RESEARCH HIGHLIGHTS

Selections from the scientific literature

ASTROPHYSICS

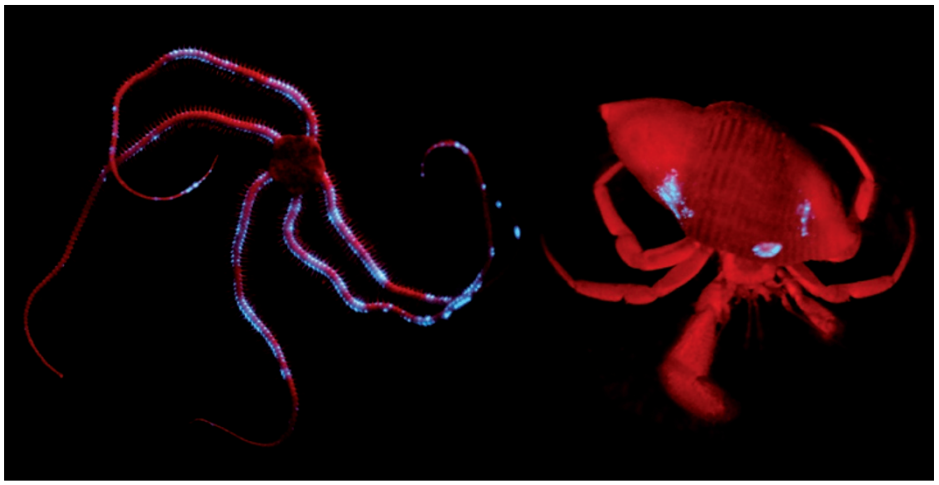
Stellar duo tests Einstein's theory

By studying the shrinking orbit of a pair of recently discovered white dwarf stars, astronomers have found further evidence that Einstein's theory of general relativity is correct.

The theory predicts that massive, accelerating objects like the two closely orbiting white dwarfs should emit gravitational waves — ripples in space-time that have never been detected directly. This release of energy, in turn, would cause the dwarfs' orbit to decay at a rate of around 0.26 milliseconds a year. James Hermes of the University of Texas at Austin and his colleagues used four telescopes to observe the dwarfs over 13 months. Their observations confirm that this is indeed roughly the rate at which the dwarfs are moving closer together.

Additional data would be needed to detect an orbital decay that deviates significantly from the rate predicted by general relativity, the team adds.

Astrophys J. 757, **L21 (2012)**



S. JOHNSEN

MARINE BIOLOGY

Glowing is rare on the sea floor

A survey of animals that live on the sea floor suggests that they are less likely to be bioluminescent than are species that swim freely at similar depths.

Sönke Johnsen at Duke University in Durham, North Carolina, and his colleagues dredged species (examples pictured) from 500–1,000 metres below the sea surface around the Bahamas, and examined them in tanks. Fewer than 20% of the creatures glowed, whereas roughly 80% of free-swimming species from similar depths are bioluminescent.

In a separate study, Johnsen, along with Tamara Frank of Nova Southeastern University in Dania Beach, Florida, and another colleague eased eight species of floor-dwelling crustacean up from the sea floor 500–700 metres down around the Bahamas and in the Gulf of Mexico.

The researchers kept the animals in light-tight boxes to protect their sensitive photoreceptors, and found that the creatures could best detect blue light — that is, wavelengths similar to those that filter through the water from the surface and are emitted by bioluminescent species. Some of the crustaceans had eyes that were sensitive to dim light, but were much less responsive to movement.

J. Exp. Biol. 215, **3335–3343; 3344–3353 (2012)**

ANIMAL COGNITION

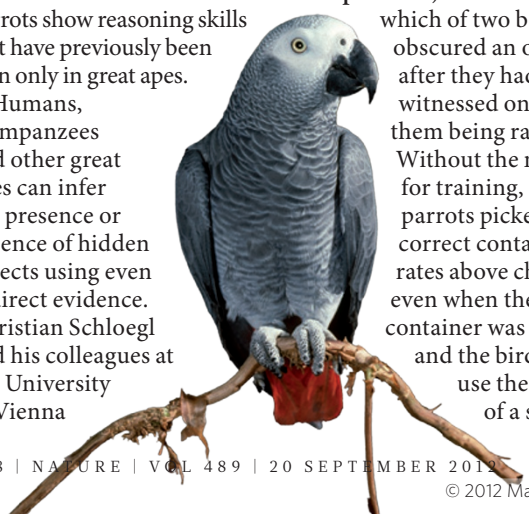
Parrots can make inferences

Parrots show reasoning skills that have previously been seen only in great apes.

Humans, chimpanzees and other great apes can infer the presence or absence of hidden objects using even indirect evidence. Christian Schloegl and his colleagues at the University of Vienna tasked six African grey parrots (*Psittacus erithacus*; **pictured**) with determining which of two boxes obscured an object after they had witnessed one of them being rattled. Without the need for training, the parrots picked the correct container at rates above chance, even when the empty container was shaken and the birds had to use the absence of a sound to guide their decisions.

Paying attention to sounds may be more important to parrots than to other animals that have failed the same test, including monkeys and dogs, the researchers suggest.

Proc. R. Soc. B 279, **4135–4142 (2012)**



S. DALTON/NATUREPL.COM

NEUROSCIENCE

Memory boost with sleep

Using external stimulation to 'replay' recent experiences during sleep can strengthen the memories of those events, according to a study in rats.

Daniel Bendor and Matthew Wilson at the Massachusetts Institute of Technology in Cambridge trained rats to run to either the left or the right in response to one of two sounds, while recording from the brain's hippocampus. As the animals slept, the researchers played the sounds again to see whether this would trigger the rats to recall the task. The duo observed signs of 'replay' by analysing the response of neurons in the hippocampus,

the brain region in which memories are thought to be consolidated.

These findings echo recent experiments in which human sensory learning improved following exposure to task-related cues during sleep, suggesting that such cues might strengthen memories.
Nature Neurosci. **http://dx.doi.org/10.1038/nn.3203 (2012)**

NANOTECHNOLOGY

Bigger rings allow thinner nanotubes

An ultrathin carbon nanotube that is stable up to temperatures of 1,000 kelvin has been predicted by a team at the Autonomous University of Madrid. The structure resembles a double helix, with alternating single, double and triple carbon–carbon bonds.

Eduardo Menéndez-Proupin and his colleagues simulated the structure and described the spectral signatures that would enable scientists to identify it experimentally. The predicted molecule is just 0.32 nanometres in diameter. Standard nanotubes this thin have never been observed, because the carbon bonds in their six-atom rings have large distortions and become destabilized as the nanotubes get thinner. The carbon rings in the predicted molecule are larger than in standard nanotubes, and the bonds are arranged such that they are less strained.
Phys. Rev. Lett. 109, **105501 (2012)**

NEUROSCIENCE

Social isolation thins neural sheath

Mice raised in isolation are unsociable and slow to learn complex tasks as adults. Failure to develop normal coatings around neurons during a crucial growth period could explain these deficits.

Gabriel Corfas at Boston Children's Hospital in Massachusetts and his colleagues found that mice isolated between 21 and 35 days old were particularly vulnerable to lasting effects. In these mice, oligodendrocytes — cells that produce the fatty layers which sheath neurons to facilitate electrical signalling — made abnormally thin sheaths in the prefrontal cortex, an area linked to sociability and memory.

In the same brain area, isolated mice showed reduced levels of NRG1, a protein that has a role in oligodendrocyte development. Mice engineered to lack an NRG1 receptor in oligodendrocytes mimicked the negative effects of isolation, suggesting that social experience might affect neural development through the NRG1 signalling pathway.
Science 337, **1357–1360 (2012)**

PLANETARY SCIENCE

Volcanic signs in Martian clays

Clay minerals on the surface of Mars (**pictured**) could be signs of previous volcanic activity rather than an indication that the planet had a warm and wet climate in the past, as has been assumed.

Clays can form when igneous rock is altered by water present at the surface or underground. But Alain Meunier at the University of Poitiers in France and his colleagues suggest that the Martian clays could have precipitated directly out of a water-rich magma, which filled voids in the igneous rock as it cooled. When the researchers analysed rocks from terrestrial lavas from a French Polynesian atoll, they found similar spectral signatures to those of the Martian clays.

The authors' suggestion — soon to be investigated by the Mars rover Curiosity — is that the planet's early climate was volcanic, but not necessarily wet.
Nature Geosci. **http://dx.doi.org/10.1038/ngeo1572 (2012)**

COMMUNITY CHOICE

The most viewed papers in science

GEOLOGY

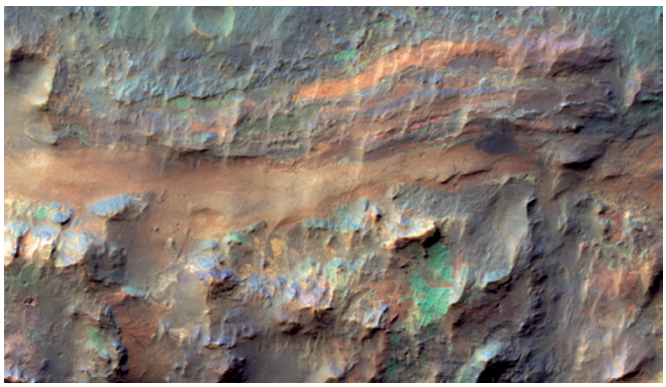
One million years of rubbing rocks

HIGHLY READ on geology.gsapubs.org in August

The strangely smooth shape of boulders in Chile's Atacama Desert, one of the world's driest locations, could be due to the rocks rubbing against each other during earthquakes.

Jay Quade at the University of Arizona in Tucson and his colleagues analysed the patterns of erosion shown by the boulders. The researchers determined that the rocks' smooth sides, and depressions in the sediment around them, could be best explained by rubbing and rocking motions experienced during earthquakes. In February 2010, two members of the team were present when an earthquake with a magnitude of 5.2 struck about 100 kilometres from their location, enabling them to observe the rocks rubbing against each other for about a minute.

Earthquakes of a similar or larger magnitude occur roughly once every four months, and the authors calculate that the boulders could have experienced 40,000–70,000 hours of rubbing over the past 1.3 million years.
Geology 40, **851–854 (2012)**



HIRISE/UNIV. ARIZONA/JPL/NASA

ORGANIC CHEMISTRY

Tagging molecules with fluorine

Attaching fluorine atoms to organic molecules is important in, for example, tweaking the properties of a drug candidate. John Groves at Princeton University in New Jersey and his colleagues have now discovered a way to substitute fluorine atoms at previously inaccessible positions in a molecule: carbon–hydrogen bonds, which are notoriously unreactive.

The researchers used a manganese porphyrin catalyst to assist the reaction, which they say requires only simple apparatus and mild conditions. They were able to fluorinate simple hydrocarbons and even complex steroid molecules with yields of up to 60%.

The technique could be used to incorporate radioactive fluorine into a wide range of biomolecules for imaging.
Science 337, **1322–1325 (2012)**

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