

RESEARCH HIGHLIGHTS

Parallel protection

Proc. R. Soc. B doi:10.1098/rspb.2007.1039 (2007)

To win the game of concealment, it's often best to use the tools at hand. Several desert spiders from around the world hide by attaching sand to their bodies. Using scanning electron microscopy on moults of spiders from Africa, South America and the United States, undergraduate Rebecca Duncan and her colleagues from Lewis & Clark College in Portland, Oregon, compared two unrelated spider genera that independently evolved this ability. The team found that both have long, thin, flexible 'hairlettes' on the bristles that cover their bodies. The researchers suggest that intermolecular forces make sand stick (see inset, right) and keep the spiders camouflaged.

The almost indistinguishable methods for adhesion in the two genera show the power of evolution to produce similar adaptations in similar environments.



K. CRAMER, MONMOUTH COLL., ILLINOIS

NEUROBIOLOGY**Faulty transmission**

Neuron 56, 58–65 (2007)

Researchers have found that a protein implicated in the autism-spectrum disorder 'Rett syndrome' regulates the formation of certain neuronal connections.

Loss of the protein MeCP2 causes Rett syndrome, but gene duplications that double protein levels also produce autism-like characteristics and seizures. A likely cause of these disorders is an imbalance between excitation and inhibition in the brain. Hsiao-Tuan Chao, Huda Zoghbi and Christian Rosenmund at Baylor College of Medicine in Houston, Texas, found that when mice lack MeCP2, neurons that transmit the amino acid glutamate in the hippocampus showed 46% less transmission. And mice that produced twice the normal level of MeCP2 exhibited twofold higher neuronal transmission.

These changes were primarily due to alterations in the number of connections — known as synapses — between neurons, the

researchers found. The results suggest that MeCP2 regulates synapse formation during early development.

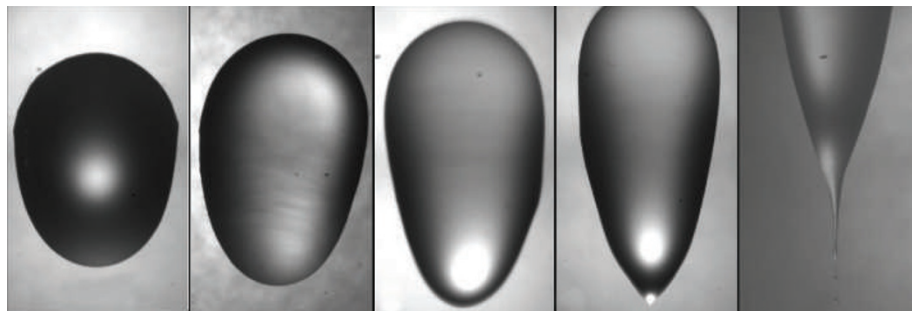
MECHANICS**A defiant droplet**

Phys. Rev. Lett. 99, 144501 (2007)

How can water travel uphill? Simple, say Philippe Brunet and colleagues from the University of Bristol, UK: place a droplet on a sloping plate and shake the plate up and down.

As the plate descends, the droplet gets taller, with a larger contact angle on the upper than the lower edge (pictured, below). This tends to push it up the slope. The effect should cancel out over a complete oscillation cycle, but it doesn't owing to a combination of factors: fore- and aft-symmetry breaking due to the slope, and nonlinear friction between the droplet and the surface.

Above a certain vibration amplitude and frequency all drops will climb. This might be used to transport liquids in microfluidic networks.



AM. PHYS. SOC.

ASTRONOMY**Superlative supernova**

Astrophys. J. Lett. 668, L99–L102 (2007)

Astronomers have found the most luminous supernova yet.

Named 2005ap, it lies 4.7 billion light years away and burst with a peak magnitude roughly eight times as bright as the Milky Way. Discovered just before this peak in March 2005, the supernova faded after three weeks. It was about twice as bright as the previous bar-setter, discovered by the leader of the current team, Robert Quimby, a postdoctoral researcher at the California Institute of Technology in Pasadena and leader of the Texas Supernova Search.

The authors speculate that this supernova's record-setting luminosity may have come from an exploding red giant's shock wave hitting and lighting up a shell of material around the star.

MICROBIOLOGY**Life on the rocks**

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0708183104 (2007)

Exactly how some microorganisms live in glacial ice has been something of a mystery. Previous research identified two habitats in which they could obtain water and energy — the surface of trapped mineral grains and liquid veins at ice boundaries. Some life is tuned to these niches, but microbes unable to survive in them have nevertheless been found in glacial ice, meaning another

habitat is probably present.

Buford Price and Robert Rohde, at the University of California, Berkeley, may have identified this missing habitat. They calculated that enough molecules such as carbon dioxide, oxygen, nitrogen and methane can diffuse through ice to sustain life.

By scanning ice cores with laser fluorimeters they detected protein spikes, some of which were indicative of single isolated cells, in just such habitats.

ASTROCHEMISTRY

Salty stars

Astrophys. J. **668**, L131–L134 (2007)

Researchers in the United States have found a dash of the unexpected in oxygen-rich stars. Lucy Ziurys and her colleagues at the University of Arizona in Tucson used the Submillimeter Telescope on Mount Graham and the 12 Meter Telescope on Kitt Peak, both operated by the Arizona Radio Observatory, to observe two red-giant stars that have shells dominated by oxygen. By analysing the recorded spectra, the team determined that the shells contain NaCl, which has previously been observed only in carbon-rich red giants.

The findings suggest that oxygen-rich stars, like their carbon-rich cousins, may be home to the complex types of chemistry that create molecular precursors to life.

BIOCHEMISTRY

Keeping the 'code'

Cell **131**, 58–69 (2007)

Certain chemical changes, or marks, made to the histone proteins around which DNA wraps seem to tell the cell whether or not that DNA should be transcribed.

Teams led by Matthias Mann at the

Max Planck Institute for Biochemistry in Martinsried, Germany, and Marc Timmers at the University Medical Centre Utrecht in the Netherlands looked for proteins that bind to one chemical mark — trimethylation of lysine 4 on the histone H3. This mark is usually associated with transcriptional activity, and they found that a component of the transcription factor TFIID bound it tightly.

Dimethylation of a nearby arginine residue inhibited this binding, and other specific marks strengthened it, lending credence to the hypothesis that a combinatorial 'histone code' determines how cells read their DNA.

PLANT ECOLOGY

Grass attack

J. Ecol. doi:10.1111/j.1365-2745.2007.01307.x (2007)

Looking for signs of biological warfare past, Carolyn Malmstrom of Michigan State University in East Lansing and her colleagues delved into herbarium specimens at two University of California sites and extracted some of the oldest plant-virus RNA ever recovered.

Although ecological theory generally says that invasive species are successful outside their home ranges because they are freed from the pathogens that evolved to plague them, Malmstrom and colleagues suspect that a historical takeover of California grasslands by Eurasian grasses succeeded in part because the invaders brought viruses with them that affected the natives or changed the dynamics of an existing virus population.

They extracted barley yellow dwarf virus RNA from several specimens, including a 1917 invasive wild oat, proving that the virus was present at the time of invasion.

VISION

A scaffold in new light

Cell **131**, 80–92 (2007)

The fruitfly protein INAD had long been considered to be a scaffolding protein, organizing important visual signalling proteins that attach to it. But recent research suggests that INAD directly regulates visual perception.

Rama Ranganathan, of the University of Texas Southwestern Medical Center in Dallas, and colleagues show that, in response to light, one of five structural 'PDZ' domains of INAD transiently switches from a reduced to an oxidized state, distorting INAD's ability to bind to other molecules. This seems crucial to visually mediated reflex behaviours and for terminating visual responses.

Many scaffolding proteins contain PDZ domains, which could undergo similar conformational changes to that of INAD. Thus, rather than support components, these might serve as control centres for other signalling molecules.

Correction

The Research Highlight 'Volcanic paintings' (*Nature* **449**, 510; 2007) wrongly named Joseph Mallord William Turner as John Mallord William Turner.



EYE OF SCIENCE/SPL

JOURNAL CLUB

Andre Geim
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Imploding atoms have softened this experimentalist's teasing views on theoretical physics.

As an experimentalist, I instinctively dislike theory papers. Too many of them seem to be written for the sole purpose of showing off an integral larger than a competitor's, or to present multiple theories just in case one idea proves right and so is hailed as visionary. I feel even less warmly towards theories that are nigh on

impossible to check, such as the supposed precursor to a theory of everything, string theory.

But speaking seriously, even the most obscure predictions can turn out to be spectacularly relevant.

In our lab we have been studying graphene, a material that comprises a single layer of carbon atoms arranged similarly to chicken wire. Because electrons in this material mimic ultra-relativistic particles, it should be possible to observe in their behaviour century-long-predicted phenomena such as the Klein paradox (which concerns how highly energetic electrons tunnel

through supposedly impenetrable barriers) and *zitterbewegung* (jittery movements of relativistic wave-packets).

Several recent theory papers on the physics preprint server arXiv predict another coup for graphene (see A. V. Shytov *et al.* arXiv:0708.0837; 2007).

According to relativistic quantum theory, atoms containing more than 170 protons cannot exist, because electrons around nuclei with such a large charge would fall into the centre. Nuclear physicists have not come close to creating atoms heavy enough to test this prediction. But the

recent theory papers suggest that it should be relatively easy to observe the effect in graphene. This is because electrons in this material interact much more strongly than they do in atoms, so should fall down on charged impurities (standing in for nuclei) rather routinely.

This makes me wonder: could we design condensed-matter systems to test the supposedly non-testable predictions of string theory too?

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