RESEARCH HIGHLIGHTS

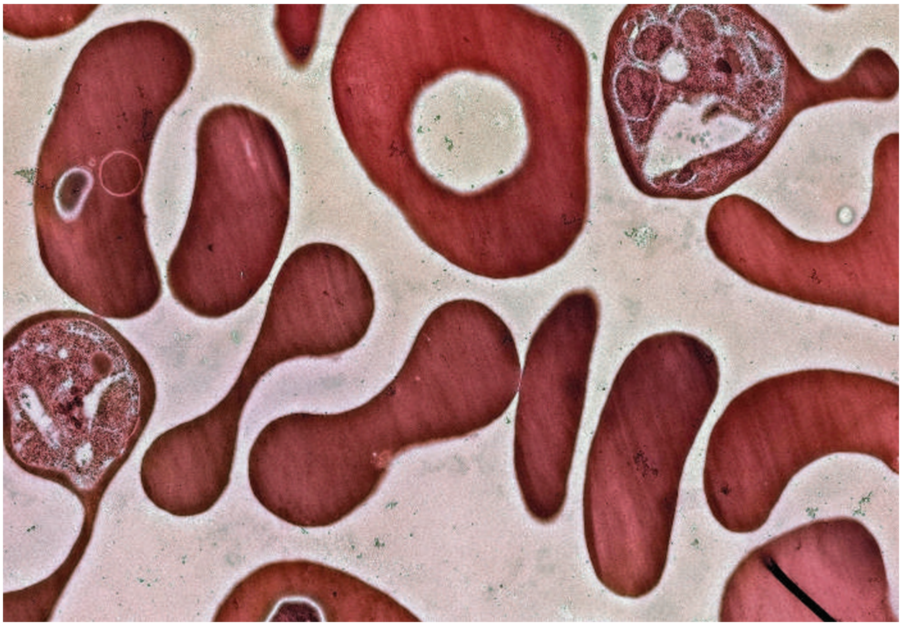
Mouse model for malaria

PLoS Pathog. **3,** e72 (2007)

A global collaboration has come up with the first non-primate animal model for human malaria — and on the way explained how a key antibody protects infected people.

Richard Pleass of the University of Nottingham, UK, and his colleagues engineered an antibody that matches those found in Gambian adults who are immune to malaria. The antibody binds a *Plasmodium falciparum* protein known as $MSP1_{19}$, an important vaccine target. The picture shows infected red blood cells.

To test the antibody in mice, the researchers engineered the mouse malarial parasite *Plasmodium berghei* to express $MSP1_{19}$. They also made transgenic mice carrying a gene that encodes the human immune-cell receptor FcγR1, suspected to play a role in the antibodies' protective effect. The antibodies protected only the transgenic mice from infection, confirming the importance of FcγR1.



G. GAUGLER/SPL

CLIMATE SCIENCE

Uncertain forecast

Science doi:10.1126/science.1140746 (2007)

Global warming could boost rainfall by more than double the amount predicted by current climate models, a new study suggests.

Frank Wentz and his colleagues at Remote Sensing Systems in Santa Rosa, California, analysed weather-satellite data from 1987 to 2006. Climate models project that worldwide rainfall will increase by between 1 and 3% per degree of warming, but the satellite data suggest rainfall will go up in line with the atmosphere's water vapour content — at a rate of around 7% per degree. The models forecast less rain because they predict that weakening surface winds will reduce water evaporation. But the data show that surface winds actually increased with warming.

It is, for now, unclear whether the discrepancy is due to flaws in the models or problems with the data. It is also unclear where the extra rain, if it arrives, might fall — whether it will make wet places wetter, or bring relief to drought-stricken regions.

NANOTECHNOLOGY

Spot the ball

J. Am. Chem. Soc. **129,** 6666–6667 (2007)

The highly symmetrical atomic structure of the football-shaped C_{60} molecule has been seen for the first time using electron microscopy.

Kazu Suenaga and his co-workers at the National Institute of Advanced Industrial Science and Technology in Tsukuba, Japan, imaged individual C_{60} molecules tethered to the surface of carbon nanotubes. Comparisons between these images (example pictured below left) and image simulations (right) based on the molecules' 20-sided cage structure (middle) allow the observed two-dimensional shapes to be assigned to various projections of the carbon shells. These are made from pentagonal and hexagonal rings.

The researchers also see several distorted, non-spherical shells that they assign to C_{58} molecules, formed when C_2 units are kicked out of the shells by the electron beam.

ACS

COSMOLOGY

When the Universe began

Astrophys. J. **170** (Suppl.), 263–287; 288–334; 335–376 and 377–408 (2007)

Four papers describing data from one of cosmology's greatest experiments have been published, a year after the results were made public.

The Wilkinson Microwave Anisotropy Probe was launched in 2001 to study the radiation left over from the inferno of the Universe's birth. By mapping temperature fluctuations in this cosmic microwave background and measuring the polarization of the radiation, the probe has provided evidence that the Universe is made up mostly of dark matter and dark energy. It has also shed light on aspects of the Universe's history, such as when the first stars were born. The four papers report observations collected over three years.

NEUROSCIENCE

Cellular angst

Nature Neurosci. doi:10.1038/nn1919 (2007)

Anxious people tend to expect the worst in uncertain situations — a trait that researchers have now linked in mice to particular cells within the brain's hippocampus.

Cornelius Gross of the European Molecular Biology Laboratory in Monterotondo, Italy, and his team studied mice genetically engineered for increased anxiety. These mice froze in fear for the same length of time when exposed to a cue — such as a flash of light — that was always followed by an electric shock as they did when exposed to a different cue that was only sometimes associated with a shock. Normal mice responded less strongly to the ambiguous than to the certain cue.

The researchers showed that inhibiting the granule cells in the anxious mice's hippocampal dentate gyrus restored normal behaviour.

GEOLOGY
Ancient lava fossils dated

Geology **35,** 487–490 (2007)

Radiometric dating has confirmed that microscopic tubular structures in ancient lavas date back billions of years. These structures are thought to show that life thrived in volcanic rocks deep within the early Earth.

Neil Banerjee of the University of Western Ontario in London, Canada, and his colleagues found the microfossils in pillow lavas in the Pilbara Craton of western Australia. The tubes contain traces of organic carbon, and appear identical to those left in basaltic rocks by modern microbes.

The tubular structures at this site also contained the mineral titanite, which allowed them to be dated by measuring trace amounts of lead and uranium. This revealed the structures to be 3 billion years old.

CANCER BIOLOGY
The price of silence

Cell **129,** 879–890 (2007)

Researchers have identified a possible genetic culprit behind one of the most common forms of adult leukaemia.

Albert de la Chapelle and Christoph Plass of Ohio State University in Columbus and their colleagues found that reduced activity of a gene called death-associated protein kinase 1 (*DAPK1*) is linked to both inherited and spontaneous forms of chronic lymphocytic leukaemia. *DAPK1* regulates programmed cell death in blood cells called lymphoid cells, and loss of that function could aid the leukaemia.

In most cases of the disease, the gene had been silenced by the addition of methyl groups to the DNA region controlling *DAPK1* expression. But the team also discovered, in affected members of a family with a history of the leukaemia, a mutation that reduces *DAPK1* expression.

BIOCHEMISTRY
Single handedly

J. Am. Chem. Soc. doi:10.1021/ja0708870 (2007)

Why are all amino acids in living organisms left-handed? Donna Blackmond and her co-workers at Imperial College London, UK, suggest a new way in which crystallization could have played a part.

The reactions expected to have produced amino acids on the early Earth generally create both left- and right-handed forms of the molecules. For some amino acids, such as serine, a tiny excess of one form can lead to that form's preferential removal by precipitation of crystals, leaving the solution enriched in the other.

Blackmond and her colleagues have now shown that this enrichment can be engineered for amino acids that don't display it by themselves. Small molecules such as dicarboxylic acids added to the mixture become incorporated into the crystals and promote the extraction of one form of the amino acid.

MATERIALS SCIENCE
Reflect on this

Nature Mater. doi:10.1038/nmat1930 (2007)

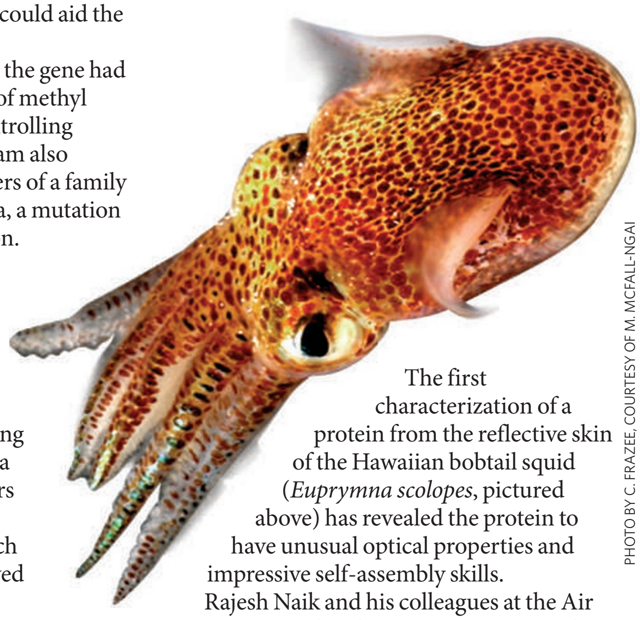


PHOTO BY C. FRAZEE, COURTESY OF M. MCFALL-NGAI

The first characterization of a protein from the reflective skin of the Hawaiian bobtail squid (*Euprymna scolopes*, pictured above) has revealed the protein to have unusual optical properties and impressive self-assembly skills.

Rajesh Naik and his colleagues at the Air Force Research Laboratory in Dayton, Ohio, engineered bacteria to produce the squid protein reflectin. They found that it has the highest refractive index — a measure of how slowly light travels through a material — reported for any naturally occurring protein.

When deposited from a particular type of solvent, the reflectin proteins self-organized into a film of regularly spaced stripes, the separation of which could be tuned. This functioned as a diffraction grating, which splits light into its different wavelength components.

JOURNAL CLUB

Gautam R. Desiraju
University of Hyderabad, India

A chemist applauds an algorithm able to predict crystal structures from chemical composition alone.

I work in crystal engineering, a field that involves designing and constructing crystals with desired physical, chemical or pharmaceutical properties from small organic molecules. It is an experimental science based on pattern recognition and retrosynthetic strategies, in which the structure is considered as the sum of smaller, simpler parts.

Improvements to computational crystal-structure prediction could make design protocols more reliable. But this is such a difficult problem that only a handful of groups in the field work on it. In this context, I found a recent paper presenting a seemingly reliable method to be thought-provoking (A. R. Oganov and C. W. Glass *J. Chem. Phys.* **124,** 244704; 2006).

Typically, crystal-structure prediction involves computer generation of putative crystal structures using a force field, which represents the interactions between atoms in neighbouring molecules. The correct structure is presumed to be that which minimizes the crystal's energy.

The procedure is problematic because the force fields may not be well tailored to the molecules being studied, and because the experimental structure may not be the lowest-energy arrangement. It is also impossible to explore all conceivable structures, which are mind-boggling in number.

Oganov and Glass use an evolutionary algorithm to localize the search to the most promising structures. Their approach is attractive in that it requires no system-specific knowledge — the input is just the molecule's chemical composition, not even its structure — and their ability to predict the unusual tetragonal structure of urea is impressive.

Is this the long-awaited break-through in crystal engineering? Perhaps not, but surely it's an important step forward.

Discuss this paper at **http/blogs.nature.com/nature/journalclub**