RESEARCH HIGHLIGHTS

Cosmic rays peek inside

Nucl. Instrum. Methods Phys. Res. A **575,** 489–497 (2007)

Researchers in Japan have taken advantage of cosmic rays to image the inside of an active volcano. This approach has previously been used to search for chambers inside pyramids.

Hiroyuki Tanaka of the University of Tokyo and his colleagues placed an instrument that detects particles known as muons on the side of Mount Asama (pictured). Muons are sent off in all directions when cosmic rays hit Earth's atmosphere.

Some muons reach the detector having passed through the rocks of the volcano. By calculating the number of muons absorbed en route, the researchers determined the density of the volcano's innards. With more devices and real-time readings, the method may help in predicting eruptions.

KYODO NEWS/AP

METABOLISM

After-dinner protein

Cell **129,** 537–548 (2007)

Eat too much and one is at risk of obesity and its attendant chronic illnesses. Wrapped up in many of these illnesses is organ and tissue inflammation, which can be triggered by excess nutrients.

But surpluses are to be expected after meals, and so Gökhan Hotamisligil of the Harvard School of Public Health in Boston, Massachusetts, and his colleagues went looking for a mechanism that limits damage and inflammation at these times. A membrane-spanning protein known as STAMP2 fits the bill. It shows up in belly fat when mice eat. And mice with a STAMP2 deficiency had many of the symptoms of obesity-associated disease. The protein's precise function, though, remains a mystery.

ASTRONOMY

Old man of the heavens

Astrophys. J. **660,** L117–L120 (2007)

A mixture of radioactive isotopes has revealed a star in our Galaxy known as HE 1523-0901 to be almost as old as the Universe.

Anna Frebel of the University of Texas in Austin and her colleagues gathered data on the star's composition with the European Southern Observatory's Very Large Telescope in Chile. They calculated the star's age to be 13.2 billion years, give or take 2 billion years, by comparing the abundances of radioactive isotopes of uranium and thorium to each other and to other 'r-process' elements (the r-process happens in supernovae, forming certain heavy elements). The Universe is around 13.7 billion years old.

Studies of such ancient stars can provide hints of what happened to the first generation of short-lived stars, and what the Universe looked like chemically when it formed.

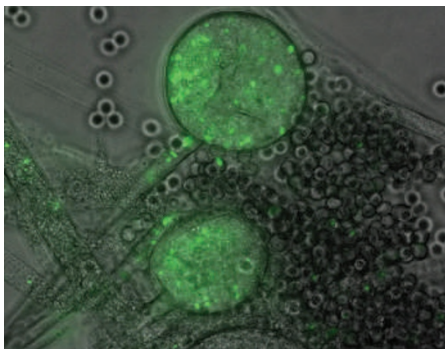
MICROBIOLOGY

Dependency in deadly duo

Curr. Biol. **17,** 773–777 (2007)

They are partners in crime. The fungus (*Rhizopus microsporus*) provides shelter to the bacterium (*Burkholderia*, shown green in image below) living in its cells. In turn, the bacterium produces a toxin that kills plants — supplying nutrients for the fungus. Together, they can wreak havoc on rice crops.

Now, Christian Hertweck of the Hans Knöll Institute in Jena, Germany, and his colleagues have found a new facet of the deadly duo's unusual bond — the fungus cannot reproduce asexually without the bacterium. The team observed that 'curing' *R. microsporus* of its bacterial partner by treating the fungus with antibiotics abolished spore formation, and that injecting labelled *Burkholderia* into cured *R. microsporus* cultures restored sporulation.



IMMUNOLOGY

Flies link sleep and sickness

Curr. Biol. **17,** R353–R355 (2007)

Sick flies don't sleep well, and flies that don't sleep well are susceptible to falling sick. This finding, from David Schneider of Stanford University in California and his colleagues, highlights a connection between circadian rhythm — an organism's daily clock — and immunity.

The researchers observed that *Drosophila* with bacterial infections lacked the daily pattern of movement seen in healthy flies. Also, flies with a mutation in either of two circadian genes died more quickly than controls when infected with bacteria. Infection may trigger a "spiral of death", says Schneider, in which worsening sleep worsens the illness. *Drosophila* could serve as a model organism for exploring the implications of the linkage for vertebrates, which share many circadian and immune signalling pathways with flies.

ELSEVIER

POLYMER PHYSICS

Forbidden symmetries

Phys. Rev. Lett. **98,** 195502 (2007)

Quasicrystals, usually associated with hard, inorganic materials such as metal alloys, have a softer side too. These materials have crystal-like structures with 'forbidden' symmetries that can't be produced by the regular packing of objects.

Kenichi Hayashida of Nagoya University in Japan and his co-workers report that a 'star' block copolymer, in which three different polymer chains are linked at a central focus, will form a type of quasicrystal. Like chains prefer to cluster together, producing segregation of chain types at the nanoscale. In a mixture with polystyrene, the segregation happens in a pattern with forbidden 12-fold symmetry.

The quasiperiodic spacing of 50 nanometres is five times greater than that seen for the only previous soft-matter quasicrystal — assembled from branched molecules known as dendrons — and is visible beneath an electron microscope.

METHODS

Tweezer pleaser

Nature Phys. doi:10.1038/nphys624 (2007)

Optical tweezers, which use light to grab and hold small particles or cells, have a new relation. Designed by Romain Quidant of the Institute of Photonic Sciences in Barcelona, Spain, the 'plasmonic' tweezer uses a single beam of light to arrange many small particles on a surface. Conventional optical tweezers would require a focused light beam to be deployed for each particle.

It works for particles placed on a glass slide decorated with dots of gold. When a beam of light shines on the slide, it excites in each dot a type of electromagnetic wave known as a surface plasmon. The plasmons concentrate light, trapping a single particle above each dot. Applied to a mixture of different-sized particles, the technique selectively traps those of a certain size. The hope is to integrate such systems into lab-on-a-chip devices.

CELL BIOLOGY

Torn to pieces

Dev. Cell **12,** 807–816 (2007)

The break-up of mitochondria, the powerhouses of a cell, seems to promote cell suicide in flies, report V. Sriram of the Tata Institute of Fundamental Research in Bangalore, India, and his colleagues.

Mitochondrial remodelling is important in guiding cells down the programmed cell-death pathway in worms and mammals, but it wasn't known whether the same was true for flies. Sriram's team observed in the fruitfly *Drosophila melanogaster* that mitochondria fragmentation precedes the initation of early steps in apoptosis. They also found evidence that Drp-1, a protein that is known to regulate mitochondrial fission in healthy cells, also regulates the break-up of mitochondria during cell death.

CANCER BIOLOGY

Destructive power

Science **316,** 1043–1046 (2007)

Researchers have discovered how mutations in the gene *WTX* drive cancerous growth in Wilms' tumours, a type of kidney cancer that mostly affects children.

The gene was first linked to the cancer in January. Using proteomic techniques, Randall Moon from the University of Washington in Seattle and his colleagues have now shown that the WTX protein is part of a complex that normally promotes destruction of β-catenin, a key signalling protein. β-catenin is involved in the WNT signal transduction pathway, which is important during embryo development and tissue repair.

Mutations in *WTX* lead to increased levels of β-catenin. This, in turn, promotes cell proliferation.

A. HENDRY

EVOLUTIONARY BIOLOGY

Size matters

Proc. R. Soc. Lond. B doi:10.1098/rspb.2007.0224 (2007)

The varied beaks of Darwin's finches are a famous example of speciation happening in geographically isolated populations. Now a team has found evidence, in the medium ground finch *Geospiza fortis* (pictured above), for what could be the early stages of sympatric speciation — in which populations evolve into different species without being physically separated.

Sarah Huber from the University of Massachusetts in Amherst and her colleagues have shown that two 'morphs' of the finch — one with a bigger beak than the other — prefer to mate with their own kind despite living side by side. Because beak size is related to song, females may select 'like males' on the basis of their song.

Furthermore, genetic analyses indicate reduced gene flow between the two populations.

JOURNAL CLUB

Peter S. Liss
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A biogeochemist is keen to find out whether oceanic plankton can help to keep our planet cool.

For years I have been fascinated by the idea that oceanic plankton can play a significant part in controlling climate. This concept is, of course, at the heart of gaian ideas of the Earth as a self-regulating system, proposed by James Lovelock.

It was given expression through the CLAW hypothesis (published two decades ago by R. Charlson, J. Lovelock, M. Andreae & S. Warren), which supposes that the gas dimethyl sulphide produced by marine plankton influences cloud formation and hence albedo and climate.

However, direct evidence for a link between plankton and clouds has been slow to emerge. A recent paper (N. Meskhidze & A. Nenes *Science* **314,** 1419–1423; 2006) shows a tantalizing seasonal and spatial association between sea-surface chlorophyll (an indicator of biological activity) and atmospheric properties for a six-year period over a substantial area of the Southern Ocean.

Over high-chlorophyll areas, the number of cloud droplets doubled whereas the droplets' size decreased by 30% compared with other regions, leading to an atmospheric cooling comparable to that over highly polluted regions.

Meskhidze and Nenes attribute these changes to plankton emitting the gas isoprene. I am sceptical whether the sea-to-air flux of this compound is sufficient to produce the observed effects, but finding out what does give rise to the apparent association will keep me and other scientists involved in projects such as the Surface Ocean – Lower Atmosphere Study (www.solas-int.org) busy for many years.

It is vital to understand what is happening in order to be able to predict how future changes in biological activity in the oceans may mitigate or enhance climate change.