

## ECOLOGY

### Conservation Calculation

Conservation of biodiversity costs money. Not only do the long-term preservation and/or restoration of habitats require investment, the acquisition of lands may be required too. Priority areas for conservation tend to be designated on the basis of their biodiversity value (e.g., the range of species present or the degree to which species and habitats are threatened) or their ecosystem services value (e.g., forest cover or water quality), but the economic costs and the return on investment (ROI) in terms of wider conservation goals are often given less attention. To address this gap, Withey *et al.* developed an economic model aimed at maximizing the ROI on the cost of the acquisition of lands for conservation, using vertebrates in the United States as the target of their analysis (though it could be applied to other organisms and regions too). Their model, which addresses the contribution that local land acquisition can make to vertebrate conservation at the wider regional scale, takes into account factors such as land costs, threats of land conversion for development, species richness, and the proportion of species ranges that are already protected elsewhere. Although local initiatives remain fundamentally important to conservation efforts, this approach can improve on the effectiveness of conservation that is based solely on local species richness or cost. — AMS

*Ecol. Lett.* **15**, 10.1111/j.1461-0248.2012.01847.x (2012).



## CELL BIOLOGY

### Recycle to Survive

The proteasome is essential for the controlled degradation of proteins in all cells. Although it is well established that proteasome inhibition is lethal, the underlying mechanism is less clear. Working in yeast, mammalian cells, and flies, Suraweera *et al.* found that proteasome inhibition caused a critical shortage of amino acids, leading to cell death. Cells could cope with high levels of undegraded proteasome substrates, but not with the resulting depletion of key amino acids. The lethality of proteasome inhibition was rescued upon amino acid supplementation. Furthermore, the shortage of select amino acids induced autophagy when the proteasome was inhibited, linking proteasome impairment and autophagy induction. Thus, the proteasome serves a basic housekeeping function as a recycling machine, beyond a simple waste disposal system, and it is the lack of critical amino acids that kills cells when the proteasome is compromised, not the accumulation of protein waste. — SMH

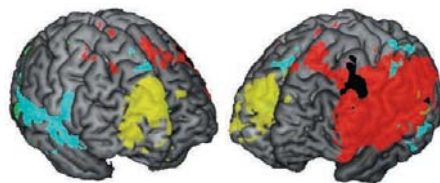
*Mol. Cell* **47**, 10.1016/j.molcel.2012.08.003 (2012).

## NEUROSCIENCE

### Mapping the Prefrontal Cortex

Although the human brain's prefrontal cortex (PFC) has been studied for decades, theories about a valuation network and a cognitive

control network—both hypothesized to reside in the PFC—have only recently emerged, and their precise distinction is still unclear. Furthermore, cognitive control, once considered a unitary construct, is now thought to fractionate into distinct executive functions whose neural correlates remain elusive. It is thus still an unanswered question how these processes map onto distinct or possibly overlapping sectors of the PFC. Glaescher *et al.* applied several new statistical mapping approaches to a sample of 344 lesion patients that had received an array of neuropsychological tests of executive functions and value-based decision-making. Background data regarding IQ, memory, and other cogni-



tive functions within individual subjects were also analyzed. The authors described detailed maps of PFC regions that are essential for different executive functions. One set involving the dorsolateral PFC and the anterior cingulate cortex is associated with a common performance factor related to flexibly switching between task and response sets, a hallmark of cognitive control. Another set involving the orbitofrontal

cortex, ventromedial PFC, and frontopolar cortex is involved in value-based decision-making. This study details the essential neuroanatomical substrates of some of the highest brain functions and provides insights about the extent to which they are distinct or overlap. — PRS

*Proc. Natl. Acad. Sci. U.S.A.* **109**, 14681 (2012).

## VIROLOGY

### An Atlas of Epstein-Barr Virus

Epstein-Barr virus (EBV), which has been associated with B cell lymphomas, gastric carcinomas, and nasopharyngeal carcinoma, may be responsible for ~1% of all human cancers. Arvey *et al.* have pooled data from nucleosome positioning maps and viral protein-binding analyses with more than 700 publicly available high-throughput sequencing data sets from human lymphoblastoid cell lines to generate a large-scale functional genomics atlas of the virus. Although much of the data was already publicly available, it was scattered, and has now been integrated in a highly usable form. Their analysis revealed possible regulatory domains within the viral genome and combinatorial control of viral gene expression by human transcription factors. There were also indications of three-dimensional organization, including loop formation between the viral origin of latent replication and latent membrane proteins 1 and 2, linked by human transcriptional repressor CTCF and cohesin. B cell specificity factor

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Pax5 was shown to bind to EBV terminal repeats, and depletion experiments showed that Pax5 is involved in the regulation of EBV transcription during latent infection. — BJ

*Cell Host Microbe* **12**, 233 (2012).

## OCEAN SCIENCE

**A Drop in the Ocean**

Observations from over the past 130 years show that global mean sea level has been rising by an average of about 1.7 mm/year and by about 3 mm/year over the past 20 years. Projections of future global mean sea level essentially all agree that this rise will continue as climate warms, mostly because of increasing ocean volume caused by the melting of glaciers and ice sheets, as well as the volume increase due to the thermal expansion of the global ocean. Superimposed on these trends are other variations, both positive and negative, caused by large-scale ocean-atmosphere processes such as the El Niño–Southern Oscillation. Boening *et al.* report that global mean sea level dropped by 5 mm during 2010 and 2011 because of an increase in terrestrial water storage caused by changes in global precipitation patterns accompanying the transition from El Niño conditions in 2009–2010 to a strong La Niña in 2010–2011. The increase in terrestrial water storage occurred mostly in Australia, northern South America, and Southeast Asia. This drop will probably be temporary, though, as runoff to the ocean moves that water back from where it came. — HJS

*Geophys. Res. Lett.* **10.1029/2012GL053055** (2012).

## ASTRONOMY

**A Positive Influence**

It is thought that most, if not all, large galaxies host massive black holes at their centers. These black holes become luminous when they accrete matter from their immediate surroundings, and during these phases of active accretion, they are thought to influence the evolution of their galaxies' stellar populations (see Volonteri, Special Issue Review, 3 Aug. 2012, p. 544). Whether this influence is positive or negative (i.e., whether black hole accretion suppresses or induces star formation) is a matter of current debate. By combining observations obtained with the European Space Agency's Herschel Space Observatory with data from NASA's Spitzer Space Telescope, Barthel *et al.* inferred the star formation rates for three extremely massive galaxies, whose central

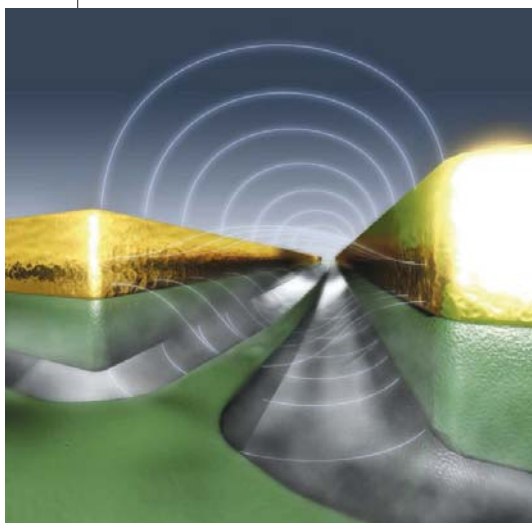
massive black holes are being fed at a high rate. Analysis of these galaxies' spectral energy distributions implies that they are all forming stars at exceptionally high rates, showing that powerful black hole accretion and vigorous star formation can occur simultaneously, at least in the most massive galaxies. — MJC

*Astrophys. J.* **757**, L26 (2012).

## APPLIED PHYSICS

**Getting Resonators on Q**

Micro- or nanomechanical resonators find application in a broad range of devices, from mass and chemical sensors to mirror arrays that can dissect and direct multiple light beams to specific targets for adaptive optics and optical communication. Their mechanical response,



however, tends to be fixed by their geometry. Often, the application is to a spectrum of chemical or biological species that may be sampled, requiring a range of frequencies to be measured. That then requires an array of resonators, structured rather like the strings on a harp of different geometry with varied length and thickness, and tuned to a specific frequency. Although some tunability of a single resonator has been demonstrated via electrical actuation, the frequency range of tunability is made at the expense of sensitivity of the resonator (as measured by the  $Q$  factor). Rieger *et al.* present a technique based on dielectric actuation and microwave readout for a single silicon-nitride string and show that the resonant frequency can be tuned over a relatively large frequency range and yet still maintain high  $Q$  factors. A single-stringed (micromechanical) instrument with the function of a multistringed harp would offer simplicity in device design. — ISO

*Appl. Phys. Lett.* **101**, 103110 (2012).