RESEARCH HIGHLIGHTS

Holding up the ice

Science doi:10.1126/science.1138393 and doi:10.1126/science.1138396 (2007)

Antarctic ice may be protected from rising sea levels by rocky wedges of debris that act as 'sandbags', a survey of one of the continent's major ice flows suggests.

A team led by Sridhar Anandakrishnan of Pennsylvania State University surveyed the final stretches of the 500-kilometre-long Whillans Ice Stream, including the 'grounding line' where the glacier passes from land to sea. Underneath the grounding line, debris deposited by the glacier has formed a wedge up to 31 metres thick. Models described in a second paper predict that the wedge will stabilize the ice stream — preventing sea water from seeping under the glacier and accelerating melting until sea levels have risen by several metres.

S. ANANDAKRISHNAN

BIOCHEMISTRY

A first for vitamins

Nature Chem. Biol. doi:10.1038/nchembio867 (2007)

The discovery of a vitamin attached to adenosine triphosphate (ATP), the molecule that fuels biochemical reactions, has taken researchers by surprise.

Lucien Bettendorff at the University of Liège in Belgium and his colleagues report that vitamin B1, or thiamine, occurs naturally in complex with ATP — the first vitamin known to do so. The researchers found that the bacterium *Escherichia coli* produces the complex when starved of glucose. The team also identified the complex in yeast, plant and mammalian cells, suggesting that it has an as yet unknown basic function in cell metabolism, perhaps in signalling.

NEUROBIOLOGY

Neurons get connected

Neuron **53,** 639–647 (2007)

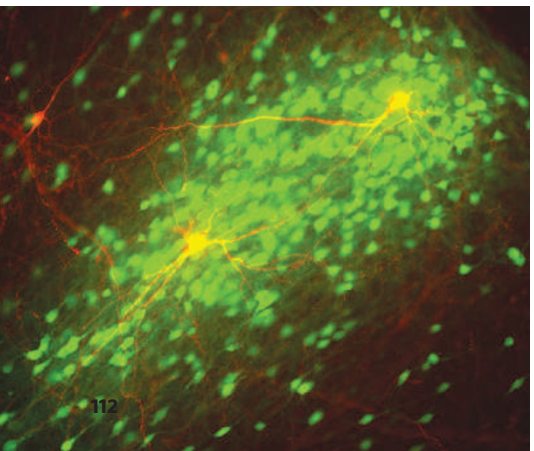
Researchers have devised a way of identifying all the brain cells that connect to one particular brain cell. The technique should help neuroscientists to understand how networks of neurons are wired together.

Current 'tracers' can spread through chains of neural connections, but are not specific enough to show just one step of a network. Now Ian Wickersham at the Salk Institute for Biological Studies in La Jolla, California, and his colleagues have modified the rabies virus, a potent tracer, so that it can do just that.

They disabled genes that help the virus to jump between neurons, then delivered the modified virus to a neuron that can make the protein the virus needs to spread. This meant the virus could proceed to immediately connected neurons, but no further.

The researchers demonstrated the method in culture (green dots in the picture below are neurons that connect to the neurons shown in yellow); they say that it should also work *in vivo*.

ELSEVIER



GENETICS

Cycle of all life

Proc. Natl Acad. Sci. USA **104,** 2939–2944 (2007)

Geneticists have mapped the genes that underpin the cell cycle in one species of Archaea, in a bid to discover whether cell growth and division involve similar genes across all branches of the tree of life.

Magnus Lundgren and Rolf Bernander of Uppsala University, Sweden, studied the heat-loving microbe *Sulfolobus acidocaldarius*. By sampling the abundance of RNA from various genes at different points in the cell cycle, they built up a catalogue of more than 160 genes that are activated at specific points.

Comparing the genes that control the cell cyles in Archaea, bacteria and eukaryotes — which diverged from each other early on — could provide information about how the cycle evolved, and identify key processes within it.

AGEING

New ideas on ageing theory

Nature Genet. doi:10.1038/ng1988 (2007)

A controversial theory of ageing is rebutted by a study that finds no link between the accumulation of mutations in energy-producing organelles called mitochrondria and symptoms of old age.

Researchers have previously speculated, on the back of work that documented the accumulation of mitochondrial mutations in mice over time, that mitochondrial failure contributes to ageing. Lawrence Loeb of the University of Washington, Seattle, and his colleagues have now measured the rate of single-base-pair mitochondrial mutations in mice to be tenfold lower than reported in earlier studies. Loeb's team also found that a mouse mutant that accumulates mutations at 500 times the rate of a normal mouse does not show signs of rapid ageing.

DRUG DISCOVERY

Tumour target

Proc. Natl Acad. Sci. USA **104,** 3478–3483 (2007)

Researchers have developed an animal model to test cancer drugs that target a tumour's blood supply.

These drugs prevent blood-vessel growth in tumours by inhibiting a protein known as VEGF-A. Several drugs have been approved to treat specific forms of lung and colorectal cancer by this method. But although the

drugs blocked tumour blood-vessel growth in humans, they failed to do so in rodents, complicating the testing process.

Now Napoleone Ferrara and his colleagues at Genentech in South San Francisco, California, have engineered mice to produce a human form of VEGF-A. They have also tested new candidate drugs and were able to weed out some that bound tightly to their VEGF target *in vitro*, but did not reduce tumour growth in engineered mice.

BIOCHEMISTRY

Lighting rods

J. Am. Chem. Soc. doi:10.1021/ja063887t (2007)

A structure that mimics the exquisite light-harvesting machinery of nature has been made from a virus's self-assembling shell.

Some photosynthetic bacteria capture and concentrate light's energy in barrel-shaped protein structures, which have light-absorbing molecules known as chromophores stacked around their rim. Matthew Francis and his co-workers at the University of California, Berkeley, copied this design by attaching chromophores to proteins from the coat of the tobacco mosaic virus, which self-assembles into stacks of disks or rods.

Some of the chromophores absorb light; others act as 'acceptors', which gather and re-emit energy from many of the 'donors'. Energy concentrated in this way might drive photocatalysis or improve photovoltaic cells.

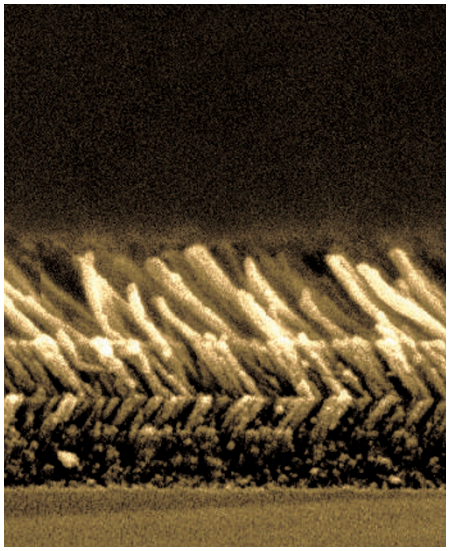
CANCER BIOLOGY

Disruptive influence

Science doi:10.1126/science.1137999 (2007)

In some cancers, the regulation of gene expression by short pieces of RNA known as microRNAs is disrupted. But it has been difficult to pin down the mechanisms involved. David Bartel of the Whitehead Institute for Biomedical Research in Cambridge, Massachusetts, and his colleagues present a clear example: it involves one microRNA acting on one target.

The researchers examined a protein called High Mobility Group A2 (Hmga2). Truncated forms of this protein are known to trigger cancer. Bartel's team found that the messenger RNA encoding the truncated protein is missing a region that would usually bind a microRNA known as *let-7*. The team showed that this interaction represses accumulation of the protein, and that disrupting it spurs cell growth in culture and causes tumours in mice.



E. F. SCHUBERT & J. K. KIM/RENSSELAER POLYTECHNIC INST.

OPTICS

No reflection

Nature Photon. **1,** 176–179 (2007)

A near-perfect anti-reflective coating that can make even shiny materials appear dull and dark is described in the current issue of *Nature Photonics*. The coating, which reflects less than 0.5% of the visible light falling on it, could have applications in devices such as solar cells.

Light gets reflected when it passes between materials in which it travels at different speeds — measured by the material's 'refractive index'. To minimize these reflections, Fred Schubert of Rensselaer Polytechnic Institute in Troy, New York state, and his colleagues designed a coating that has five layers (pictured left), with refractive indices that increase in steps. The two uppermost layers, arrays of silica nanorods, have refractive indices close to that of air. The lower layers, made from titanium dioxide, have indices that tend towards that of the material beneath.

PHYSICS

The test of time

Phys. Rev. Lett. doi:10.1103/PhysRevLett.98.093001 (2007)

Researchers have, for the first time, captured radium atoms in a magneto-optical trap, laying the groundwork for a fundamental test of time's properties.

Jeffrey Guest and a team at Argonne National Laboratory in Illinois trapped radium-225 and radium-226 atoms by cooling them with a combination of lasers and magnetic coils. The team was aided by the ubiquitous thermal radiation from their room-temperature apparatus, which helped to confine the atoms.

Radium atoms may eventually be used to test 'time-reversal symmetry', which says that there should be no way to determine the direction of time from observations of the atoms' properties. If this symmetry were violated, it might help to explain the imbalance of matter and antimatter in the Universe.

JOURNAL CLUB

Jeffery W. Kelly
The Scripps Research Institute, La Jolla, California, USA

A biochemist considers whether protein misfolding plays a part in type II diabetes.

Much of my research is on cellular protein folding, and in particular on how protein misfolding or protein aggregation causes disease. My group has developed therapies for a spectrum of misfolding diseases, most of which are associated with neurodegeneration, such as Alzheimer's.

But we are beginning to appreciate that therapies that affect protein folding could have a role in treating a much wider spectrum of diseases than is currently realized.

A compelling article from Gokhan Hotamisligil and his colleagues at Harvard University (U. Özcan *et al. Science* **313,** 1137–1140; 2006) presents one example. They found that mice that are both obese and diabetic benefit from treatment with drugs that enhance protein folding.

Their experiment was motivated by observations that linked obesity and diabetic insulin resistance to stress in the endoplasmic reticulum (ER), a compartment in cells where a third of all proteins are folded.

The researchers gave their fat, diabetic mice chemicals that enhance protein folding in the ER. The effect was notable: the mice's blood-sugar levels fell, they showed increased glucose tolerance and reduced lipid accumulation in the liver.

This suggests to me that protein misfolding may be at the heart of type II diabetes, the age-related disease for which these mice are a model.

Folding of the insulin receptor is inefficient. So it seems reasonable to speculate that cells could become insulin-resistant because of compromised insulin-receptor folding in the ER.

We may find, as we develop more selective small molecules to enhance ER folding, that we discover other disorders that can be treated in this way.