

RESEARCH HIGHLIGHTS

Selections from the scientific literature

STEM CELLS

Telomeres help cells to commit

Stem cells have trouble assuming a specialized identity if their telomeres, the protective caps on the ends of their chromosomes, are short.

Pluripotent stem cells can become any cell type in the body, and are known to require long telomeres to grow normally. A group led by Lea Harrington, formerly at the University of Edinburgh, UK, reports that telomeres are also important for stem cells to differentiate into other cell types. They found that mouse embryonic stem cells with experimentally shortened telomeres did not differentiate stably, and that the pluripotency gene *Nanog*, which is normally silenced during differentiation, was abnormally active in these cells. In addition, the chemical modifications to DNA that normally stabilize differentiation were disrupted throughout the genome.

Telomere length might also have a role in differentiation of cancer stem cells in the body, the authors suggest.

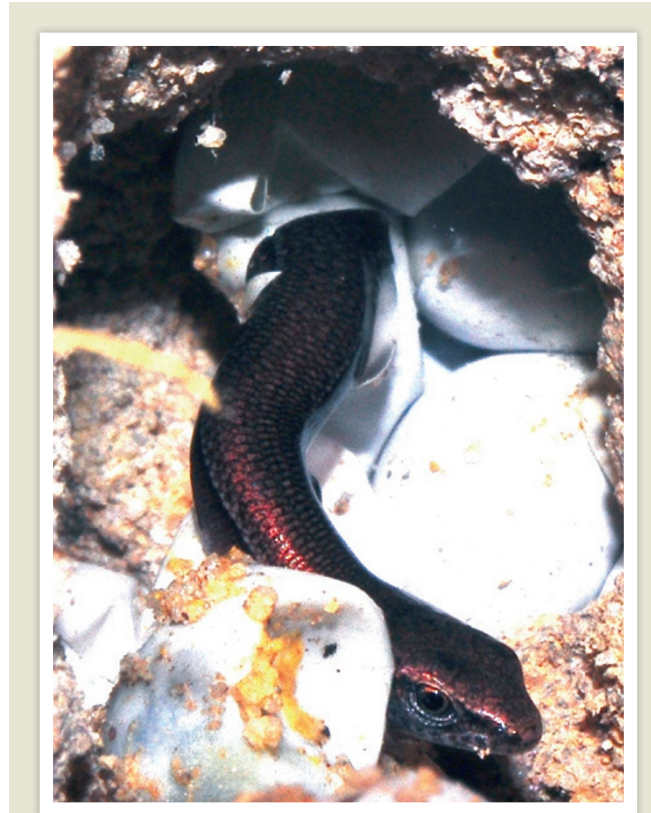
Cell Stem Cell 12, 479–486 (2013)

PSYCHOLOGY

Here's looking at you

When humans cannot tell where gaze is focused, they assume that people are looking at them.

Isabelle Mareschal, now at Queen Mary University of London, and her team asked volunteers to determine where the gazes of computer-generated faces were directed. When the true direction of the gaze was obscured by pixelating the eyes, all six observers



ANIMAL BEHAVIOUR

Lizards hatch early to flee

On sensing predators, developing delicate skinks (*Lampropholis delicata*, pictured) burst from their eggs and, in one fluid motion, sprint about 40 centimetres and dive for cover.

Sean Doody and Phillip Paull at Monash University in Clayton, Australia, poked, pinched and dropped skink eggs to simulate predator attacks. The duo found that threatened embryos escape their eggs several days earlier than unperturbed siblings. However, hatching early comes with a cost. Compared with spontaneously hatching skinks, hatchlings under threat leave more yolk behind and their bodies are about 4% shorter.

Although similar behaviour has been reported in amphibians, fish and invertebrates, this is the first report of reptiles hatching early in response to perceived predation.

Copeia 2013, 159–164 (2013)

believed the gaze was directed towards them — even if the eyes or faces were rotated to the left or right.

Although it is not clear whether this gaze bias is learned or innate, it could prove

useful in anticipating social interactions. Conditions such as autism have been linked to abnormal gaze behaviours, the authors note.

Curr. Biol. <http://dx.doi.org/10.1016/j.cub.2013.03.030> (2013)

SOLID-STATE PHYSICS

Diamonds tick like atomic clocks

Flaws in diamond crystals could make precise timekeeping more convenient.

Today's most accurate timekeeping standards are kept by clocks that contain hard-to-manufacture atomic gases. These clocks are usually placed only in specialist laboratories or on satellites, where their signals are used for applications such as communication and navigation. Dirk Englund, now at Massachusetts Institute of Technology in Cambridge, and his colleagues propose a scheme for keeping time using a diamond containing a nitrogen impurity. This defect has an oscillating electronic spin state that could be detected from the light it emits when excited by a laser, and therefore could provide a timekeeping signal. A device that relies on diamond chips would be more portable than atomic clocks, as well as easier to integrate into solid-state manufacturing.

Phys. Rev. A 87, 032118 (2013)

GEOLOGY

Quake linked to drilling

Waste water from oil and gas drilling that was pumped underground may have set off a magnitude-5.7 earthquake in the central United States.

In November 2011, a series of quakes near Prague, Oklahoma, could be felt across 17 states. A team led by Katie Keranan at the University of Oklahoma in Norman analysed the aftershocks to see how faults ruptured. Of three segments to break in the fault network, the first was located

NADAV PEZARO

within 200 metres of a shaft that had been used to inject fluid underground for 18 years. The authors conclude that changes in ground stress as the fluid built up probably caused the faults to fail.

Wastewater injections are known to have triggered earthquakes before, but this is the largest that has been tied to the practice so far, the authors say. They suggest that even a relatively small volume of fluid can lead to significant quakes many years down the line.

Geology <http://dx.doi.org/10.1130/G34045.1> (2013)

METABOLISM

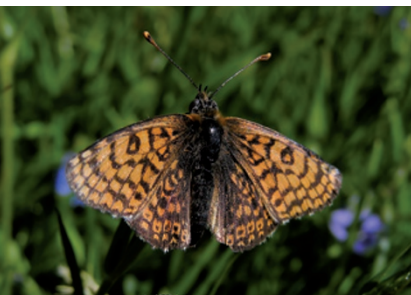
Butterflies that live fast, die old

Butterflies with speedier metabolisms may live longer.

Kristjan Niitepõld at Stanford University in California and Ilkka Hanski at the University of Helsinki measured the energy expenditure of Glanville fritillary butterflies (*Melitaea cinxia*, pictured) by placing them in chambers and recording their carbon dioxide output. Every few days, the butterflies were forced to fly in the chambers for 10-minute stretches. Butterflies with the highest rates of CO₂ production lived the longest. Field experiments in which butterflies were released and recaptured showed the same pattern. Peak metabolic rate during flight could explain up to 33% of lifespan variation.

Such results are at odds with the generalization that faster metabolisms accelerate ageing and contribute to early death. **J. Exp. Biol.** 216, 1388–1397 (2013)

PAVE VARSANEN



CANCER BIOLOGY

Targeting cancer metabolism

Compounds that inhibit mutated metabolic enzymes may shift cancer cells into a more benign state.

Mutations in two metabolic genes — *IDH1* and *IDH2* — drive the growth of some tumours. Katharine Yen at Agios Pharmaceuticals in Cambridge, Massachusetts, Ingo Mellinger at the Memorial Sloan–Kettering Cancer Center in New York and their colleagues found a compound that selectively inhibits a mutated form of the IDH1 protein. In cells that carry these mutations, the inhibitor blocked formation of a cancer-associated metabolite. The compound also delayed cell growth and prompted differentiation.

Another team led by Yen designed a compound that inhibits mutated IDH2 protein. In human leukaemia cells that bear this mutation, the compound reduced accumulation of the metabolite and prompted the cells to differentiate and mature, a transition thought to prevent cancerous growth. **Science** <http://dx.doi.org/10.1126/science.1234769>; <http://dx.doi.org/10.1126/science.1236062> (2013)

CELL BIOLOGY

Prions prompt multicellularity

Prions, pathogens that trigger catastrophic chain reactions of misfolded proteins in various diseases, can help yeast to survive in harsh conditions.

Yeast assume complex multicellular structures when resources are scarce, such as long-branching stalks when cells are starved of nitrogen, or ridges when fermentable carbon is in short supply. Researchers led by Randal Halfmann at the University of Texas Southwestern Medical Center in Dallas report that

COMMUNITY CHOICE

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SINGLE-MOLECULE DYNAMICS

Cell motors wobble to binding sites

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on www.cell.com
19 Mar–2 April

Improved high-speed imaging of single molecules shows protein motors use random motions to clamber towards their targets.

When muscles contract or cells divide, the necessary movements depend on foot-like projections of the protein myosin ‘stepping’ their way to binding sites on strands of the protein actin. Researchers led by Yale E. Goldman at the University of Pennsylvania in Philadelphia attached a dye to a myosin subunit, then used superfast switching of polarized light from multiple directions to take microsecond-scale snapshots that revealed the subunit’s orientation and rotations. After detaching from one binding site, myosin takes a forward step that propels it only about two-thirds of the distance towards the next site. Wild gyrations get it the rest of the way. The group is now using the same technique to reveal the dynamics of molecular motors involved in processes such as protein synthesis.

Biophys. J. 104, 1263–1273 (2013)

such adaptive formations occur when a protein called Mot3 forms prions, drastically changing its shape and causing other Mot3 proteins to convert to this state. The researchers show that a non-fermentable carbon source such as ethanol induces Mot3 to form prions, and a lack of oxygen eliminates them. Thus, prions can mediate how yeast cells act cooperatively in response to their environment.

Cell 153, 153–165 (2013)



TOM BEAV/GETTY

HYDROLOGY

More rain for the Central Plains

Climate change has altered the water cycle in the Upper Mississippi River Basin, producing rainier summers that send more runoff into the river (pictured).

Chris Frans at the University of Washington in Seattle and his team studied data from 1918 to 2007 and report that increasing precipitation during July and August, especially in the northwestern part of the region, raised stream flows in the Upper Mississippi. Hydrological modelling

showed that although an expansion in the amount of land cleared for agriculture did increase runoff in some parts of the basin, these changes were not enough to explain the overall trend.

The findings suggest that climate change could hamper efforts to reduce the flow of nitrogen-rich runoff from the river into the Gulf of Mexico, where the nutrients create low-oxygen ‘dead zones’.

Geophys. Res. Lett. <http://dx.doi.org/10.1002/grl.50262> (2013).

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