RESEARCH HIGHLIGHTS

STEM CELLS

Becoming a blood vessel

Nature Meth. doi:10.1038/nmeth1041 (2007)

Stem-cell therapies have enormous potential to replace defective blood vessels, such as those destroyed by heart attacks and degenerative eye disease.

Now, Robert Lanza of the company Advanced Cell Technology in Worcester, Massachusetts, and his colleagues have made progress towards coaxing stem cells into becoming the right kind of cells for the job. The group reports a two-step method for making large amounts of regenerative cells, called haemangioblasts, from human embryonic stem-cell cultures. The team shows that when injected into rodents, these haemangioblasts give rise to cells that improve symptoms of heart attack, eye disease and stroke. The method is more efficient than those previously reported, and its well-defined protocol should be reproducible by other labs.

ECOLOGY

Urban chicks

Ecology **88,** 882–890 (2007)

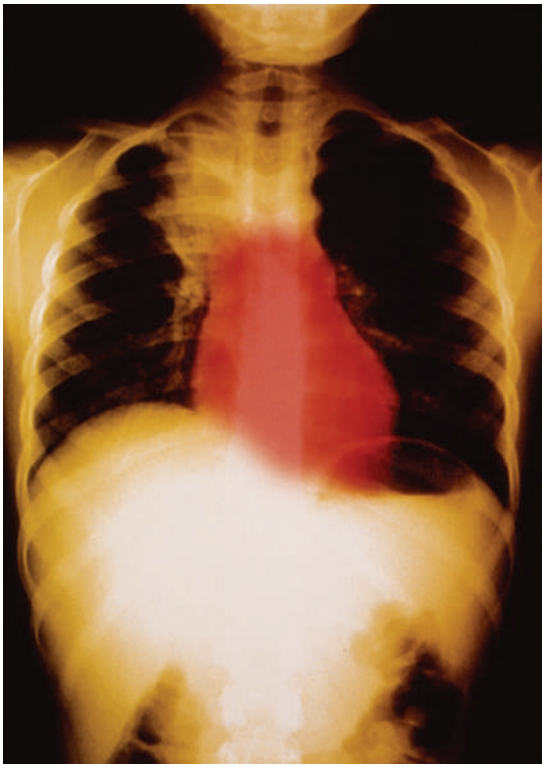
City birds migrate less frequently than country birds, and their breeding patterns have changed.

Jesko Partecke and Eberhard Gwinner (deceased) of the Max Planck Institute for Ornithology in Andechs, Germany, have found a link between these two life-history traits. They kept hand-raised European blackbirds (*Turdus merula,* pictured below), a partially migratory species, from both urban and forest populations under identical conditions for two years.

Compared with their country cousins, they found that urban males, but not females, showed less of two principle features of a migratory disposition: night activity and fat deposition. The researchers suggest that there may be an evolutionary benefit for the urban males to winter at home, so that they can access prime breeding habitats and start mating before migratory birds return.

M. DANEGGER/NHPA

Heart-disease hunt



S. CAMAZINE & S. TRAINOR/SPL

Science doi:10.1126/science.1142447 and doi:10.1126/science.1142842 (2007)

Disease-gene hunting, anyone? It's open season. Following a slew of reports linking common single-letter DNA variations to diseases ranging from diabetes to Crohn's, researchers are closing in on the world's biggest killer.

Two independent groups have identified single-nucleotide polymorphisms, or SNPs, that confer a significantly increased risk of heart disease in white people. All reside in the same tight neighbourhood on chromosome 9. They aren't found in a gene, but in a non-coding region that abuts two tumour-suppressor genes and that scientists speculate may regulate gene expression or function.

Ruth McPherson at the University of Ottawa Heart Institute in Canada and her colleagues used SNP-seeking gene chips to identify one cluster of SNPs. In studies of the DNA of 23,000 Caucasians, those subjects who carried this high-risk cluster on both of their chromosome 9s were 30–40% more likely to have heart disease than those without it. The X-ray pictured shows the chest and heart of a healthy person.

Kari Stefansson of deCode Genetics in Reykjavik, Iceland, and colleagues found an even stronger association in some 17,000 Caucasians. Those who carried two copies of the SNP that this team identified in the same region of chromosome 9 had a 64% higher risk of heart attack than those subjects who did not carry the variation — and more than twice the risk of having a heart attack young.

NANOMEDICINE

This won't hurt a bit

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0700567104 (2007)

The world's thinnest hypodermic needles have been made from carbon nanotubes just 10–20 nanometres wide. Carolyn Bertozzi, Alex Zettl and their co-workers at the University of California, Berkeley, have used these nanoneedles to inject material into live human cells, leaving no visible damage to the cell membranes.

The team attached tether molecules to the nanotube walls that contain short molecular chains tipped with biotin, an organic molecule that binds tightly to the protein streptavidin. These served as hooks for streptavidin-coated fluorescent nanoparticles, which coated the nanotube surface. When the needle, attached to the tip of an atomic force microscope, is pushed through the cell membrane, the tether is chemically snipped and the nanoparticle cargo released.

BIOCHEMISTRY

A bacterial nose

J. Am. Chem. Soc. doi:10.1021/ja0692480 (2007)

A bacterial cell capable of following a particular chemical trail could track down pollutants or help to combat disease — especially if equipped with machinery for degrading the source of the 'smell'.

Shana Topp and Justin Gallivan at Emory University in Atlanta, Georgia, have designed such a general-purpose search function for *Escherichia coli*. Because re-engineering the receptor proteins involved in *E. coli*'s natural chemical-based movement (chemotaxis) is difficult, the researchers pursued another strategy — they designed a way to immobilize any bacteria that go off target.

The team made RNA switches sensitive to a particular signal or 'smell' — here a chemical very similar to caffeine. If there is none of this chemical about, the switch will prevent production of a protein needed for 'swimming'. But the presence of the signal flips the switch and activates the production of the protein, enabling the cells to, in effect, swim up a gradient of increasing signal concentration — although many immobilized *E. coli* that went in the wrong direction will litter the route to the source.

GEOLOGY

Seasonal shaking

Geophys. Res. Lett. **34,** L08304 (2007)

There are more earthquakes in the Himalaya in the winter than in the summer, according to a new study of Nepalese seismic records from 1995 to 2000.

The fact that there are 37% more earthquakes in winter in Nepal, say Laurent Bollinger of the French Atomic Energy Commission and colleagues, can be attributed, indirectly, to the weather. The researchers theorize that summer monsoons weigh down northern India with rainfall and fill underground aquifers. This changes the stress patterns in the surrounding rock and in the fault systems that stretch up into the Himalaya, suppressing summer seismicity.

ECOLOGY

Stream of tears

Glob. Clim. Change Biol. **13,** 942–957 (2007)

Although many studies show the grim ecological effects of climate change, some ecosystems are somewhat neglected, including streams. Isabelle Durance and Steve Ormerod of Cardiff University, UK, have shown, through a 25-year project on Welsh stream macroinvertebrates such as

CARDIFF UNIV.

mayflies and stoneflies, just how big the effects might be. After the team factored out other cyclical climate phenomena, they concluded that winter temperatures in the streams rose by 1.4–1.7 °C during the study period, with clear ecological consequences.

Their results suggest that in the most species-rich streams the abundance of invertebrates in the spring-time could decline by one-fifth for every degree of temperature gain. An increase of 3 °C could see up to ten species extinct locally — as much as 25% of the typical richness, the scientists say.

MOLECULAR BIOLOGY

All about growing yeast

J. Biol. **6,** 4 (2007)

Researchers have catalogued the changes in gene expression, protein abundance and metabolite composition that accompany cell growth in the yeast *Saccharomyces cerevisiae*.

Previous attempts to characterize cell growth did not separate the effects of growth from responses to nutrient depletion as the growing cells exhausted nutrients from the medium. Now, Stephen Oliver of the University of Manchester, UK, and his colleagues have grown yeast cultures under four different nutrient limitations and at three different growth rates. They then measured changes in the abundance of thousands of cellular compounds, looking for trends dependent on growth rate and independent of nutrient deficiency.

Their results provide a catalogue of parameters that could be used in mathematical models and to make genetic engineering of metabolic pathways easier.

CHEMISTRY

Snap, crackle and glow

J. Am. Chem. Soc. doi:10.1021/ja0716498 (2007)

Bubbles created by ultrasound can collapse violently and agitate crystals of certain chemicals to the point of bursting. These crystals then give off light. And the gases released in the process can react with each other, say researchers at the University of Illinois in Urbana-Champaign.

Kenneth Suslick and Nathan Eddingsaas closely watched this mechanoluminescence in a slurry of the organic molecule resorcinol in the solvent dodecane. The emitted energy responsible for the luminescence was 1,000 times as intense as that produced if the same crystals had been cracked by mere milling or grinding. Suslick attributes this to the increased speed of molecular collisions under ultrasound conditions, and the subsequent increase in emitted energy from both inert and radioactive gases caught in the discharge. It is those gases, specifically oxygen and small hydrocarbons, that went on to react.

JOURNAL CLUB

Eric Wolff
British Antarctic Survey, Cambridge, UK

An ice-core scientist wonders what makes the Earth run hot and cold.

In the past 800,000 years, Earth has seen long, cold phases punctuated every 100,000 years by short, warm interglacials. If I claim to understand climate, then I should know why these cycles occur and why we are in a warm phase today.

The most obvious external controls on our climate are small changes in Earth's orbit. These affect the variation of incoming sunlight (insolation) with season and latitude. 'Milankovitch theory' says that this in turn controls the occurrence of glaciations.

There is one obvious problem: although 100,000 years is the period of eccentricity of Earth's orbit, insolation shows much stronger effects at shorter periods, such as 41,000 and 23,000 years.

A recent paper (E. Tziperman *et al*. *Paleoceanography* **21,** PA4206 doi:10.1029/2005PA001241; 2006) suggests a way around this. It uses a model in which climate varies with an average period controlled by internal features — such as the time needed for ice-sheet growth — on a 100,000-year timescale.

However, the exact timing of climate changes is paced by orbital cycles at shorter periods. The result is that a wide range of plausible internal controls on climate can give similar predictions of how climate has evolved with time, all of them with a 'Milankovitch imprint'.

This frees us from the apparent misconception that we need an external forcing with a period of 100,000 years, but it does not identify the internal mechanisms responsible.

I used to think this was a problem for others to solve, but as part of the team that extended the ice-core record back 800,000 years, I have the tantalizing hope that the clues we need might be locked in our cold room.