RESEARCH HIGHLIGHTS

Horny beetles

Am. Nat. 168, 711–729 (2006)

The function of horns on *Onthophagus* beetles (pictured) isn't just for combat or sexual prowess, but also so that the animals can break out of their larval shells.

Armin Moczek of Indiana University in Bloomington used electric currents to destroy the horn tissue of beetle larvae. When the altered larvae tried to hatch they were unable to break free of their shell. Moczek's team also discovered that all larvae have the horns regardless of sex — some females reabsorb their horns before reaching adulthood.

It remains unclear whether the evolution of the beetles' thick shell was made possible by the horns, or whether the need for a harder shell drove the appearance of stronger horns.

A. COOKE

SYNTHETIC CHEMISTRY

Gold road to safe sushi

Angew. Chem. Int. Edn doi:10.1002/anie.200601963 (2006)

Use of a new kind of chemical reaction catalysed by a gold compound has helped Craig Forsyth and his team at the University of Minnesota, Minneapolis, make an important segment of azaspiracid, a toxic marine molecule. This toxin accumulates in shellfish and when ingested by humans attacks the liver, pancreas and spleen. It may also be associated with neurological problems and tumour growth.

Forsyth's team achieved its synthesis by replacing the ketal group often used in similar reactions with an alkyne group. This prevented a carbon–carbon double bond within the molecule from shifting to a new position, a process that can disrupt the reaction. The method for making part of the complex azaspiracid molecule will aid the lab-based synthesis of related toxins, boosting attempts to study the molecules and treat their effects.

PALAEONTOLOGY

Unscrambled eggs

Geology 34, 1037–1040 (2006)

Silty shales from China contain 500-million-year-old eggs preserved in a way never before seen in the fossil record.

A team led by Jih-Pai Lin of Ohio State University in Columbus used X-ray imaging to study deposits from the Kaili Formation in Guizhou province. The analysis revealed clusters of eggs dating from the Middle Cambrian, between 501 million and 513 million years ago, preserved three-dimensionally in silica. The team was even able to distinguish cells in the act of dividing.

The discovery sheds light on the life histories of marine invertebrates that produced the eggs. It also raises the possibility of finding fossil embryos in other similar settings.

EVOLUTION

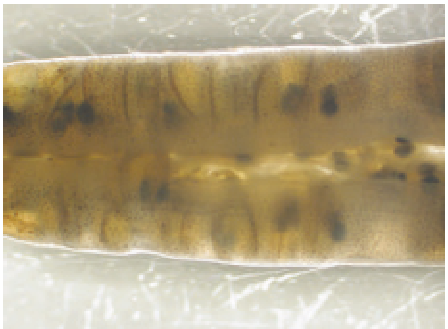
Old gene learns new tricks

Proc. Natl Acad. Sci. USA 103, 19407–19412 (2006)

Seahorses and pipefish are unique among vertebrates in that pregnancy is a burden shouldered by males. This phenomenon may have evolved because dads co-opted an ancestral gene and used it to nurture embryos.

April Harlin-Cognato of Texas A&M University in College Station and her colleagues searched for genes that are highly expressed in the brood pouch (pictured below) — where eggs are fertilized and embryos grow — of pregnant male gulf pipefish (*Syngnathus scovelli*). They show that an ancient version of one of these genes may have worked in the liver and kidneys of bony fish.

The gene, which may have been drafted into the brood pouch more than 50 million years ago and has been dubbed *patristacin* by the authors, could help to control embryo ion content or help embryos to hatch.



C. PARTRIDGE

GEOLOGY

Lava locks up carbon

J. Geophys. Res. 111, B12201 (2006)

Flood basalts, giant outpourings of lava on Earth's surface, could be a good place to sequester carbon dioxide emitted by power plants.

The basalts come in layers with porous tops that could soak up carbon dioxide, and in areas — such as India and the US southeast — where coal-fired power plants are common. But little technical work has been done on the feasibility of sequestration in flood basalts, says a team led by Peter McGrail of the Pacific Northwest National Laboratory in Richland, Washington.

The team's lab experiments show that water saturated with carbon dioxide reacts with basalt to form stable minerals, adding weight to the idea that carbon dioxide pumped into basalt could be stably locked away.

GENETICS

Malaria parasite uncovered

Nature Genet. doi:10.1038/ng1924; 10.1038/ng1930; 10.1038/ng1931 (2006)

Geneticists have unveiled a slew of information on *Plasmodium falciparum*, the parasite that causes malaria. Three papers in *Nature Genetics* compare and contrast genome sequence data from a variety of strains — some that are used in the lab, some taken from infected people, and some from a species that infects chimpanzees.

By comparing the genomes, the researchers have identified which life stages of the parasite are more likely to show variation. They can also pick out more constant parts of the genome, which could serve as targets for treatments.

BACTERIOLOGY

Fight on two fronts

Proc. Natl Acad. Sci. USA 103, 18499-18503 (2006)

One way in which mammals infected with anthrax fight back is by trying to starve the bacteria of iron. Bacillibactin, a compound with which anthrax scavenges iron from the environment, is targeted by siderocalin, a part of the innate immune system.

Now Kenneth Raymond of the University of California, Berkeley, and his co-workers have shown how a second iron-scavenging molecule, petrobactin, allows anthrax to evade this control. The subunit with which petrobactin binds iron is very unusual, so siderocalin, which recognizes a range of iron-binding compounds, ignores this one.

Targeting petrobactin, the team suggests, might be a way of producing very specific anti-anthrax treatments.

GEOLOGY

Deep waters of life

Science doi:10.1126/science.1135013 (2006)

The arrival of oxygen in the world's oceans may have sparked the evolution of animal life.

Analysis of 580-million-year-old rock from the Avalon Peninsula in Newfoundland, Canada, suggests that oxygen entered the deep oceans at the end of an ice age known as the Gaskiers glaciation. Fossil evidence indicates that large multicellular organisms appeared on the sea floor shortly after this period of glaciation.

The rock data were generated by Don Canfield of the Nordic Center for Earth Evolution in Odense, Denmark, and his colleagues. Canfield's team studied levels of iron, sulphur and carbon in the rocks in order to characterize the chemical make-up of the oceans at the time when the rocks formed.

OCEANOGRAPHY

Southern warming

J. Clim. 19, 6382-6390 (2006)

Global-warming predictions are currently hampered by uncertainties about the amount of heat and carbon dioxide that the Southern Ocean will take up. A computer model developed by Joellen Russell of the University of Arizona in Tucson and her colleagues now suggests that the ocean will be able to absorb more than previously thought.

The key is westerly winds that drive the powerful Antarctic circumpolar current. Russell's team locates these winds closer to the pole than in previous climate models, in line with recent observations. With the winds gradually moving poleward, the ocean no longer stratifies into layers as rapidly, allowing heat and carbon dioxide to penetrate more deeply.

MATERIALS SCIENCE

Concrete evidence

J. Am. Ceram. Soc. 89, 3788-3796 (2006)

Some of the massive blocks making up the great pyramids of Giza in Egypt (pictured below) are not limestone, but a synthetic mix like concrete, argue materials scientists.

The paper by Michel Barsoum of Drexel University in Philadelphia, Pennsylvania, and his colleagues is the latest entry in a decades-long argument. Most Egyptologists reject the idea, put forth in the mid-1980s, that the pyramids contain concrete.

A. VAN ZANDBERGEN/LPI

Barsoum's team took a fresh look at 15 samples using scanning- and transmission-electron microscopes. The samples contain ratios of elements, such as calcium and magnesium, that do not exist in nearby limestone. The imaging also revealed regions of amorphous structure. Both observations suggest that other substances were added to make a concrete mix, say the authors.

BIOFUELS

Positively negative

Science 314, 1598-1600 (2006)

A mixture of prairie grasses could produce a biofuel that mops up more carbon than it produces, say David Tilman and his colleagues at the University of Minnesota in St Paul.

The grasses are 'carbon negative' because each hectare of the crop can lock away up to four and a half tonnes of carbon dioxide in soil and roots every year. This dwarfs the 0.3 tonnes or so of carbon dioxide released during production and combustion of the fuel.

Tilman concludes that the grasses would reduce carbon dioxide 6 to 16 times more effectively than grain ethanol and biodiesel, two rival biofuels.

JOURNAL CLUB

Thomas Mrsic-Flogel
Max Planck Institute of Neurobiology, Martinsried, Germany.

A neuroscientist asks whether neurons are enough when it comes to learning.

One of my main scientific interests is understanding how the brain adapts to and learns from experience. By 'brain' I normally mean networks of neurons, because the electrical impulses they produce are the common currency of sensation and perception; learning involves changes in the synaptic connections between these cells driven by sensory experience. But it's beginning to seem that the brain's plasticity depends on more than neurons alone.

A few months ago, I found myself debating with a colleague what role glial cells might play. I was sceptical. Some years ago, the various sorts of non-neuronal cells that go by the name of glia were thought of simply as a glue (which is what glia means in greek) that holds the brain together. More recently, though, these cells have been shown to form extensive networks important for regulating the local brain environment and to communicate with neurons.

Despite knowing all of this, I had not considered glia as serious players in neuronal plasticity. My thinking changed after reading two recent studies showing that glia not only change their activity after sensory stimulation (X. Wang *et al. Nature Neurosci.* 9, 816–823; 2006) but also influence the strength of synaptic connections on neurons via a secreted soluble protein (D. Stellwagen and R. Malenka, *Nature* 440, 1054–1059; 2006). Because the amount of secreted factor depended on the level of surrounding neuronal activity, these results may provide a glial link between sensory experience and synaptic plasticity. The challenge is now to show this directly in the intact brain. I am willing to give it a try — the glia may have changed my mind!