

RESEARCH HIGHLIGHTS

Selections from the scientific literature

ZOOLOGY

How the sponge got its skeleton

Sponges build their skeletons using specialized cells that transport and assemble structural beams like construction workers — a novel way of producing a skeleton compared to other animals.

Sponge skeletons are made of rod-like silica structures called spicules that are cemented to rocks and to each other with collagen. To find out how the spicule assembly process works, Noriko Funayama at Kyoto University in Japan and her colleagues studied a freshwater sponge (*Ephydatia fluviatilis*) under a microscope and discovered 'transport cells' that move spicules inside the sponge. The cells then push the spicules through the animals' outer surface to raise them up and attach them together.

This process allows sponges to adopt a huge variety of shapes and sizes, the authors say.

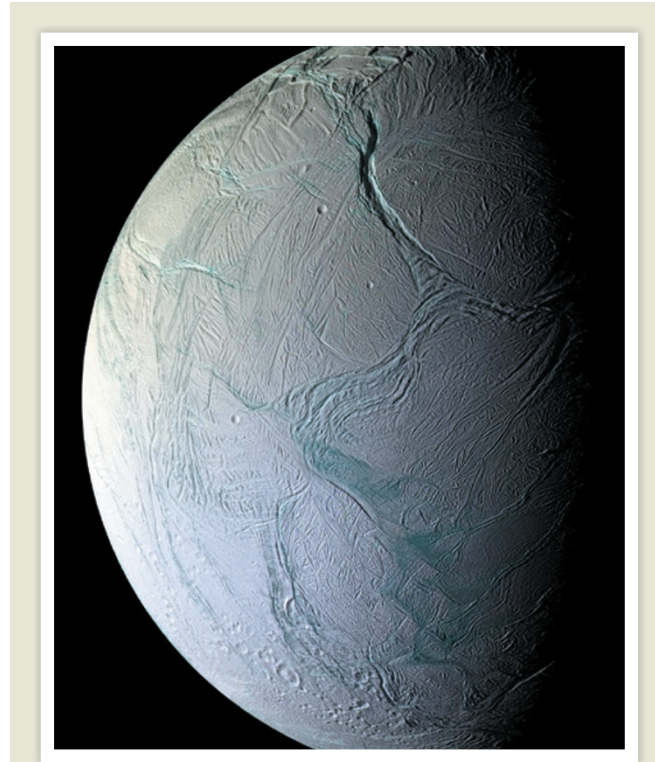
Curr. Biol. <http://doi.org/7sr> (2015)

NEUROSCIENCE

Sound switches on worm cells

Ultrasound has been used to stimulate individual brain cells in a worm. If the technique works in mice, it could be a less invasive way of studying specific neurons.

Neuroscientists currently implant probes into animal brains to stimulate cells that have been engineered to become sensitive to light. Sreekanth Chalasani at the Salk Institute for Biological Studies in La Jolla, California, and his colleagues instead introduced a pressure-sensitive protein,



PLANETARY SCIENCE

Global ocean on Enceladus

Beneath an icy crust, Saturn's moon Enceladus (pictured) has an ocean that covers its entire globe.

NASA's Cassini spacecraft measured wobbles in Enceladus's rotation over more than seven years. The data confirm that the crust is moving separately from the rocky core, meaning that there must be a widespread layer of liquid between them, says a team led by Peter Thomas of Cornell University in Ithaca, New York.

Cassini had previously spotted jets of liquid spewing from the moon's surface, and other studies have suggested that Enceladus has an underground sea only near its south pole. This latest finding further highlights how Enceladus could be one of the most likely places for extraterrestrial life.

Icarus <http://doi.org/7rf> (2015)

TRP-4, into neurons in the nematode *Caenorhabditis elegans*. They then put the worms in a Petri dish that was partially submerged in a water bath and sent a short burst of ultrasound into the dish, delivering mechanical signals to TRP-4 to activate certain neurons.

By adding the TRP-4 protein into neurons with different functions, the researchers were able to make free-crawling worms reverse direction, stop reversing or make more-frequent sharp turns in response to a brief pulse of ultrasound.

Nature Commun. 6, 8264 (2015)

NEUROSCIENCE

Electric zaps help spinal-cord rehab

Electrically stimulating a damaged spinal cord as part of rehabilitation therapy may enhance improvements in movement.

Steve Perlmutter at the University of Washington in Seattle and his team bruised the spinal cords of rats to partially paralyze the animals' forelimbs. They then used a neural-computer interface connected to the limb muscles and spinal cord to direct an electrical pulse to just below the damaged spinal area whenever the device detected activity in the weakened muscles.

Rats that received pulses for several weeks recovered their ability to reach for and grasp food pellets with their forelimbs to a greater extent than those that did not receive pulses. The stimulated rats maintained their recovery even after the stimulation was stopped, suggesting that it induced lasting changes in the spinal cord. The scientists suggest that the approach might also work in the clinic.

Proc. Natl Acad. Sci. USA <http://doi.org/7q4> (2015)

EVOLUTION

Ancient lung parts found in fish

A fish species found in the Indian Ocean has a vestigial lung, suggesting that its ancestors had working lungs before they shifted to life in deep waters.

The coelacanth fish *Latimeria chalumnae* is descended from ancient coelacanths that lived in shallow waters. Paulo Brito at Rio de Janeiro State University in Brazil and his colleagues studied the fish at different

NASA/JPL/SPACE SCIENCE INST.

stages of development, and found that a lung developed early in the embryo but then slowed its growth as the embryo matured. As the lung shrank in size relative to the growing embryo, a fatty organ that helps fish to control their buoyancy developed.

This is further evidence that ancestral coelacanths could breathe air in shallow waters, and that they lost the use of the lung as it was replaced by the fatty organ — an important adaptation to the deep ocean. *Nature Commun.* 6, 8222 (2015)

PLANETARY SCIENCE

A balmy climate on exoplanets?

Certain planets outside our Solar System could have wind patterns that produce habitable climates.

Ludmila Carone at the University of Leuven in Belgium and her team used climate models to investigate atmospheric temperatures and wind patterns on planets with Earth-like atmospheres. The chosen planets closely orbit red-dwarf stars and always face their stars with the same side. The team found 3 possible climates for planets that have orbits of less than 12 days. Two of these climates could potentially host life, because of wind jets that stop the side of the planet exposed to the star getting too hot.

The findings could help to guide the selection of exoplanets for future study, the authors say.

Mon. Not. R. Astron. Soc. 453, 2412–2437 (2015)

PLANT ECOLOGY

Orchid shapes trick male insects

Orchids have adapted the shape of their flowers to attract pollinating wasps.

These flowering plants lure male insect pollinators by producing chemicals that mimic the pheromones of

their female counterparts, but the effect of flower shape on pollinators has been unclear. To look at this, Marinus de Jager and Rod Peakall at the Australian National University in Canberra studied two species of *Chiloglottis* orchids that emit the same pheromone and the two species of *Neozeleboria* wasps that pollinate the flowers. They found that the wasps copulated more frequently and for longer periods of time (pictured) with the orchid that they normally pollinate.

The dimensions and colour of the preferred orchid's callus (the central part of the flower) closely resembled the respective female wasp, and the overall shape of the flower allowed the male wasp to fit better within it.

Funct. Ecol. <http://doi.org/7rd> (2015)

AGRICULTURE

Ecological impact of crops drops

The environmental impact of maize (corn) and cotton crops on US freshwater ecosystems has been decreasing over the past decade, mainly because of the use of genetically modified plants that require less added pesticide.

Sangwon Suh and Yi Yang at the University of California, Santa Barbara, assessed the local environmental impacts of crops, including pollution from direct runoff of fertilizers and pesticides, as well as from processing and transportation. They found that the impact of maize and cotton has decreased by about 50% over the past decade.

However, the impact of soya-bean crops has increased threefold, owing to the

spread of an invasive soya-bean pest and a consequent rise in the use of insecticides.

The authors say that further improvements may be more



SOCIAL SELECTION

Popular topics on social media

A call to deal with the data deluge

As the number of biomedical research papers continues its relentless growth, the quality and credibility of science is buckling under the weight of all the data. That is the conclusion of an article in the journal *eLife* that triggered discussion online this week. The piece, which is based on interviews with 20 anonymous US senior scientists, suggests a radical rethinking of the peer-review system to deal with the 'overflow' of data. Erik Müllers, a cell biologist at the Karolinska Institute in Stockholm, summed up the issue on Twitter: "Too many journals, too many researchers, too low quality: Overflow in #science and its implications for trust." But not everyone was

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on board. "Is there really an 'overflow' problem in science? I don't think so," tweeted Savraj Grewal, a cell biologist at the University of Calgary in Canada. *eLife* 4, e10825 (2015)



difficult, because pests and weeds are beginning to develop resistance to the pesticides produced by the modified crops.

Environ. Res. Lett. 10, 094016 (2015)

GENETICS

How Inuit genomes have adapted

The genomes of indigenous people in Greenland (pictured) show how they have adapted to thousands of years of frigid temperatures and a diet that is rich in fatty seafood.

Rasmus Nielsen at the University of California, Berkeley, and his colleagues analysed the genomes of 191 Inuit people from Greenland and compared

them with genomes from people of European or Han Chinese descent. They found that the Inuit genomes were enriched for genes that convert certain fatty acids in the diet into more biologically active forms, and that counteract the oxidative stress associated with a high-fat diet. The team also discovered a mutation in the Inuit genomes that is linked to the development of brown fat cells, which generate heat.

These mutations seem to date from at least 20,000 years ago, when Inuit ancestors lived around the Bering Strait between Russia and Alaska.

Science 349, 1343–1347 (2015)

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