

RESEARCH HIGHLIGHTS

Taming the transposon

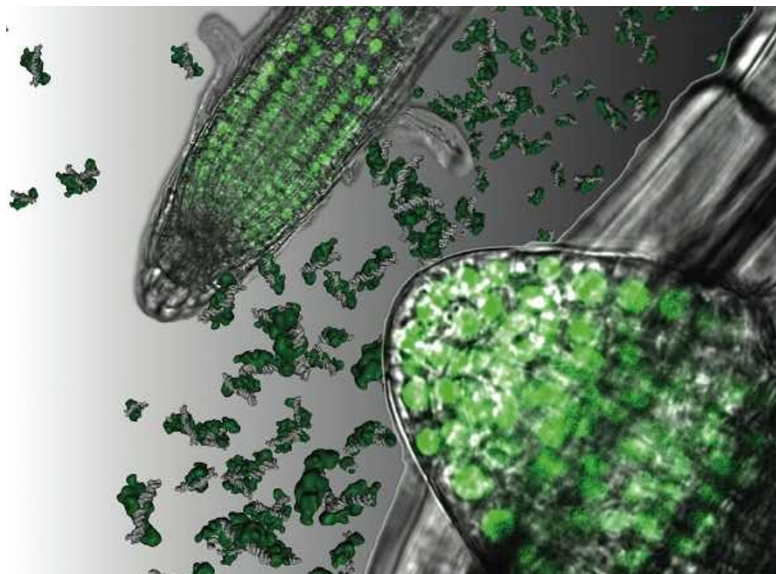
Science 318, 1302–1305 (2007)

Two proteins that help plants to develop optimally for their light environment may have evolved from 'jumping genes', called transposons, researchers have found.

Many plants use proteins known as phytochromes to sense and respond to red (and far-red) light. Two proteins involved in phytochrome signalling, FAR1 and FHY3, are encoded by DNA sequences similar to the sections of transposons that enable them to jump around the genome. These sections encode enzymes known as transposases.

Haiyang Wang at the Boyce Thompson Institute for Plant Research in Ithaca, New York, and his colleagues report that FAR1- and FHY3-like genes are intermingled with transposase genes in many flowering plants — and that the FAR1 and FHY3 proteins turn on other genes required for phytochrome signalling. They suggest that transposons may have provided a supply of 'control' genes in evolution, enabling flowering plants to respond sensitively to light.

The image shows FHY3 protein (green) accumulated in the nuclei of *Arabidopsis thaliana* root cells.



SCIENCE

NANOELECTRONICS

Carbon patchwork

Nano Lett. 7, 3394–3398 (2007)

Graphene — single sheets of graphite-like carbon — has been hailed as a microelectronic wonder material. Richard Kaner and his team at the University of California, Los Angeles, have come up with a novel way of making films of the two-dimensional electrical conductor that can be patterned into circuits only a few nanometres thick.

Previous approaches to such manufacture have involved stripping down graphite layer by layer or heating silicon carbide to extreme temperatures. By oxidizing graphite and then using water to separate the product into individual flakes the team has come up with a simpler and cheaper method. Graphite oxide flakes are sprayed onto a heated surface and reduced back into graphene using hydrazine. Overlapping flakes create a continuous patchwork, from which the team has made tiny transistors.

STRUCTURAL BIOLOGY

Sneaking in

Nature Struct. Mol. Biol. doi:10.1038/nsmb1342 (2007)

Researchers have solved the structure of the protein that allows the measles virus to bind and enter host cells. The finding may provide a template for the design of drugs that block the virus's entry.

Christopher Garcia and his colleagues at Stanford University School of Medicine in California crystallized the virus's haemagglutinin protein. They report that

it is folded like another class of protein, the neuraminidases, despite limited sequence and functional similarity to that group.

Haemagglutinin's structure resembles a propeller, with six blades around a cavity. Amino acids that have a crucial role in binding to host-cell receptors are located outside the rim of the cavity.

POPULATION BIOLOGY

Polar bare

Proc. R. Soc. B doi:10.1098/rspb.2007.1307 (2007)

When a declining population becomes too thinly spread, the sheer unlikelihood of meeting a potential mate will reduce reproductive success and hasten the decline. The possibility of this phenomenon — the Allee effect — affecting polar bears has been modelled by Péter Molnár of the University of Alberta in Canada and his colleagues.

In Canada, selective hunting of male polar bears has reduced the ratio of males to

females available to mate — that is, without cubs. Using population data from Lancaster Sound, in Nunavut, collected annually between 1993 and 1997, the team predicts at what point, as the overall population falls, male scarcity would lower fertilization rates. Should the Lancaster Sound population decrease by two-thirds and maintain its current sex ratio, Molnár and his team predict that only 81% of females would mate successfully — compared with an estimated 99% today.

QUANTUM PHYSICS

Mini mysteries

Nature Photon. doi:10.1038/nphoton.2007.227 (2007)

Researchers have designed a quantum dot that emits high-frequency streams of single photons, a breakthrough in the field of quantum cryptography.

Streams of photons, the particles that carry light, are fundamental components in quantum information science, and could be used to exchange cryptographic keys that foil eavesdroppers.

Stefan Strauf and his team at the University of California, Santa Barbara, measured an output of 4 million photons per second from their semiconductor device. This outstrips previous methods for generating single photons, which have managed up to about 200,000 photons per second. A more powerful source laser plus a perfect detector, they say, promises rates higher than 100 million per second — close to making the exchange of quantum information practical.



R. GREEN/TAXI/GETTY

PHYSICS

Picking the packing*New J. Phys.* **9**, 406 (2007)

Mathematicians still cannot explain why spheres take on a range of packing arrangements — some loose, some tight — when they fill a fixed volume randomly. But physicists can now control the arrangement formed by small ferromagnetic beads.

Geoffroy Lumay and Nicolas Vandewalle at the University of Liege in Belgium report tuning the beads' packing by applying magnetic fields. Turning up the magnetic force increases repulsion between the beads and thus forces them into a looser configuration. As the magnetic forces are removed, the beads slip into tighter arrangements. This technique could become important for engineers designing emulsions because knowing the number of droplets in a given volume permits an emulsion's viscosity, among other properties, to be accurately determined.

ECOLOGY

Blue-sky thinking*Geophys. Res. Lett.* **34**, L20707 (2007)

The growing frequency of wildfires in the western United States has been attributed to increasing temperatures and drought conditions, often linked to global warming. But two geographers in North Carolina believe that there is a third important factor in the northern Rocky Mountains: fewer storms.

Paul Knapp of the University of North Carolina at Greensboro and Peter Soulé of Appalachian State University pored over more than a century's weather records. They noticed that major mid-latitude cyclones, which bring precipitation and cooler temperatures, are arriving later in the year and occurring less often.

The trend was gradual for most of the twentieth century but became more pronounced in the 1980s — corresponding to sharp changes in wildfire statistics, which have been kept over six decades. This relationship explains about a fifth of the rise in wildfire activity, the authors estimate.

PSYCHOLOGY

Mind and memory*Science* **318**, 1257 (2007)

A trait called 'theory of mind' involves being able to infer the current mental states of others. This has been thought to require the ability to imagine a personal experience occurring in other contexts on the basis of remembered events. But the link has proved difficult to test.

Shayna Rosenbaum and her co-workers,

from the York University and Rotman Research Institute in Toronto, Canada, did just that — and debunked the assumption. They gave a range of tests to two patients with rare brain injuries that cost them the ability to recall personal experiences but not the facts they learned before becoming brain damaged. The tests assessed how well they could reason about the thoughts and feelings of others and their scores were indistinguishable from those of 14 control subjects.

ANTHROPOLOGY

Jade trade*Proc. Natl Acad. Sci. USA* doi:10.1073/pnas.0707304104 (2007)

Lingling-o, three-pointed jade ornaments worn as ear pendants across Southeast Asia (pictured below), were spread by seafaring traders in the South China Sea. And, suggest Hsiao-Chun Hung, of the Australian National University in Canberra, and her colleagues, they may have brought Austronesian languages with them.



By working out the elemental composition of 144 jade ornaments, which were mostly recovered in archaeological digs, the authors show that at least 116 examples were carved out of stone from eastern Taiwan. Given where the ornaments were found, this implies that jade was traded throughout a 3,000-kilometre-wide region encompassing the Philippines, and parts of Malaysia, Vietnam, Cambodia and Thailand, between 500 BC and AD 500.

Because the distribution of *lingling-o* reflects that of Austronesian languages, which are spoken by about 350 million people in Southeast Asia and Oceania today, the researchers propose that itinerant craftsmen may have carried the jade to other Austronesian-speaking settlements or helped spread the languages with their trade.

PROC. NATL. ACAD. SCI. USA

JOURNAL CLUB

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Unexpected links between cellular organelles continue to unfold.

As a graduate student, I was intrigued by centrioles. Their beautiful ninefold symmetry, occurrence in pairs and positioning at the heart of the cell — as a constituent of the microtubule-organizing centrosome — made them appear significant. But how they are built and replicated, and even their true purpose in cell division, remained enigmatic.

Adding to my fascination was the fact that, in my cultured cells, one of the centrioles often acted as an anchor, or basal body, for a cilium-like appendage — even though the endothelial cells I used were not thought to ever have cilia.

Once considered a biological oddity, these stubby, non-motile 'primary' cilia are now known to be present in most cells of the human body (see www.bowserlab.org/primarycilia/cilialist.html) and probably serve as essential sensors whose disturbance is linked to a growing list of diseases.

I have always wondered whether there is an additional functional link between centrioles and primary cilia. A recent paper (A. Robert *et al.* *J. Cell Sci.* **120**, 628–637; 2007) shows that a protein involved in the biogenesis of primary cilia is also a bona fide constituent of the centrosome. Moreover, this centrosomal/ciliary component is tied into the regulation of the cell cycle.

This finding joins a series of recent discoveries of proteins that are both centrosomal and ciliary. Taken together, these studies are revealing a truly novel functional link: centrioles are there to make primary cilia; primary cilia act as sensors of external stimuli; and, as other studies have shown, external stimuli can regulate cell proliferation. So the mysterious organelles of my graduate student days are being demystified, but the story that unfolds turns out to be even more fascinating than I expected.

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