RESEARCH HIGHLIGHTS

In hot water

Geophys. Res. Lett. **35,** L03613 (2008)

The warmest regions of open ocean on Earth may be protecting reefs from exposure to temperature spikes that cause corals to 'bleach' — that is, eject the colourful algae that live in their tissues and provide them with sustenance.

Joan Kleypas at the National Center for Atmospheric Research in Boulder, Colorado, and her colleagues analysed sea-surface-temperature records between 1950 and 2006 and a quarter-century of data on coral bleaching. They found that coral bleaching was less common in a region of the Pacific Ocean known as the western Pacific warm pool, where temperatures were high — around 30 °C — but had remained relatively constant.

Negative feedback mechanisms in areas of naturally warm open ocean may hold back warming beyond a threshold temperature, the authors suggest.

N. WU/FLPA

MATERIALS SCIENCE

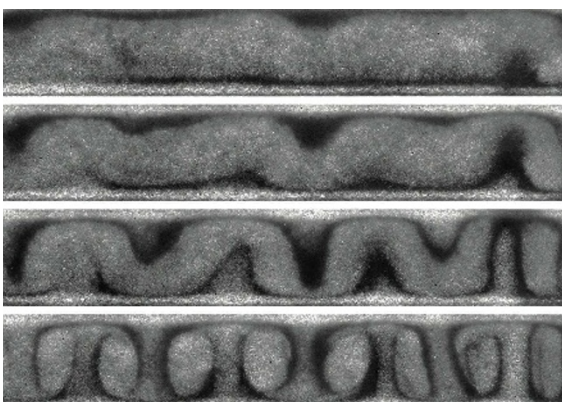
Stirred, not shaken

Phys. Rev. Lett. **100,** 078002 (2008)

Frank Rietz and Ralf Stannarius of the Otto-von-Guericke University in Magdeburg, Germany, have added a new pattern to the menagerie of arrangements into which grains can spontaneously separate.

Shaken or sliding grains are a rich source of patterns, many of which are seen in nature — such as segregation by size or shape in wind-blown sand — and in industrial powder processing.

The researchers produced their pattern by confining tiny glass beads between two closely spaced long, narrow, horizontal plates that rotate around the long horizontal axis. When the space between the plates is almost full, most grains can only slide in compact clusters, and the 'slab' of grains develops a series of regularly spaced cells that circulate between the top and bottom of the container (pictured, over time, below; from the top, after 2,000, 4,000, 6,000 and 12,000 rotations). This circulation is analogous to that of convection cells that form in fluids with temperature gradients, yet seems to demand a new mechanism.



F. RIETZ

EVOLUTIONARY BIOLOGY

Modelling malaria

Proc. R. Soc. B doi:10.1098/rspb.2007.1545 (2008)

After infecting people, malaria parasites form many more merozoites — which cause red blood cells to burst — than gametocytes, sexual forms that do not harm the host but can transmit the infection to mosquitoes. This contributes greatly to the severity of the disease, and perplexes evolutionary biologists.

Nicole Mideo and Troy Day from Queen's University in Kingston, Canada, have adapted a model of malarial infection, and their calculations suggest that there are two possible explanations for the high number of merozoites. Either the host's immune response varies according to the number of gametocytes, or parasites from one strain need to fend off others. It follows from the latter that interventions that reduce the incidence of multiple infections — and thus reduce the risk of inter-strain competition — could favour gametocytes and improve the clinical course of the disease.

PLANETARY SCIENCE

Coming up dry

Geology **36,** 211–214 (2008)

High-resolution topographic models of Mars's surface cast doubt on the idea that recently formed gullies are evidence for transient flows of liquid water.

Jon Pelletier at the University of Arizona in Tucson and his colleagues used data from the HiRISE camera now orbiting Mars to produce three-dimensional representations of a crater in which a gully formed between 2001 and 2005. They then applied software that models fluid or granular flow; modelling of dry, dusty flows produced features closer in appearance to the observed gully than did the wet models.

This work, the authors say, shows that gullies and similar formations could be made without water in at least one region of the planet, thus calling into question the watery origins of gullies elsewhere.

SOLID STATE PHYSICS

Making silicon shine

Nature Nanotech. doi:10.1038/nnano.2008.7 (2008)

Silicon is a mainstay of the electronics industry. It is also weakly luminescent — a property that has huge potential for devices such as those used in communication networks, which have long exploited the element's electrical properties. Now researchers have worked out what makes silicon nanocrystals luminesce.

Whether these nanocrystals glow because of quantum effects that are confined to each tiny crystal, or owing to defects in the material joining the nanocrystals together, has been debated for more than a decade.

Manus Hayne at Lancaster University, UK, and his colleagues distinguished between the two mechanisms by looking for subtle changes in the colour of the light emitted by silicon nanocrystals in a strong magnetic field. Such changes would be caused by the quantum-confinement mechanism. The authors found that both explanations were

valid, and that the dominant mechanism depended upon the number of defects in a structure. The team was also able to manipulate the origin of the light by controlling the number of defects.

SYSTEMS BIOLOGY

A powerhouse dissected

Nature Biotechnol. doi:10.1038/nbt1387 (2008)

A compendium detailing how an organelle involved in cellular energy production responds to a catalogue of compounds, two-thirds of which are marketed drugs, has been made freely available online.

Vamsi Mootha at Harvard Medical School in Boston and his colleagues developed a rapid technique for monitoring changes in the activity of mitochondria in cultured muscle cells in response to almost 2,500 compounds. They also measured alterations in the expression of 25 genes involved in the organelle's function.

People with heart disease are often prescribed propranolol to treat high blood pressure, and statins to lower cholesterol. The researchers found that when propranolol is applied to cell cultures in combination with several statins, this can drastically reduce mitochondrial function. This may explain why some people who take statins experience muscle pain.

ANTHROPOLOGY

An infectious idea

Proc. R. Soc. B doi:10.1098/rspb.2008.0094 (2008)

Historical patterns of the prevalence of nine major infectious diseases predict some social attitudes in today's societies better than do contemporary patterns of illness. This finding, from Corey Fincher at the University of New Mexico in Albuquerque and his colleagues, lends weight to the idea that certain social attitudes — such as distrust of outsiders, or high regard for behavioural conformity (pictured, right) — develop in response to disease.

The authors compare historical data on pathogen distribution with several surveys of cultural attitudes. They also factor in an analysis that statistically controls for other likely predictors, including income and inequality, to support a causal link between historical pathogens and cultural values.

G. C. HIN/AFP/GETTY

QUANTUM PHYSICS

Magnetic gas

Nature Phys. doi:10.1038/nphys887 (2008)

Bose–Einstein condensates are weird clumps of extremely cold atoms. Normally, the condensates are made of atoms that interact with only neighbouring atoms, bouncing off each other like billiard balls. A team of physicists at the University of Stuttgart in Germany has now demonstrated that they can make stable clumps with long-range interactions.

Tobias Koch and his colleagues made a Bose–Einstein condensate by cooling a gas of chromium-52 to just above absolute zero. The atoms of this condensate had strong magnetic dipoles, and the team applied an external magnetic field to eliminate contact forces between the atoms. This left only the interaction between the magnetic dipoles.

Because the dipoles have a preferred direction, these clumps of atoms are only stable in certain configurations.

METEOROLOGY

Bacteria make rain

Science **319,** 1214 (2008)

Fresh snow contains a surprisingly large amount of cells or cell fragments, a team of researchers has found. For the ice crystals that produce rain and snow to form, the high atmosphere must contain tiny particles on which moisture can condense.

Brent Christner of Louisiana State University in Baton Rouge and his colleagues sampled fresh snow collected at mid and high latitudes in North America, Europe and Antarctica. They found small amounts of biological ice nucleators in all of the samples, indicating that snow- and rain-making particles, such as certain plant pathogens, are able to travel long distances and that their effect on precipitation is not limited to vegetation-covered regions.

Health and plant growth have been linked to atmospheric processes, so changes in forestry or agriculture may have a large and direct impact on global precipitation, the authors add.

JOURNAL CLUB

Keith Devlin
Center for the Study of Language and Information, Stanford University, California

A mathematician considers the early signs of mathematical ability.

Have you ever wondered whether there is any reliable way to predict whether a three- or four-year-old child will be good at mathematics when he or she goes to school? Many people find it surprising that an early aptitude for arithmetic is not a terribly good indicator.

A 2004 paper by the psychologist Daniela O'Neill and her colleagues at the University of Waterloo in Ontario, Canada, suggested something better. O'Neill and her team showed three- and four-year-old children a picture book and asked them to tell a story about what they saw. The researchers then measured many parameters of the children's story-telling, including the diversity of vocabulary used and the length of the sentences constructed. Two years later, the team set the same children various tests of academic achievement (D. K. O'Neill *et al. First Lang.* **24,** 149–183; 2004).

O'Neill and her co-workers found that vocabulary and sentence length in the initial study bore little relation to the test performances a couple of years later. However, the sophistication with which the children told their stories was important. The most significant feature of this sophistication was children's ability to switch perspectives as they related the stories. Crucially, the correlation that the researchers found pertained not to later performance in reading, spelling or general knowledge, but to future mathematical ability.

I have long thought that the human capacity for mathematical thinking must predate symbolic arithmetic, because numbers are a relatively recent invention. This study backs up this idea, because it suggests that the ability to solve mathematical problems has co-opted other innate capacities that have been important for much longer in our evolution.

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