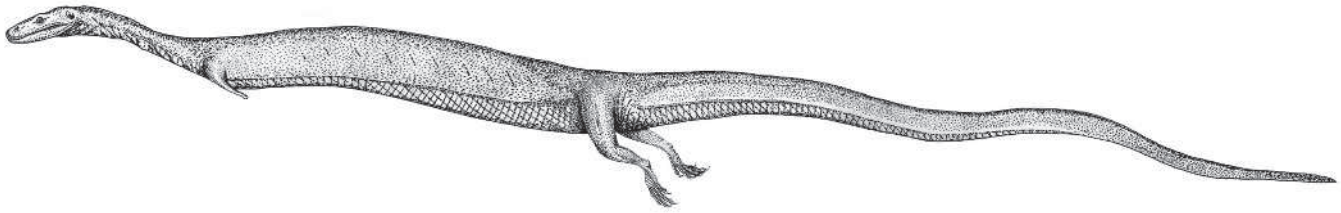
RESEARCH HIGHLIGHTS



A. PALCI

Hissing link?

J. Vertebr. Paleontol. **27,** 1–7 (2007)

The complex history of how snakes lost their limbs to evolution may become clearer, thanks to a fossil found in Slovenia.

Snakes evolved from four-limbed lizards, but the details of how this happened are unclear. Alessandro Palci of the University of Modena, Italy, and Michael Caldwell of the University of Alberta in Edmonton, Canada, describe the first fossil of a lizard that shows limb reduction. Dubbed *Adriosaurus microbrachis* (pictured), the marine lizard lived about 95 million years ago. The fossil has greatly reduced forelimbs, a diminished supporting skeletal girdle and an elongated neck, as seen today in snakes including pythons and boas.

But researchers cannot conclude that snakes evolved directly from such lizards without other fossils to fill the evolutionary gaps.

CHEMICAL BIOLOGY

Turn up the genes

Angew. Chem. Int. Edn doi:10.1002/anie.200604485 (2007)

It's relatively easy for biologists to switch off genes to study their functions, but harder to turn genes' expression up. Researchers in the United States have synthesized a molecule that can penetrate living cells and do this.

The molecule consists of a peptoid — similar to a peptide — bound to a protein that activates gene expression, and a compound called ImPy7 that binds DNA. It increased by more than threefold the expression of 45 genes with multiple binding sites for ImPy7.

Thomas Kodadek and his colleagues at the University of Texas Southwestern Medical Center in Dallas put the molecule together after screening 50,000 peptoids to identify those that could both bind the gene-activating protein and cross the cell membrane.

CELL BIOLOGY

Old before their time

Proc. Natl Acad. Sci. USA **104,** 4949–4954; 4955–4960 (2007)

The mutant protein responsible for Hutchinson–Gilford progeria syndrome, which causes premature ageing, may hold up the cell cycle, two groups have shown.

Teams led by Francis Collins of the National Human Genome Research Institute in Bethesda, Maryland, and by Robert Goldman of Northwestern University in Chicago, Illinois, studied cells that were making the mutant form of lamin A, which normally acts as scaffolding for the cell nucleus. They found abnormalities in various processes, such as chromosome segregation, assembly of the nuclear membrane and cell division. Similar defects occur in a fraction of normal human cells, backing the idea that this anomalous protein contributes to the normal ageing process.

NANOTECHNOLOGY

Jitter balls

Nano Lett. doi:10.1021/nl070210a (2007)

Movies of molecules jittering about on a metal surface may inform how future electronic devices are built, says a team led by Ellen Williams of the University of Maryland.

Researchers hoping to build devices in which single molecules serve as wires need first to understand how a device's performance may be affected by changes in the position of the wires or of their contact points. Thermal energy causes fluctuations on these scales.

Using a scanning tunnelling microscope, Williams and her colleagues imaged the motion of carbon C_{60} molecules lined up around the edge of plateaus of silver atoms (C_{60} molecules appear as bright lines in the image below). The researchers characterized the fluctuations, measuring how frequently the C_{60} molecules and silver atoms moved apart.

AM. CHEM. SOC.

PHYSIOLOGY

Tiny heartbreaker

Science doi:10.1126/science.1139089 (2007)

A small RNA molecule regulates some forms of stress-induced heart damage, a new study has shown.

Eric Olson and his colleagues at the University of Texas Southwestern Medical Center in Dallas created mice that lacked a microRNA molecule called miR-208. The mutant mice seemed normal at birth, but when subjected to conditions that stress the heart, sustained less stress-induced cardiac damage (such as excessive heart growth) than normal mice.

miR-208 is highly conserved among mammals, suggesting that its function may also be conserved. Blocking the action of miR-208 may provide a future means of preventing heart damage.

CLIMATE SCIENCE

Sea change

Geophys. Res. Lett. doi:10.1029/2006GL028605 (2007)

Rising concentrations of carbon dioxide in the atmosphere will increase the acidity of the world's oceans by roughly the same amount, regardless of how much global temperatures go up, say Long Cao of the University of Illinois in Urbana and his colleagues.

The oceans' ability to absorb CO_2 is thought to help offset climate change. But, through making the oceans more acidic, it may also change the ocean chemistry to a point that affects marine life. For example, corals and other calcifying marine species may be unable to form shells and skeletons.

The researchers used an Earth system model to estimate changes in ocean pH for climates that show different temperature responses to CO_2. Whether this climate 'sensitivity' was small or large, surface ocean pH dropped by around 0.5 units relative to a pre-industrial value of 8.17 by 2500. This occurred under a scenario in which CO_2 levels were stabilized at 1,000 parts per million.

NEUROBIOLOGY

Three-seeing mice

Science **315,** 1723–1725 (2007)

Mice endowed with a human eye pigment gain the ability to see extra colours, report Gerald Jacobs from the University of California in Santa Barbara and his colleagues. The pigment allows mice to see longer-wavelength light than their two natural photopigments can detect.

The fact that the mouse's brain is plastic enough to process information from the foreign photopigment suggests that a simple mutation creating an additional light-detecting protein could have given rise to tri-colour vision in some primates. They are unique among mammals in having more than two photopigments.

The team had previously shown that human pigments expressed in mouse retinas create electrical signals in response to light, but have only now completed the behavioural trials that prove the extra pigment enhances a mouse's ability to distinguish colours.

ASTROPHYSICS

A star is spawned

Astrophys. J. **657,** 884–896 (2007)

Might light from a massive star trigger the birth of smaller stars in its neighbourhood? Hsu-Tai Lee and Wen-Ping Chen of the National Central University, Taiwan, say yes.

The team analysed loose groupings of stars known as OB associations. In such systems, the smaller B-type stars are arranged in order of decreasing age between a massive O-type star and nearby clumps of molecular gas.

This odd geometry can be explained if photons from the O star progressively eat their way through the gas cloud, ionizing and compressing it. The denser patches of gas fall in on themselves gravitationally, forming new stars and exposing the next stretch of cloud.

GENETICS

When two fuse with one

Hum. Genet. **121,** 179–185 (2007)

Researchers have discovered a pair of twins who are identical through their mother's side, but share only half the genes inherited from their father.

The twins result from the combination of two sperm cells with a single egg — a previously unknown way for twins to come about, says the team that made the finding. The twins are also chimaeras, meaning that their cells are not genetically uniform. Each sperm has contributed genes to each child.

There are two routes by which this might have happened. Either the egg cell divided, without separating, and each cell was then fertilized with a single sperm. The genetically mixed embryo then later split. Or, two sperm

D. PHILLIPS/SPL

cells fused with a single egg, creating a cell with three sets of chromosomes which later split into two embryos having a normal complement of chromosomes.

Vivienne Souter of the Banner Good Samaritan Medical Center in Phoenix, Arizona, and her colleagues investigated the twins' genetic make-up because one was born with ambiguous genitalia.

PALAEONTOLOGY

Dinosaurs' digs

Proc. R. Soc. B doi:10.1098/rspb.2006.0443 (2007)

The jumbled remains of an adult dinosaur found together with two juveniles in an underground den provide what experts say is the first evidence that dinosaurs burrowed. It also supports the idea that dinosaur parents cared for their young.

David Varricchio of Montana State University in Bozeman and his colleagues found the fossils in what looks to be a custom-built hole in southern Montana. The 2-metre-long burrow seems to have been filled with mud during a flood, burying its occupants.

The team has named the beast *Oryctodromeus cubicularis*. The skeletons show that, when fully grown, the animal was about 2.1 metres long with a broad snout and powerful shoulders well adapted for digging.

JOURNAL CLUB

Philippe Grangier
Institut d'Optique, Palaiseau, France

A physicist hopes that cool techniques could show up quantum effects in 'big' systems.

When I was a postdoc in Bell Labs during the 1980s, many of the ideas stimulating our work in quantum optics came from researchers developing sensors for gravitational waves.

Gravitational waves propagate as distortions in space, and a passing wave is expected to have a subtle influence on the oscillation of a heavy bar, or to change by a fraction the separation of two mirrors.

To minimize the uncertainty in measurements of such effects, researchers developed new concepts for manipulating the quantum fluctuations that affect parameters such as an oscillator's position.

Concepts they invented, such as 'quantum non-demolition measurements' and 'squeezed states', have since been demonstrated (sometimes with my help), but with light beams rather than massive objects.

Detecting quantum effects in 'big' systems has remained an elusive goal, despite experiments moving to smaller masses and higher oscillation frequencies to make the quantum noise larger. The stumbling block has been heat — thermal excitations overwhelm the well-hidden quantum noise.

Here, recent work suggests a way forward. Three papers published last autumn (S. Gigan *et al. Nature* **444,** 67–70; O. Arcizet *et al. Nature* **444,** 71–74; D. Kleckner & D. Bouwmeester *Nature* **444,** 75–78; 2006) each show that the techniques used to measure a micromirror's motion can cool the mirror at the same time, pushing its temperature close to absolute zero.

Such cold micromirrors could well become the first 'heavy-weight' quantum-mechanical objects — and the techniques developed in quantum optics may eventually feed back into the gravitational-wave detectors that got us started.