RESEARCH HIGHLIGHTS

Hear, hear

Cell 127, 277–289 (2006)

Researchers have uncovered a novel mechanism underlying inherited deafness.

Christine Petit of the Pasteur Institute in Paris, France, and her colleagues studied the mouse equivalent of a protein known to be defective in some people who are profoundly deaf. They found that the protein, otoferlin, is sited at a key location within the inner hair cells (pictured) of the cochlea.

These cells transform sound into signals that trigger auditory nerves to fire. Sacs of neurotransmitters are anchored to the inner side of membranes of these hair cells. They fuse with the membrane to release their contents, activating neighbouring nerve endings. Otoferlin is essential for fusion.

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PLANETARY SCIENCE

Frosted Earths

Astrophys. J. 650, L139–L142 (2006)

Recent observations have shown that some small stars called M dwarfs host icy planets that are roughly ten times more massive than the Earth. How are these 'super-Earths' made?

Planet formation around dwarf stars is different to that around Sun-like stars. This is because the dwarfs fade and shrink during the process, pulling in the 'snow line', which separates regions of icy-planet formation from those of rocky-planet formation.

Grant Kennedy of the Australian National University in Weston Creek and his team have concocted a theoretical model of this process, showing that it favours the rapid appearance of middleweight icy planets. As the contracting snow line moves like a cold front over small rocky protoplanets, they become thickly ice-coated before coagulating through collisions to make super-Earths.

DRUG DISCOVERY

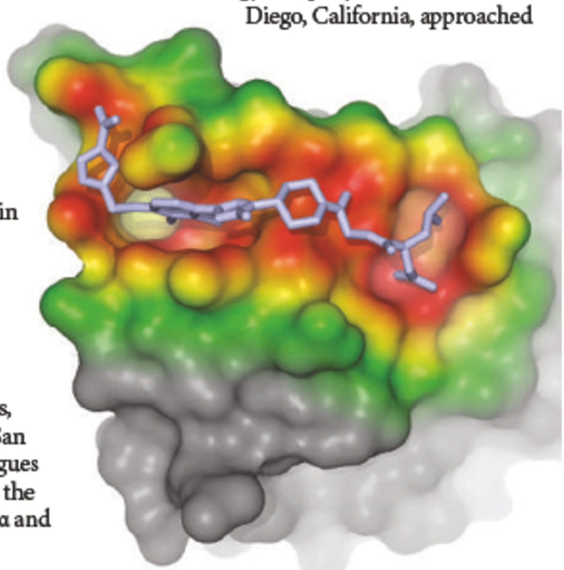
Target practice

Proc. Natl Acad. Sci. USA 103, 15422–15427 (2006)

An analysis of how one small molecule interrupts a protein–protein interaction may help researchers to design new drugs.

Protein–protein interactions are promising drug targets, but researchers have struggled to find footholds for small molecules in flat protein–protein interfaces. Jim Wells, then at Sunesis Pharmaceuticals in San Francisco, California, and his colleagues studied a small molecule that blocks the interaction of two proteins — IL-2Rα and IL-2, involved in conveying immune signals.

This small molecule binds within a crevice of IL-2 (pictured below). They found that it targets many of the same contact points as does IL-2Rα, despite having a different structure. This is possible because IL-2 is very flexible. The finding shows that small molecules do not need to structurally mimic the proteins they displace.



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STEM CELLS

Grown naturally

Nature Biotechnol. doi:10.1038/nbt1259 (2006)

Researchers have edged a step closer to making cells that might cure diabetes.

Diabetes occurs when 'beta' cells in the human pancreas fail to make enough of the hormone insulin. Making functional beta cells from human embryonic stem cells might cure this deficit, but it has proved difficult.

A team led by Emmanuel Baetge at the biotechnology company Novocell in San Diego, California, approached the problem by trying to coax human embryonic stem cells through the stages of normal fetal pancreatic development. The stem cells did develop into cells that produce high levels of insulin, but not in response to the body's normal chemical triggers.

CELL BIOLOGY

A chaperone for arsenic

Proc. Natl Acad. Sci. USA 103, 15617–15622 (2006)

Arsenic is flushed through biological systems with the help of a protein that clings to the toxic metal and guides it to a cellular-scale pump, a new study finds.

Researchers are driven to understand arsenic toxicity because the metal contaminates water supplies in areas such as Bangladesh and West Bengal. In this study, Barry Rosen of Wayne State University in Detroit, Michigan, Adrian Walmsley of Durham University, UK, and their team identify a protein, ArsD, in bacterial cells that picks up arsenite ions from the cell's cytoplasm. ArsD then liaises with an enzyme to activate the cell's efflux pump. The protein is therefore acting as a metallochaperone — the first to be described for arsenic.

GEOLOGY

Deep impact

Earth Planet. Sci. Lett. doi:10.1016/j.epsl.2006.09.009 (2006)

A painstaking survey of rocks from around the globe has provided new information about the nature of a meteorite impact 65 million years ago, which may have triggered the mass extinction that wiped out the dinosaurs.

The impact would have been most devastating if the meteorite hit at a shallow angle, digging through the Earth's top layers. This could show up as asymmetries in the distribution of ejecta around the crater site in Chicxulub, Mexico.

Joanna Morgan of Imperial College London, UK, and her colleagues examined nearly 5,500 shocked quartz grains from sites as far afield as Italy and New Zealand. At most, the researchers report, there is evidence that ejecta lying to the southeast of the crater experienced greater shock, which, along with thick ejecta deposits in Belize, would be consistent with an impact angle of 45° or more.

CLIMATE RESEARCH

Winds of change

J. Clim. 19, 5388-5404 (2006)

Winds that blow over the mountains of the Antarctic Peninsula are the main driving force behind the exceptional warming in this region, report Gareth Marshall of the British Antarctic Survey in Cambridge, UK, and his colleagues. That warming has contributed to the collapse of ice shelves surrounding the peninsula.

Marshall's team used data from climate stations to reconstruct wind patterns over the past 50 years. They found that the strength of the westerly circumpolar wind had increased over this period, which is an expected effect of global warming and ozone depletion in the Southern Hemisphere. The stronger winds more frequently made it over the 2,000-metre-high mountains that divide the peninsula. Air warms as it descends, creating 'föhn' winds that raise local temperatures.

STEM CELLS

Caution urged for therapy

Nature Med. doi:10.1038/nm1495 (2006)

Brain cells that produce the neurotransmitter dopamine have been created from human embryonic stem cells and used to treat rats with a model of Parkinson's disease. But a potentially cancerous side effect might put the brakes on developing such therapies for humans.

It's currently difficult to turn stem cells into the right kind of neuron in large enough numbers for useful therapies. Steve Goldman of Cornell University Medical College in New York and his colleagues encouraged stem cells to grow into dopamine-producing neurons by placing them in cultures similar to the environment of the developing brain. Transplanting the neurons into the rats restored much of the animals' lost movement. But an expanding core of undifferentiated stem cells within the mass of transplanted dopamine cells could cause tumours, the researchers warn.

ANIMAL BEHAVIOUR

Extreme diving

J. Exp. Biol. 209, 4238-4253 (2006)

Scientists monitoring two species of beaked whale (*Mesoplodon densirostris*, pictured below, and *Ziphius cavirostris*) have recorded ocean dives that are among the deepest and longest reported for air-breathing species.

The dive data came from devices attached by suction cups to 10 whales, which were recorded making 44 dives near Italy and the Canary Islands. Some individuals spent nearly an hour at depths of up to 1,888 metres. The whales also engaged in a series of shallower dives after each deep prey-foraging trip.

M. USHODA/IMAGEQUESTMARINE.COM

Lead author Peter Tyack of the Woods Hole Oceanographic Institution, Massachusetts, speculates that beaked whales' ability to dive so deep has implications for understanding how the mammals may be affected by sound from devices such as military sonar.

OPTICS

Keep it together

Nature Phys. doi:10.1038/nphys438 (2006)

The ability to slow down pulses of light could be useful in telecommunications. But slowed pulses have a bad habit of spreading out, degrading the information that they carry. Joe Mok and his co-workers at the University of Sydney, Australia, present a cure.

The researchers modified the properties of an optical fibre in a repeating pattern along its length. They showed that sub-nanosecond pulses of light travelled through this 'fibre Bragg grating' at 16% of the typical speed of light. What's more, each pulse behaved as a soliton, a type of wave that shows no dispersion. This happens because the pattern reflects the weak edges of a spreading pulse back towards its brighter centre.

JOURNAL CLUB

Shigeru Kuratani
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An evolutionary biologist hopes to tell head from trunk.

Anatomy involves dissecting the body not only into its physical components, but into categories and concepts as well. This is indeed the only means by which we can bring an approximation of logical order to our understanding of biological phenomena, or to describe and explain them to others.

Unfortunately, the results of anatomical parsing tend to be semantic. Just as a single word can convey different meanings depending on its grammatical context, so can anatomical names apply to different parts of an embryo during development.

The boundary between 'head' and 'trunk', for instance, has resisted clarification — I use at least five different definitions according to the embryological events on which I happen to be focusing.

An article published last year appeared to only add to the menu of choices by proposing that an intermediate 'neck' separates the head and trunk (T. Matsuoka *et al.* *Nature* 436, 347–355; 2005).

The authors looked at a cell population known as the neural crest. This runs the length of the embryo and forms a range of structures. They defined the neck as the region where crest cells that differentiate as they do in the head overlap with a second structure that is characteristic of the trunk. That structure consists of segments of tissue known as somites.

Naming this grey area a 'neck' in fact neatly sidesteps the need for a clear demarcation between head and trunk. It allows the anatomical terms to be flexible at their boundaries.

But, sadly, it hasn't helped me. In my lab we study lampreys, a kind of ancient fish, and its embryos don't seem to have a neck. I suppose biological concepts also have their evolutionary origins, and the lamprey must pre-date the 'neck'.