



ECOLOGY

## Narrow Niches and Nowhere to Go

Studies of the changing distributions of plant species under contemporary climate change tend to not take into account the often quite specialized requirements of plants for soil composition, pollinators, and regeneration conditions. A good example is plant species found on serpentine soils, which are generally restricted geographically. Damschen *et al.* revisited the rich but narrowly restricted floras on serpentine in the Siskiyou Mountains in the northwest United States, first studied 60 years ago by the ecologist Robert Whittaker. They found striking changes in the species composition of herbaceous communities, with the strongest declines in the more-specialist serpentine species, which have no suitable neighboring habitat to migrate to. The plant communities are becoming more characteristic of drier, warmer habitats, and with fewer, more widely tolerant species. Besides showing how climate change may pose special risks to the floras of hot spots of endemic species, this work illustrates the increasing power of long-term ecological records in illuminating the effects of climate change on biota. — AMS

*Ecology* **91**, 3609 (2010).

MOLECULAR BIOLOGY

## Less Expression from X

Sex is genetically determined in many organisms and has often involved the evolution of specialized sex chromosomes—the X and Y chromosomes in mammals, for example. The sex chromosomes originally evolved from a pair of normal chromosomes, or autosomes. To balance gene dosage between mammalian female (XX) cells and male (XY) cells, one of the pair of female XX chromosomes is inactivated, a process known as X inactivation. Because dosage compensation can involve inactivating or reducing gene expression on the X chromosome, it has been hypothesized by Susumu Ohno that, during evolution, gene expression on an individual X must have been boosted chromosome-wide by a factor of 2 to balance expression with the (paired) autosomes, giving an X:AA expression ratio of 1.

Xiong *et al.* have used publicly available RNA sequencing data, which they demonstrate is more sensitive than equivalent microarray-based analyses, to measure the X:AA expression ratio across

several mouse and human tissues. They find that the ratio is consistently lower than 1, and the average falls close to 0.5, which is inconsistent with Ohno's hypothesis. Proteomic data also support an expression ratio of ~0.5 in mice and worms. The apparent absence of expression equalization between the sex chromosomes and autosomes suggests that new models are needed to explain dosage compensation. — GR

*Nat. Genet.* **42**, 1043 (2010).

MATERIALS SCIENCE

## A Stressful Situation

We typically think of fluids as materials that flow when stressed. Water and honey, for instance, can both be poured, even though the flows occur on different time scales because of differences in viscosity. However, some fluids, such as mayonnaise or tomato paste, show yield properties that are typically associated with a solid. When undisturbed, they withstand the force of gravity and do not flow out of a container, and when gently pushed and released they elastically return

to their original shape. Reliable measurements of the yield stress are difficult to obtain and can vary considerably from one technique to the next. Fall *et al.* measured the rheological behavior of emulsions of surfactant-stabilized oil droplets in water. For this simple fluid, the yield stresses measured through increasing or decreasing shear stress sweeps, i.e., in going from/to a solid or static state to/from a liquid or dynamic one, were the same. However, most real yield-stress fluids are thixotropic: Induced flow temporarily changes the internal structure of the fluid, so that the viscosity also depends on the shear history. The authors achieved this property by adding clay particles to their emulsions, which linked together the oil droplets. In this composition, the transition is complicated by the constant rejuvenation and breakdown of the aggregates under changing flow conditions. However, the authors found that by measuring the lowest stress under which steady-state flow occurs, they could define a dynamic yield stress, which also provides valid measurements for simple fluids. — MSL

*Phys. Rev. Lett.* **105**, 225502 (2010).

## APPLIED PHYSICS

## Hitting the Spot in 3D

High-density optical storage media, high-resolution spectroscopy, and surface imaging rely on the ability to focus a beam of light to as small a spot as possible. There are limitations, though, to how small a spot can be made. Certain tricks can be used, such as manipulating the phase of the incident light, so that interference effects can bring the size down close to and even beyond the diffraction limit. Because the light is incident from just one side, such tricks tend to concentrate on focusing the spot only in the two-dimensional (2D) plane and ignore the out-of-focus features along the optic axis. To provide focusing in a small volume, *Mudry et al.* address the asymmetry of light incidence by placing a mirror behind the focal plane. Their trick is to apply a time-reversal process, which just means that the illumination wavefront is shaped with a spatial light modulator so that the incident and reflected beams converge at the same point. Such a technique of focusing light to a small volume should be useful in 3D imaging applications. — ISO  
*Phys. Rev. Lett.* **105**, 203903 (2010).

## ASTRONOMY

## X-ray Vision

In 2008, the Fermi Large Area Telescope detected a pulsar based solely on its gamma-ray pulsations. Now, using the XMM-Newton space-based telescope, *Lin et al.* and *Caraveo et al.* have revealed that this source, PSR J0007+7303, also pulsates in x-rays. Pulsars are magnetized, rapidly rotating neutron stars; like lighthouses, they appear to flash periodically as their beams of electromagnetic radiation cross our line of sight. For many decades, the vast majority of pulsars astronomers knew about were detected through their radio emission. PSR J0007+7303 was only the second radio-quiet pulsar to be detected in gamma rays; now it is also the second radio-quiet gamma-ray pulsar to show x-ray pulsations.

These observations help build a more complete picture of this pulsar. The x-rays are believed to stem from both the heat of the neutron star's surface and from relativistic particles in the star's magnetosphere, which are also the origin of the gamma rays. In the case of PSR J0007+7303, the heat component appears to dominate; the



x-ray pulsations possibly originate from a hot spot on the neutron star's surface, which is heated by return currents from the magnetosphere. — MJC

*Astrophys. J.* **725**, L1; L6 (2010).

## IMMUNOLOGY

## You Are What You Eat

Oligosaccharides modified by the addition of a sialic acid to lactose are a major component of milk. These sialylated sugars may act to shape the composition of the gut microflora in neonatal mammals, because they can act as a food source for colonizing bacteria. By comparing mice nursed by wild-type mothers to mice nursed by mothers deficient in sialyl( $\alpha$ 2,3)lactose, *Fuhrer et al.* found that the absence of just this one milk sugar reduced the sensitivity of the mice to acute colitis induced several weeks after weaning. Mice fed sialyl( $\alpha$ 2,3)lactose-deficient milk had an altered composition of their intestinal microflora as compared to mice fed normal milk, suggesting that differences in bacterial colonization may have shaped the later susceptibility to gut injury. These results suggest that besides providing passive immunity to the newborn, milk components may act to shape gut colonization by commensal microflora and thereby affect subsequent immune responses, for better or for worse. — KLM

*J. Exp. Med.* **10.1084/jem.20101098** (2010).

## MOLECULAR BIOLOGY

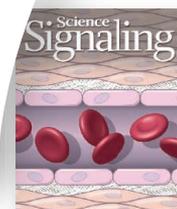
## RNAs Amplify

Eukaryotic unicellular ciliates contain two nuclei, a micronucleus and a macronucleus. After sexual reproduction, the macronucleus is derived from the micronucleus through DNA rearrangements, which include gene processing, the removal of all noncoding material, and the amplification of the exons of coding genes. *Heyse et al.* and *Nowacki et al.* now investigate the influence of RNAs on gene amplification within the macronucleus of the ciliates *Stylonychia* and *Oxytricha*, respectively. Both groups found that DNA copy numbers decreased when additional complementary RNAs were added and increased upon the addition of anti-complementary RNAs. Future

studies should describe the underlying mechanism behind these results and determine whether RNA-mediated DNA amplifications and reductions are limited to the ciliates or also occur in other organisms. — LMZ

*Proc. Natl. Acad. Sci. U.S.A.* **10.1073/pnas.1009284107; 10.1073/pnas.1012236107** (2010).

## Call for Papers



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