EDITED BY KRISTEN MUELLER AND JAKE YESTON

ECOLOGY

Hibernators Take It Slow

Hibernation is thought to have evolved as a strategy for avoiding extreme environmental conditions in seasonal climates. Hibernators, however, are also found in the tropics and will sometimes continue to hibernate after mild conditions, and plentiful food, return. Other forces, therefore, may act to make hibernation, which is present in nearly half of all mammalian orders, a common strategy. Hibernation lowers metabolism and conserves energy, but as animals enter hidden dens and burrows to hibernate, it also removes them from the external environment, perhaps affecting survival. Turbill *et al*. reviewed the published literature on 19 species of mammalian hibernators and found that, indeed, annual survival and total life span in hibernating mammals are greater than they are in nonhibernators of the same size. Hibernators also have a "slower pace of life," including a delay in maturity, lower annual reproductive output, and longer generation time. This analysis suggests that small hibernating mammals may trade high annual reproduction for a longer reproductive life, a successful life history strategy that is seen more often in large, long-lived mammals. — SNV

Proc. R. Soc. London Ser. B **278**, 10.1098/rspb.2011.0190 (2011).

BIOMEDICINE

Signs of Rejection

Recipients of heart transplants are treated with powerful immunosuppressants to prevent organ rejection, but complications still occur. Early signs of rejection are often monitored by an invasive procedure that requires heart tissue biopsy. A noninvasive diagnostic test was recently approved in the United States, in which blood cells from heart transplant recipients are monitored for the expression of genes associated with immune-mediated rejection.

Snyder *et al*. have designed a potentially complementary noninvasive test based on the concept that during organ rejection, dying cells in the organ release donor DNA that might be detectable in the recipient's bloodstream by high-throughput sequencing methods. In a small proof-of-principle study of archived blood samples from heart transplant recipients, the authors showed that the level of cell-free donor DNA in the recipient's blood increased substantially when there was an acute cellular rejection episode and then declined again once the patient received more aggressive treatment. Although an encouraging start, the predictive value of this test will become clear only from much larger studies in which its performance is compared with that of biopsies and with conventional clinical measures of heart function, such as echocardiograms. — PAK

Proc Natl. Acad. Sci. U.S.A. **108**, 10.1073/pnas.1013924108 (2011).

MOLECULAR BIOLOGY

A Complicated Start

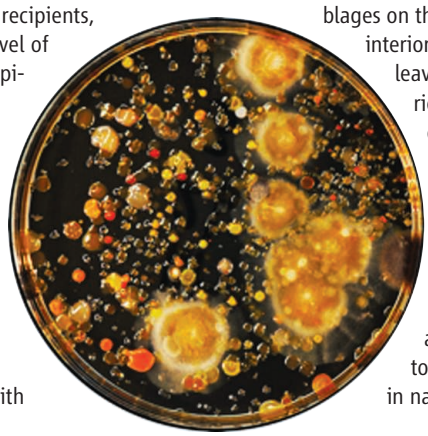
In the eukaryotic cell nucleus, DNA is compacted through its association with histone proteins. These are assembled into octomers to form nucelosomes; "linker" DNA connects nucleosomes and is associated with histone H1. DNA-histone interactions must be modified, however, for transcription to occur. Although much is known about transcription-induced changes to core histones, how linker histones are affected is less understood. Vicent *et al*. examined histone H1 dynamics at hormone receptor target genes and showed that four enzyme complexes act immediately after hormone induction. First, the ASCOM complex induces an activating H3K4me3 signal, which is increased by displacement of the demethylating complex KDM5B. This is followed by the rapid recruitment of the ATP-dependent NURF remodeling complex, CDk2 promoter binding and phosphorylation, and displacement of histone H1. Finally, the core histone proteins are displaced to allow access to hormone receptor target genes. Thus, substantial enzymatic complexity is required for the "eviction" of linker H1 to set up a remodeled chromatin template for regulated gene expression. — BAP

Genes Dev. **25**, 10.1101/gad.621811 (2011).

EVOLUTION

Location, Location, Location

Experimental studies of bacteria-phage interactions can model both disease evolution and coevolutionary theory. Koskella *et al.* used DNA sequencing to compare the bacterial assemblages on the surface and in the interior of horse chestnut tree leaves, and then used a series of cross-inoculation experiments to assess both the strength and spatial scale of phage adaptation to local bacterial populations. From this, they found that the spatial scale at which phages adapt to parasitic bacteria in natural communities



CREDITS (TOP TO BOTTOM): GEORGE MCCARTHY/CORBIS; BRITT KOSKELLA AND ZACHARY BURTIS

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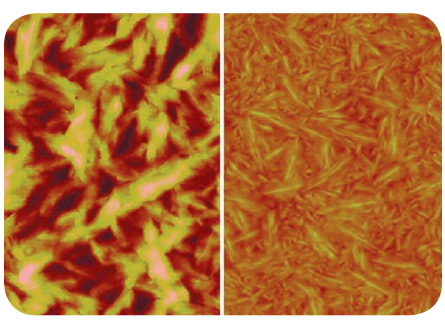
depends on the host environment in which the phage-bacterial interaction occurs. The tree, rather than the individual leaves on a tree, best explained phage local adaptation for both the exterior and interior leaf surface. The degree of adaptation varied by location, however, with phage from the leaf interior showing higher adaptation as compared to those from the leaf exterior. These differences could not be explained by the differences in host bacterial compositions between the two sites. Thus, even across micrometers, the local environment affects the degree and spatial structure of adaptation and probably plays a role in coevolution. — LMZ

Am. Nat. **177**, 440 (2011).

MATERIALS SCIENCE

Silicon Goes Organic

Though organic- (i.e., predominantly carbon-) based solar cells are less efficient than their inorganic counterparts, they have the advantage of being processed from solutions and thus can be fashioned at large scale on curved or flexible substrates. Graham *et al.* explored the use of polydimethylsiloxane (PDMS) as a solvent additive for improving organic solar cell performance



without the need for subsequent thermal or solvent annealing steps. Low concentrations of PDMS were added in the fabrication of cells, with thiophene and isoindigo-containing oligomers as the electron donor and $PC_{61}BM$ as the acceptor. There was significant variation in the efficiencies of the cells obtained in each of the three labs where the experiments were performed, but in all cases the addition of PDMS improved the cell performance and decreased the variability between cells fabricated within a single lab. The PDMS strongly altered the film morphology, with a decrease in roughness and feature size (as shown left to right above), and reduced the need for postfabrication thermal annealing. Because plastic syringes are commonly used for fabricating organic solar cells, the variability in reported efficiencies may be partly due to syringe-derived PDMS contamination. — MSL

ACS Appl. Mater. Interfaces **3**, 10.1021/am2000328 (2011).

CREDIT: GRAHAM *ET AL., ACS APPL. MATER. INTERFACES* **3**, 10.1021/AM2000328 (2011)

PLANETARY SCIENCE

Hammering Rims into Place

Chondrites, the most primitive of meteorites, are fragments of parts of asteroids that never melted or suffered substantial alteration and thus sample the materials from which the solar system formed. They contain millimeter-sized grains called chondrules, which are surrounded by rims of finer grains. How these rims formed has been a matter of debate. Did they sample dust accreted onto the chondrules while these were still freely floating in the early protoplanetary nebula, or did they suffer alteration after the chondrules were incorporated into the meteorite's parent asteroid? To solve this question, Bland *et al.* used 3D electron backscatter diffraction to look at the preferred orientation of grains around the chondrules in a chondritic meteorite. Away from the chondrules, grains share a single preferred orientation that suggests they were compressed while in the asteroid. In the rims, in contrast, the grains have different orientations, which are spherically symmetric, centered on the chondrules. The analysis suggests that the rims were emplaced outside the parent asteroid and oriented themselves in response to gentle collisions in the protoplanetary nebula. — MJC

Nat. Geosci. **4**, 244 (2011).

CHEMISTRY

Isotopes Spinning Apart?

The fractionation of a mixture of stable isotopes is typically governed by mass differences. A few processes, however, exhibit a mass-independent effect, such as the impact of molecular symmetry on oxygen isotope fractionation during the formation of ozone in the atmosphere. The effects of an external gradient on isotopic fractionation are not as well understood, but recent experiments have demonstrated that under certain conditions, O_2 gas shows signs of mass-independent fractionation along a thermal gradient. Building on these efforts, Sun and Bao systematically examined possible factors controlling this phenomenon in O_2 and SF_6 gases to determine a physical mechanism. In both cases, the experimental data are consistent with the temperature gradient manipulating the different isotopes in accord with their associated differences in nuclear spin (as distinct from mass). Because the mechanism operates for two gases with very different molecular and nuclear configurations, it could be common among low-density gases with spin differences, such as those abundant in molecular clouds or solar nebulae (e.g., CO and H_2O). — NW

Rapid Commun. Mass Spectrom. **25**, 765 (2011).

Silicon Goes Organic

Marc S. Lavine

Science **332** (6027), 285.
DOI: 10.1126/science.332.6027.285-a