

# RESEARCH HIGHLIGHTS

Selections from the scientific literature

## DEVELOPMENT

### Birds' mysterious missing penises

The development of chicken penises is cut short by signals that prompt cell death, a finding that could help to explain why 97% of bird species have little or no phallus despite reproducing by internal fertilization.

Researchers led by Martin Cohn at the University of Florida in Gainesville cut tiny windows into eggs to compare developing chickens, which lack phalluses, with ducks, whose penises can be half as long as their bodies.

Chicken embryos began to form penises, but these shrank midway through development. The researchers pinned the cause on elevated levels of a protein called Bmp4, which promotes cell death, at the tip of the organ.

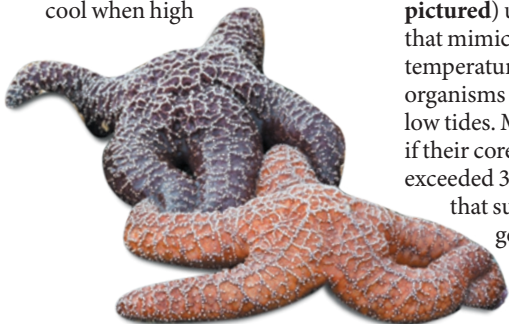
The loss of penises may have been a by-product of the evolution of other features, such as beak shape, which are also influenced by Bmp proteins, the authors suggest. *Curr. Biol.* <http://dx.doi.org/10.1016/j.cub.2013.04.062> (2013)

For a longer story on this research, see [go.nature.com/1mgn9w](http://go.nature.com/1mgn9w)

## ANIMAL BEHAVIOUR

### Sea stars shed too-hot arms

Sea stars may use their arms to keep their central cores cool when high



temperatures threaten their survival.

Sylvain Pincebourde at the University of Tours, France, and his colleagues kept ochre sea stars (*Pisaster ochraceus*, pictured) under conditions that mimicked the sweltering temperatures to which the organisms can be exposed at low tides. Most sea stars died if their core temperatures exceeded 35°C. Individuals

that survived the heating generally had arms that were hotter than their cores,

possibly because the creatures reroute body fluids into their central cavities to cool down. When their cores warmed, sea stars shed arms — consistently losing the hottest one first. *J. Exp. Biol.* 216, 2183–2191 (2013)

## CANCER BIOLOGY

### Immunity let loose

Experimental therapies that unleash the immune system to fight cancer, by blocking

'checkpoint inhibitors', continue to show promise in early clinical trials.

Immune checkpoint inhibitors prevent autoimmunity, and can rein in the immune response against tumours. Antoni Ribas at the University of California, Los Angeles, and his colleagues tested lambrolizumab, a compound that blocks a checkpoint inhibitor called PD-1, in 135 people with advanced melanoma. Tumours shrank by at least 30% in 38% of the patients.



## CLIMATE SCIENCE

### Reindeer keep the ground cool

Reindeer herding practices and their effect on vegetation in northern Scandinavia may influence when snow melts in spring.

Tall, dense shrubs can hasten snow melt in the tundra. As more branches protrude over packed snow, less sunlight is reflected off the bright surface and more heat is absorbed by the ground.

A team led by Juval Cohen at the Finnish Meteorological Institute in Helsinki used satellite observations to examine the cover of vegetation

and snow in northern Scandinavia. In Finland, where reindeer typically graze on the tundra throughout the year, snow melt begins later. In inland Norway, where the pastures are left ungrazed during summer and vegetation is taller and more abundant, the snow melts earlier.

More intense reindeer grazing could delay snow melt and reduce ground heating during spring in the rapidly warming tundra, the authors suggest.

*Remote Sens. Environ.* 135, 107–117 (2013)

In a separate study, Jedd Wolchok at Memorial Sloan-Kettering Cancer Center in New York and his colleagues, treated 86 people with advanced melanoma using two compounds: nivolumab, also a PD-1 inhibitor, and ipilimumab, an approved drug that blocks a checkpoint inhibitor called CTLA-4. Tumours shrank by at least half in 40% of the patients.

*N. Engl. J. Med.* <http://dx.doi.org/10.1056/NEJMoa1305133>; <http://dx.doi.org/10.1056/NEJMoa1302369> (2013)

## ASTRONOMY

## Trap holds protoplanet dust

Dust particles spotted around a young star support an idea about how planets are born.

Planet formation is a paradox: according to standard theory, dust grains orbiting newborn stars should spiral into those stars rather than accrete to form planets. Astronomers have suggested that there are regions, or 'pressure bumps', where density and pressure gradients trap particles long enough to allow them to clump together.

A team led by Nienke van der Marel at Leiden University in the Netherlands has observed such a trap around the star Oph IRS 48 located about 120 parsecs from Earth. The Atacama Large Millimeter/submillimeter Array in Chile detected a crescent-shaped cluster on one side of the star — probably a reservoir of coalescing dust grains (pictured as an artist's impression).

*Science* 340, 1199–1202 (2013)



## ENZYME ENGINEERING

## Serendipity outstrips design

Accelerated evolution of an artificial enzyme improved its activity several-thousand fold, owing to unexpectedly extreme remodelling of its active site.

A team led by Donald Hilvert and Nenad Ban at the Swiss Federal Institute of Technology in Zurich optimized a computationally designed enzyme with several rounds of random mutagenesis and screening. The activity levels of the evolving enzyme eventually approached those of natural enzymes, but the protein no longer catalysed its reaction using the machinery the researchers had intended. An amino-acid residue installed to help rearrange bonds was abandoned for one that emerged at another location in the active site. Such swaps could be important in natural-enzyme evolution and design efforts, the authors say. *Nature Chem. Biol.* <http://dx.doi.org/10.1038/nchembio.1276> (2013)

## MOLECULAR BIOLOGY

## Boosting plant defence

The discovery of a gene that regulates the effects of the plant hormone jasmonic acid might lead to ways to increase pest resistance in crops, without hindering their growth.

Jasmonic acid helps plants to fend off insects and pathogens; it also regulates aspects of plant development, including fertility and fruit ripening. Daoxin Xie of Tsinghua University in Beijing and his colleagues identified a gene called *JAV1* in the model plant *Arabidopsis thaliana* that suppresses several responses triggered by jasmonic acid. The *JAV1* protein was degraded when insects or fungi attacked. Silencing *JAV1* boosted plant resistance to disease, but had no adverse effect on fertility or other developmental processes. *Mol. Cell* 50, 506–517 (2013)

## COMMUNITY CHOICE

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## CHEMISTRY

## One polymer with multiple forms



An unusual material can switch between polymers from two different classes with the addition of light.

Da-Hui Qu, He Tian and their colleagues at the East China University of Science and Technology in Shanghai combined two types of molecules. Cyclodextrins form non-covalent complexes to yield supramolecular polymers, whereas coumarins form covalent bonds with each other under one wavelength of light, and release those bonds under another. The material that the researchers created could go from a supramolecular polymer to a covalent polymer and back again with the addition of light; adding a detergent produced a reversible hydrogel. Substances with switchable properties can combine advantages of distinct polymers in a single platform, the authors say.

*Langmuir* 29, 5345–5350 (2013)

## PALAEOLOGY

## Big lizard among mammals

A giant, plant-eating lizard successfully competed with mammals about 40 million to 36 million years ago.

Researchers led by Jason Head at the University of Nebraska-Lincoln identified the lizard in a diverse assemblage of fossils collected in Myanmar. The teeth and jaws of the creature revealed that it was a plant-eater, and at an estimated 27 kilograms, it was one of the largest animals in the area. The researchers dubbed the species — which was almost twice the length of any living herbivorous lizard — *Barbatorex morrisoni* after the singer Jim Morrison, who famously proclaimed himself the lizard king.

Reptiles need external heat to keep their bodies warm, so the hotter temperatures of past climates could have allowed the large lizards to survive, the authors say. *Proc. R. Soc. B* 280, 20130665 (2013)

## PLANT SCIENCES

## Tomatoes make tubers

Boosting levels of a hormone in tomato plants (*Solanum lycopersicum*) causes them to make tubers, like their sibling species the potato (*Solanum tuberosum*).

Yuval Eshed at the Weizmann Institute of Science in Rehovot, Israel, Eliezer Lifschitz at the Israel Institute of Technology in Haifa and their team engineered tomatoes to have high levels of a cytokinin, a type of hormone found in all plants. The tomatoes formed tiny tubers (pictured) at the base of leaves along their stems, where cells divide and levels of hormones fluctuate.

Giving potato plants the hormone in culture also elicited small spuds along plant stems. The authors suggest that a simple, common mechanism might prompt tubers in other species.

*Curr. Biol.* <http://dx.doi.org/10.1016/j.cub.2013.04.061> (2013)

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