room temperature, and imaged them directly.

The team arranged cobalt nanorods into a honeycomb lattice on silicon to form a two-dimensional analogue of the spin-ice structure. By applying magnetic fields they disrupted the bars' magnetic alignments, so that regions of north or south magnetic charge were trapped at points where three bars met.

OCEANOGRAPHY

Early bloomers

Ecology doi:10.1890/09-1207.1 (2010)

An analysis of satellite data suggests that the vast phytoplankton blooms that grace oceans around the globe in springtime actually start to develop in the depths of winter, challenging long-held theories about what drives them.

With almost 10 years' worth of data from NASA's SeaStar spacecraft, Michael Behrenfeld of Oregon State University in Corvallis found that phytoplankton populations begin to increase during winter, when deeper, nutrient-rich waters mix with the ocean surface layer and disperse zooplankton grazers that keep phytoplankton in check.

J. SCHMALTZ/MODIS RAPID RESPONSE TEAM/NASA GSFC

The visible bloom (pictured right) occurs in spring, months after the active surface layer stops deepening. Phytoplankton, multiplying quickly, are concentrated in the layer and nourished by spring sunshine — previously believed to be a major factor in initiating the bloom.

The bloom ends when grazing zooplankton or dwindling surface nutrients bring the phytoplankton population back under control.

BEHAVIOURAL GENETICS

South bee-ch diet

PLoS Genet. **6,** e1000896 (2010)

Foraging behaviour in the honeybee *Apis mellifera* can be altered by tweaking the expression of a gene in abdominal fat cells.

Gro Amdam and her colleagues at Arizona State University in Tempe watched bee strains that had been selected for their foraging preference — for either pollen or nectar. After lowering the expression of a gene related to insulin signalling in the insects' fat cells, bees of both strains cut down on their collection of sugary nectar in favour of protein-containing pollen. However, the treatment had no effect on the bees' sensory response to sugar.

The results suggest that systems other than the nervous system can affect behaviour, although the subtleties in the shift indicate that multiple genes are involved.

SEISMOLOGY

On shaky ground

Geophys. Res. Lett. doi:10.1029/2009GL042352 (2010)

The earthquake that struck the Italian city of L'Aquila on 6 April 2009 killed about 300 people. It was preceded by many foreshocks, but the authorities did not evacuate buildings and were heavily criticized after the event.

However, Thomas van Stiphout of the Swiss Seismological Service in Zurich and his colleagues show that, given the uncertainties of earthquake forecasting, evacuations are rarely cost-effective. Combining a seismic-hazard model with an analysis of the costs and benefits of evacuation, they found that an expensive, general evacuation was not justified in the weeks and hours leading up to the L'Aquila quake.

The model also showed that weak buildings and loose soil conditions contributed most to overall risk. The authors say that future mitigation strategies should focus on these factors for targeted evacuations or the placement of civil first-aid groups.

ASTROPHYSICS

The odd couple

Astrophys. J. **714,** L84–L88 (2010)

Astronomers have found a planet that may have formed like a star — through gravitational collapse. Kamen Todorov of Pennsylvania State University in University Park and his colleagues spotted a planet 5–10 times the mass of Jupiter orbiting a brown dwarf — a star too small to ignite by fusion.

The brown dwarf is only about one million years old, so its companion is too young to have slowly accreted from the dwarf's disk of dust and gas. Yet the planet is much too big to have quickly collapsed from a large lump in a dwarf's modest disk.

The authors suggest that the dwarf and its planet formed unusually, in the same way that binary star systems do — with a vast, primordial gas cloud fragmenting and collapsing gravitationally into two objects.

JOURNAL CLUB

Xing Xu
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A palaeontologist considers the evolution of birds' mechanism of breathing.

During both inhalation and exhalation, the air in birds' lungs moves in just one direction, through small tubes. This is unusual: most animals move air tidally, in and out of dead-end gas-exchange structures. The question of when and how the avian breathing mechanism evolved is interesting to palaeontologists like me who study these unusual features.

Traditionally, the avian pattern of one-way breathing has been thought to depend on special accessory air sacs that work similarly to bellows. Largely because they don't have these air sacs, alligators have always been presumed to be tidal breathers. However, this has now been questioned by Colleen Farmer and Kent Sanders at the University of Utah in Salt Lake City, who suggest that alligators actually breathe like birds (C. G. Farmer & K. Sanders *Science* **327,** 338–340; 2010).

By measuring air and water flows in the lungs of anaesthetized and dead alligators, respectively, the authors demonstrate unidirectional flow. They draw the reasonable inference that this bird-like breathing is characteristic of the archosaurs, a broad group that includes both alligators and birds.

The finding is leading to changes in the direction of palaeontological research. Farmer and Sanders' results imply that air sacs are not essential for unidirectional breathing. The function of these sacs in extinct ancestors of birds — dinosaurs such as theropods — should thus be reconsidered.

Unidirectional breathing probably appeared among ancestral archosaurs during the Early Triassic period, some 250 million years ago, a time of low oxygen levels that might have encouraged evolutionary experimentation with improved ventilation. This raises the question of whether the drastic conditions led to other notable changes in Triassic animals.

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