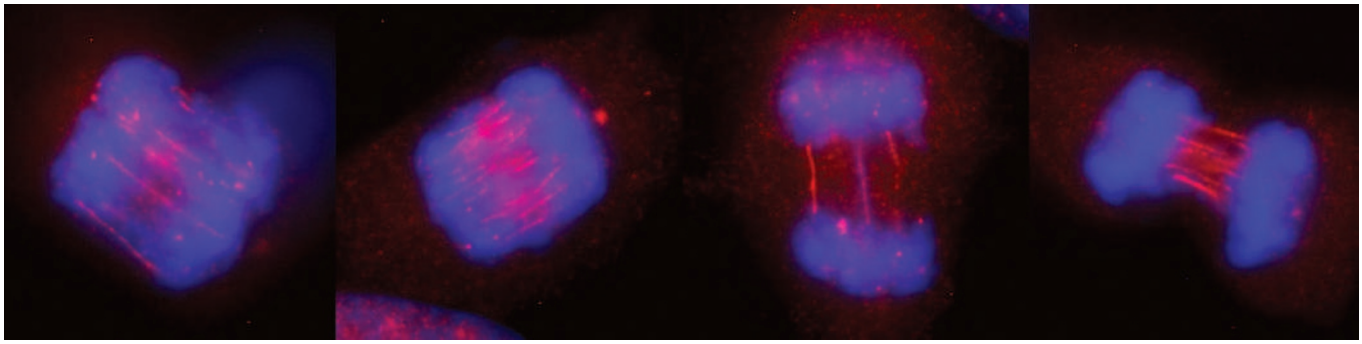
RESEARCH HIGHLIGHTS



K.-L. CHAN & I. D. HICKSON

A bridge too far

EMBO J. doi:10.1038/sj.emboj.7601777 (2007)
Newly copied chromosomes stay entangled for longer during cell division than once thought, researchers report.

Ian Hickson and his team at the Weatherall Institute of Molecular Medicine in Oxford, UK, studied cells from patients with an inherited cancer predisposition called Bloom's syndrome. This arises from faults in a protein called BLM.

Duplicated chromosomes are pulled apart during the last stage of cell division, known as anaphase. In cells with the faulty protein, the copied chromosomes remain tethered together with large 'bridges' of DNA for longer than in normal cells. The researchers suggest that snapping of these bridges may cause the chromosome instability seen in Bloom's patients.

They also showed that BLM protein is associated with very fine DNA bridges between chromosomes in normal cells (shown pink in the image above), and speculate that the healthy protein helps untangle duplicated chromosomes.

BIOMECHANICS

Top legs

Phys. Rev. E **76,** 017301 (2007)
What's as sticky as a gecko and walks on water better than a water strider? According to Cheng Wei Wu of Dalian University of Technology in China and co-workers, the answer is a mosquito.

These researchers studied mosquitoes under the electron microscope. They saw legs covered with ribbed scales that confer high water repellence, and feet covered with hundreds of hair-like setae, which, like those of a gecko, penetrate into microscopic cracks to grip the smoothest of surfaces. The nanostructured legs are so efficient at supporting mosquitoes on water that they can hold up to 23 times the mosquito's body weight, whereas water striders can support only 15 times their own weight.
(For more about geckos, see p. 338.)

MICROBIOLOGY

Fungal attack

Proc. Natl Acad. Sci. USA **104,** 11772–11777 (2007)
Reactive oxygen species (ROS) defend plants against pathogens, but they may also be crucial for plant infection.

Nicholas J. Talbot of the University of Exeter, UK, and his colleagues found that *Magnaporthe grisea*, the fungus responsible for rice blast disease, requires two ROS-generating enzymes before it can damage a plant. Both enzymes are NADPH oxidases (Nox).

Although the fungus produces ROS in multiple ways, ROS generation through Nox was found to be important for the formation of specialized infection structures known as appressoria. Fungi with mutations that inactivate the two Nox develop appressoria that are not functional and therefore do not cause plant disease. ROS may aid infection by mediating changes in cell-wall biochemistry.

PLANETARY SCIENCE

Moon dust

Geophys. Res. Lett. **34,** L13203 (2007)
Thirty-five years after the Apollo 17 astronauts left the Moon (pictured below), researchers have mapped some aspects of the geology of the craft's landing site using the Hubble Space Telescope. The feat demonstrates a method that may help to unravel the Moon's volcanic history.

NASA-JPL

Some volcanic basalts are rich in the mineral titanium dioxide (TiO_2). Mark Robinson of Arizona State University in Tempe and his colleagues distinguished these basalts from other lunar rocks by measuring the tell-tale signature of TiO_2 in reflected ultraviolet light. Such measurements might also inform decisions about the location of future Moon bases, because TiO_2 can be broken down to supply oxygen.

The Hubble camera the team used has since broken, but the Lunar Reconnaissance Orbiter, set to launch in 2008, can try the same technique. Space telescopes are best for the job because Earth's atmosphere blocks much of the ultraviolet spectrum.

CELL BIOLOGY

A short fuse

Cell **130,** 165–178 (2007)
Researchers have uncovered part of the mechanism underlying autophagy, the process by which cells digest and recycle cytoplasmic proteins and organelles.

Yoshinori Ohsumi at the National Institute for Basic Biology in Okazaki, Japan, and his colleagues studied the role of a protein called Atg8 that joins with a lipid called phosphatidylethanolamine (PE). Formation of autophagosomes, the membrane-bound bodies that engulf material to be recycled, requires Atg8–PE.

Using artificial membranes, the researchers showed that an assemblage

of Atg8–PE molecules binds membranes together and allows them to partly fuse (a process known as hemifusion). Mutated forms of Atg8 that did not cause the membranes to cluster *in vitro* also failed to form autophagosomes *in vivo*.

NANOTECHNOLOGY

One step at a time

Small doi:10.1002/smll.200600721 (2007)

Silicon particles, the stickiness of which depends on pH, can be persuaded to assemble in a predetermined sequence, researchers in Japan have shown. They suggest that the technique might be used to build structures for microelectronics or biochips.

Hiroaki Onoe of the University of Tokyo and his colleagues made particles that had some attachment sites decorated with an organic film (A) and others with a smooth silicon surface (B). The B sites are sticky only at low pH, so particles mixed into a solution that is only weakly acidic pair up by binding at their A sites. When the pH is lowered, these pairs join up through their B sites.

To demonstrate the technique, the researchers made U-shaped particles that linked into X-shaped pairs; these pairs then assembled into a structure resembling an interlocked chain.

CELL BIOLOGY

Stuck back together

Science **37,** 242–245; 245–248 (2007)

A protein complex important for binding together pairs of chromosomes during cell division and DNA repair has been found to act independently of DNA replication. It was previously thought that the complex, called cohesin, could act only on replicating chromosomes.

Two research groups — one led by Camilla Sjögren of the Karolinska Institute in Stockholm, Sweden, and one led by Douglas Koshland of the Carnegie Institution in Baltimore, Maryland, and their colleagues — found that a wave of cohesin complexes formed around a break in a yeast chromosome, in addition to the binding of cohesin seen after replication. Furthermore, selectively damaging only one chromosome activated cohesin complexes on both damaged and undamaged chromosomes.

The results suggest that cohesin responds to DNA damage to help maintain chromosome integrity, although the mechanism for this is not fully understood.

ASTRONOMY

Star bright

Astrophys. J. **664,** L17–L21 (2007)

Space telescopes have looked back around 9 billion years to see a dense cluster of galaxies taking shape. Astronomers think that some of today's largest galaxies formed through the merger of smaller ones, and that this cluster may be a system on the brink of such a merger.

The cluster contains at least 12 massive galaxies. Patrick McCarthy of the Observatories of the Carnegie Institution of Washington in Pasadena, California and his colleagues estimate that the galaxies' total mass is nearly a trillion times that of the Sun. They suggest that several of the central galaxies may have merged within a few billion years of the light now observed leaving the system, perhaps forming what is known as a 'brightest cluster galaxy'.

PALAEONTOLOGY

Forerunner to roadrunner

Naturwissenschaften **94,** 657–665 (2007)

Palaeontologists have discovered 110-million-year-old footprints of a fleet-footed bird. The finding predates previously described avian runners by at least 50 million years.

The fossilized footprints, found in Shandong province in China, were originally reported two years ago but researchers initially thought the bird tracks resembled those of a modern shorebird. Martin Lockley of the University of Colorado, Denver, and his colleagues have since reanalysed the *Shandongornipes* tracks and found that the bird had feet more like a roadrunner's (pictured), with two toes pointing forwards and two pointing backwards.

T. BEAN/GETTY

Based on the spacing of the tracks and the projected height of the bird, the researchers estimate its speed to have been 8 kilometres per hour.

JOURNAL CLUB

Colin Prentice
QUEST, University of Bristol, UK

A theoretical biologist suggests that evolution makes plants more predictable.

The debate over how forests respond to rising levels of carbon dioxide has brought home to me how much spin even a dry journal article can contain.

In the mid-1990s, when the forest Free Air Carbon dioxide Enrichment (FACE) experiments began, I thought that we were poised to learn how trees really respond to CO_2. In these experiments, CO_2 is pumped over forests to simulate future conditions.

Unfortunately, years of data collection and scores of papers later, we still haven't reached agreement. Using the same data, researchers conclude that CO_2 either fertilizes forests or it doesn't (or the effect is small, or it goes away, or will soon go away...)

The situation would be helped if we had better theories of how trees might be expected to react to changes in their resources. It was refreshing, therefore, to encounter an elegant analysis of plant behaviour (O. Franklin *New Phytol.* doi:10.1111/j.1469-8137.2007.02063.x; 2007).

Plants, subject to selective pressure, have to optimize what they can. This is a basic principle of evolutionary biology, too often disregarded in experimental contexts.

Theoreticians have long known that an individual leaf in high CO_2 will maximize the amount of carbon it fixes — a measure of its growth success — if it lowers its nitrogen content to optimize the balance between photosynthesis and respiration.

Franklin extends this nitrogen optimization principle to the whole plant, a significantly more complex problem. His model predicts 83% of the variation in plant growth enhancement seen across FACE studies, explains the observed relationship between plant growth and canopy nitrogen content, and does much else besides. It is a welcome step forwards.

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