forest ecology influencing factors such as nutrient levels and tree growth for several years after their emergence, the authors suggest.

Am. Nat. 181, 145–149 (2013)

eighteenth century.

Irina Pugach at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, and her colleagues analysed genome-wide genetic variation from 344 people, including Australian Aboriginals and individuals from Africa, India and island Southeast Asia. The authors found evidence of a migration out of Africa into Australia at least 36,000 years ago, and one from India about 4,230 years ago.

The Australian archaeological record

shows rapid changes in tool technology around 4,000 years ago, leading the authors to suggest that the migrants could have brought in the new technology.

Proc. Natl Acad. Sci. USA <http://dx.doi.org/10.1073/pnas.1211927110> (2013)

NEUROSCIENCE

Hearing restored with new hair cells

An experimental drug can restore hearing in deaf mice by regenerating sound-sensitive

cells in the inner ear.

Excessive noise permanently damages hair cells that conduct sound to the brain and are found in an inner-ear structure called the cochlea. A team led by Albert Edge at Harvard Medical School in Boston, Massachusetts, has identified a molecule that can convert other cochlear cells into hair cells. The compound, named LY411575, blocks a biochemical pathway called Notch, which normally prevents supporting cells in the cochlea from developing

into hair cells. When applied to the ears of mice deafened by loud sounds, the molecule triggered the generation of new hair cells. By three months after this treatment, the rodents' hearing had been partly restored.

LY411575 would probably need to be delivered locally to the ear in humans to avoid side effects, the authors say. *Neuron* 77, 58–69 (2013)

ANIMAL BEHAVIOUR

Mothers call for parenting help

Male laboratory mice do not spontaneously care for their offspring, but they can exhibit some paternal behaviour in response to signals from their mates.

Haruhiro Higashida at Kanazawa University in Japan and his colleagues found that when female mice were separated from their young, they could encourage their male partners to adopt parental behaviour — such as carrying wandering pups back to the nest (pictured) — using high-pitched vocalizations and pheromones.

About 60% of the males tested retrieved pups after hearing a recording of 38-kilohertz distress calls of females removed from their pups. The team found similar results when males were placed in cages that had previously held females separated from their young. Paternal behaviour disappeared when the researchers simultaneously blocked hearing and olfaction in the males.

Nature Commun. 4, 1346 (2013)



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MATERIALS

Spinning strong, conductive carbon

Fibres spun from carbon nanotubes can be as electrically conductive as metal wires, yet as strong as conventional carbon fibres.

Individual carbon nanotubes are strong, stiff and exceptionally conductive — but spinning them into larger filaments adds defects, impurities and misalignments that compromise the fibres' physical properties. Matteo Pasquali at Rice University in Houston, Texas, and his colleagues have improved the spinning process by adapting techniques used to make industrial fibres such as Kevlar. The authors extruded filaments from nanotubes dissolved in an acid and wound them into fibres of dense, well-aligned tubes that are stronger than copper and almost as conductive.

The fibres could be manufactured on a large scale and have a variety of applications in electronics, the authors say.

Science 339, 182–186 (2013)

CELL FATE

Impede a protein to reprogram

Blockade of just one protein is sufficient to change skin cells into neurons.

Several research groups have already converted one cell type to another by adding, for example, specific genes. Now researchers led by Xiang-Dong Fu at the University of California, San Diego, have found another approach. They used small RNA molecules to repress an RNA-binding protein called PTB. Decreased levels of this protein led to the activation of genes that can convert skin cells to neurons. PTB influences the stability of RNA molecules and coordinates molecules called microRNAs that regulate gene expression.

The approach is a

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CLIMATE SCIENCE

Warming matches predictions

HIGHLY READ
on iopscience.iop.org in December

Temperature data collected since 1990 are in good agreement with model-based estimates of global warming made by the Intergovernmental Panel on Climate Change (IPCC).

Stefan Rahmstorf of the Potsdam Institute for Climate Impact Research in Germany and his colleagues removed short-term temperature fluctuations or 'noise', which result from events such as volcanic eruptions, from a 1980–2011 time-series of annual global temperatures. The adjusted warming trend of 0.16 °C per decade closely matches the projections made by the IPCC in its reports in 2001 and 2007.

The global sea level, however, has since 1993 been rising 60% faster than anticipated. Future sea-level rise could exceed even the highest value — some 60 centimetres by the end of the century — projected by the IPCC in its 2007 report, the team cautions.

Environ. Res. Lett. 7, 044035 (2012)



convenient way to reprogram other cell types to neurons, and provides a glimpse of the complex mechanisms involved in the control of gene expression.

Cell <http://dx.doi.org/10.1016/j.cell.2012.11.045> (2013)

ANIMAL BEHAVIOUR

Wasp parasites keep hosts clean

By peering into the bodies of American cockroaches, researchers have found that a parasitic larva disinfects its host with antibacterial secretions.

Larvae of the emerald cockroach wasp (*Ampulex compressa*; pictured) feed on the innards of the American cockroach (*Periplaneta americana*), but also have to contend with bacteria that live in their host's tissues. Gudrun Herzner at the University

of Regensburg in Germany and her colleagues installed transparent panels into the sides of parasitized roaches and observed that the wasp larvae secrete large amounts of a clear liquid from their mouthparts onto their hosts' tissues.

Analysis of the liquid revealed the presence of the chemicals mellein and micromolide. These substances slow the growth of certain microorganisms, including the bacterium *Serratia marcescens*, which can kill insect larvae and was also isolated from the cockroaches.

Proc. Natl Acad. Sci. USA <http://dx.doi.org/10.1073/pnas.1213384110> (2013)
For a longer story on this research, see go.nature.com/vxttfo

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