



PHYSICS

## Weighing the Options

Ever since the theoretical discovery of the Higgs mechanism, which endows particles with mass, the experimental evidence for the existence of the elusive Higgs boson has been a prime objective of particle physics. As the Standard Model does not predict the mass of the Higgs boson, the search has had to be undertaken in a wide parameter space, which has since been constrained to between approximately 115 and 190 GeV as a result of both direct (using the large electron positron collider at CERN) and indirect measurements. Now, Aaltonen *et al.* have combined the searches for the Higgs at the two multipurpose detectors at the Tevatron facility, CDF and D0. To detect the Higgs, they concentrated on the decay channel resulting in one positive and one negative W boson (the mediators of the weak interaction), which is favored if the Higgs mass is above 130 GeV; all Higgs production channels were taken into account. Even though they did not observe the Higgs boson, they were able to exclude a region of Higgs mass between 162 and 166 GeV using sophisticated neural network algorithms to distinguish between observed signal and background events. These analyses were performed with approximately  $5 \text{ fb}^{-1}$  worth of data; the Tevatron is scheduled to close when  $12 \text{ fb}^{-1}$  has been reached, so more results are yet to come. — JS

*Phys. Rev. Lett.* **104**, 061802 (2010).

### MOLECULAR BIOLOGY

## Acting Out of Character

The steroid receptor coactivator 3 gene, *SRC-3*, was identified in a region on chromosome 20 that was frequently amplified in breast cancer. The SRC-3 protein was shown to act in the nucleus to regulate the transcription of genes involved in growth and development. Long *et al.* report that the *SRC-3* transcript can undergo

alternative splicing to produce two proteins with distinct personalities. In comparison to the full-length protein, SRC-3Δ4 lacks exon 4, which encodes the DNA-binding domain and a nuclear localization signal. Like SRC-3, the SRC-3Δ4 isoform is overexpressed in breast cancer and other tumors, but it localizes to the plasma membrane and acts as a cytoplasmic signaling coactivator by mediating epidermal growth factor (EGF)-induced cell migration.

SRC-3Δ4 couples the EGF receptor to one of its downstream signaling effectors, focal adhesion kinase. EGF is known to promote cancer cell migration and metastasis, and overexpression of SRC-3Δ4 in breast cancer cells induced metastasis to the lymph node and lung in mice. Thus, both SRC-3 and its close relative SRC-3Δ4 are linked to breast cancer, but likely via completely distinct pathways. — HP

*Mol. Cell* **37**, 321 (2010).

### PALEONTOLOGY

## Moving by Mistake

Large macroscopic animal fossils first appear in the Ediacaran, the period just before the Cambrian, about 600 million years ago. Although there are some clear trackways closer to the Cambrian, and several purported reports of earlier tracks, most of these fossils seem to have been sessile organisms. One of the most diverse megafossil assemblages, and one of the oldest, is at Mistaken Point, Newfoundland, dating to 565 million years ago. A variety of leaf-like forms extending up to several tens of centimeters are thought to represent early suspension feeders. Liu *et al.* now report the presence of several tracks in these rocks, implying that mobile animals were also present. The tracks range up to more than 1 cm in width and extend for tens of centimeters. It seems that, together with the diverse macrofossils, Mistaken Point preserves a diverse marine benthic ecosystem at this time. — BH

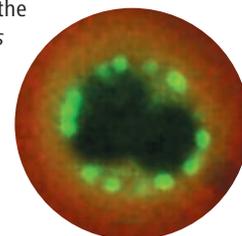
*Geology* **38**, 123 (2010).

### MICROBIOLOGY

## A Home Within a Home

Ion-motive ATP synthases are the primary producers of ATP in mitochondria, chloroplasts, bacteria, and archaea. They convert a transmembrane gradient of ions ( $\text{H}^+$  or  $\text{Na}^+$ ) into cytoplasmic ATP, and hence can only operate—in concert with the ion gradient-generating enzymes—in membranes that are relatively impermeant to  $\text{H}^+$  or  $\text{Na}^+$ . In the cases of mitochondria, chloroplasts, and Gram-negative bacteria, this is the inner membrane; the outer membrane is too leaky to support the establishment of ion gradients. Küper *et al.* report that in the archaeon *Ignicoccus hospitalis*, both the ATP synthase and

ATP synthase (green) in the outer membrane.



the  $H_2$ :sulfur oxidoreductase are located in the outer membrane. *Ignicoccus* obtains energy by reducing elemental sulfur with molecular hydrogen, and its inner membrane encloses the customary complement of DNA and ribosomes. Unlike the aforementioned organelles and cells, however, the intermembrane compartment is as large as the inner membrane-bounded cytoplasm. This sizable periplasmic space likely supports ATP-consuming metabolic reactions such as the fixation of  $CO_2$ , the sole carbon source for *Ignicoccus*. The authors point out that in an earlier age, engulfed bacteria might have found this environment hospitable. — GJC

*Proc. Natl. Acad. Sci. U.S.A.* **107**, 3152 (2010).

## PSYCHOLOGY

## How Hard Is Hard?

Rankings of incommensurable entities are often equated to comparisons of apples and oranges, the implication being that no objective answer exists. Nevertheless, subjective answers do exist, as can be demonstrated simply by asking people for their judgments. Keil *et al.* have developed a battery of 30 questions representing phenomena in the disciplines of physics, chemistry, biology, psychology, and economics; they posed these questions to students in kindergarten, the second, fourth, sixth, and eighth grades, and college. They did not ask for answers, but instead asked how hard it would be to explain these phenomena and whether they would need to consult an expert to do so. By these measures, psychology was rated as less difficult than the hard sciences and easier to learn about on one's own, although these differentials decreased with age. Economics was at first perceived to be like the hard sciences, but its ranking approached that of psychology in older students, perhaps reflecting a shift from seeing it as relying on mathematics to regarding it as a spectrum of human behaviors. — GJC

*J. Exp. Psychol. Gen.* **139**, 1 (2010).



## MOLECULAR BIOLOGY

## Spreading Barrier

DNA methylation generally functions to silence gene expression, and is most often targeted to parasitic and repeated sequences in the genome. Like other epigenetic marks, DNA methylation

may be self-propagating, which can result in its inappropriate spreading into and silencing of nearby active genes. Clearly, barriers are needed to corral such silencing marks, and in yeast these consist of specific DNA sequences. In the filamentous fungus *Neurospora*, DNA methylation is found at AT-rich repeat sequences, including transposon relics and repetitive DNA, and Honda *et al.* show that spreading of DNA methylation into GC-rich regions that contain active genes is strictly limited by the protein DNA methylation modulator 1 (DMM1) and its binding partner DMM2. DMM1 and DMM2 are concentrated at the edges of methylated and silenced regions, and this localization depends on heterochromatin protein 1 (HP1) and histone H3 trimethylated on lysine 9 (H3K9me3), both of which are also implicated in silencing. DMM1 contains a Jumonji-C domain, which is known to direct histone demethylation in other Jumonji-C-containing proteins, and critical catalytic residues are required for the barrier activity of DMM1, suggesting that it might limit spreading by removing ectopic H3K9me3 marks, which recruit HP1, at the edges of methylated silencing domains. — GR

*Genes Dev.* **24**, 10.1101/gad.1893210 (2010).

## CLIMATE SCIENCE

## Ski While You Can

Contemporary global climate change is a phenomenon defined in large part by the rapid and substantial warming it includes. During the last glacial period, the climate of the Northern Hemisphere experienced numerous rapid, large warming episodes, termed Dansgaard-Oeschger (DO) events after the Danish and Swiss researchers who documented them through ice-core studies. Can the past be used to help us understand what other impacts modern global warming may bring? In an attempt to garner such insight for the American Southwest, Asmerom *et al.* present oxygen isotopic data from a well-dated stalagmite recovered from central New Mexico. The oxygen isotopic composition of calcite in this speleothem is a proxy for the relative amounts of summer precipitation (from the Gulf of Mexico) and winter precipitation (from the Pacific Ocean) received at the sample site. What the authors find is an excellent match to the record of DO events, which they interpret as a result of a shift of the polar jet stream and Northern Intertropical Convergence Zone to the north during warm periods. This change in turn causes a reduction in winter precipitation and consequently greater aridity. If that same response to warming occurs in the future, an already drought-prone region could become even drier, with significant consequences for the population that lives there. — HJS

*Nat. Geosci.* **3**, 114 (2010).

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# Science

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