

ECOLOGY

Communal Convergence

Mutualistic interactions between related or unrelated species are widespread in ecological communities, yet their contribution to community structure is poorly understood as compared to those of other drivers such as competition and phylogenetic relationships. Elias *et al.* have studied the effects of mutualistic interactions between neotropical ithomiine butterfly species, which form mimicry complexes with convergently evolved, brightly colored wing patterns that advertise toxicity to predatory birds. The mutualistic benefit between the butterfly species in a mimicry complex lies in the shared cost of “educating” predators. By studying 58 species in eight different complexes at a rainforest site in Ecuador, they were able to tease apart the relative effects of competition, phylogeny, and mutualism and showed that the adaptive benefits of mimicry drive increased ecological similarity between species—the opposite, in fact, from the effects of competition on community composition. — AMS

PLoS Biol. **6**, e300 (2008).

BIOMEDICINE

Deadly Exposure

In the Northern Hemisphere, winter is coming; so too are the seasonal episodes of cold and flu. With such a wide range of viruses causing a multitude of human and animal diseases, there remains a lucrative market for drugs that can target multiple classes of viruses and hence boost the current armory of antiviral therapies. The challenge is to develop therapies that are specific, yet avoid stimulating drug resistance.

When viruses hijack intracellular machinery in order to replicate, they alter the infected host cells, making them more visible to the immune system or to specific drugs. Phosphatidylserine is an abundant phospholipid that is actively maintained on the inner side of the plasma membrane, but under certain conditions the asymmetrical localization of this and other aminophospholipids is lost. Soares *et al.* reasoned that infected cells might also expose hidden lipids, which could be used as drug targets. Indeed, they found that four different viruses, including influenza A, induced infected cells to expose phosphatidylserine on their outer surfaces, which could then be recognized by the mouse/human chimeric antibody bavituximab. Animals that had been infected with

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lethal doses of Pichinde virus or cytomegalovirus were saved by bavituximab treatment, which caused cytotoxicity of virus-infected cells. — HP*
Nat. Med. **14**, 1357 (2008).

PHYSIOLOGY

Cockroach Strategies

Household cockroaches, which in northern climes are most often *Periplaneta americana* or *Blattella germanica*, are much maligned as pests despite their fascinating neurobiology. They are also survivors par excellence—as anyone who has tried to swat one well knows, the cockroach skitters away in some unexpected direction and disappears out of sight. The choice of escape trajectory must be sufficiently variable so that a predator cannot learn to predict which way the prey will run. Yet the range of potential trajectories should also exclude, in a nonrandom manner, running toward the source of danger. Domenici *et al.* determined which bearing cockroaches chose by recording multiple escape trajectories of five *P. americana*

individuals in response to a wind stimulus (perhaps somewhat similar to the bow wave of a rapidly approaching rolled-up newspaper). They found that the wily little insects first turned away, and then raced along one of four preferred trajectories, of approximately 90°, 120°, 150°, and 180° relative to the stimulus, and that these results were representative of the experimental cockroach colony (86 residents). Radial coordinate analysis of previously published escape data revealed similar, though not identical, preferred escape trajectories. Though these routes are not random and are limited in number, they clearly suffice for the cockroach to live another day. — GR

Curr. Biol. **18**, 1792 (2008).

CHEMISTRY

Straight-Ahead Synthesis

One regrettably common source of inefficiency in the synthesis of complex organic molecules is the need to apply successive oxidation-reduction cycles. In principle, a synthesis could proceed by preparing fragments of the molecule in more or less final form and then linking them together in the proper order. In practice, however, this strategy often leaves dangling groups in the wrong orientation or fails to provide reliable linkage sites at intermediate stages. Fragments incorporated into the partial

Catch me if you can!



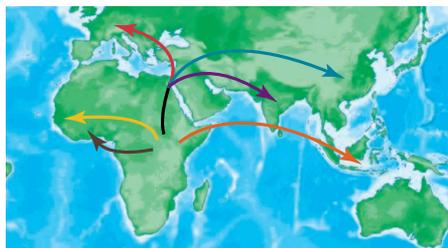
framework must then be modified, often through redox transformations, to facilitate further assembly, after which they must somehow be retransformed into their previous, proper state. Nicewicz *et al.* have skirted this dilemma in the assembly of the intricately oxygenated core of zaragozic acid C. Taking advantage of a silyl glyoxylate reagent that can self-couple by acting successively as an electrophile and nucleophile, the authors built up the core through several straightforward carbon-carbon bond-forming steps. They could then complete the overall construction of the molecule with minimal application of redox modifications, highlighting the potential of the approach for general synthetic efficiency. — JSY

J. Am. Chem. Soc. 10.1021/ja808347q (2008).

MICROBIOLOGY

Of Migrations and Variations

Once it was thought that *Mycobacterium tuberculosis* was genetically uniform. However, global surveys of clinical samples have shown that like other human-specific pathogens, it has a marked biogeography. Hershberg *et al.* have compared 90 genes in over 100 strains of the tuberculosis bacterium and established that the geographic varia-



Phylogenetic dispersion to Europe (red), China (blue), and India (purple).

tion has arisen as a consequence of human migrations over the millennia—first by land out of Africa 50,000 years ago and then by sea back to Africa over the past few centuries—and subsequent genetic drift rather than immune selection. In the apparent absence of purifying selection, many of the mutations are retained and result in nonsynonymous changes in amino acids, which are likely to have functional effects. It is not clear how *M. tuberculosis* tolerates the potentially deleterious consequences of genetic drift, but this cryptic variation needs to be taken into account in vaccine and drug design. — CA

PLoS Biol. 6, e311 (2008).

SIGNAL TRANSDUCTION

Suntanned to Death

Cells with DNA damage caused by ultraviolet radiation can become cancerous. Normally, cells damaged by excessive exposure to sun-

light are eliminated when they undergo programmed cell death or apoptosis. The protein kinase Rho-associated kinase (ROCK) has been implicated in promoting apoptosis in various cell types. To explore how it might do so, Ongusaha *et al.* identified proteins that preferentially associated with ROCK in cultured human embryonic kidney cells that had been exposed to radiation. One such protein was c-Jun N-terminal kinase (JNK)-interacting protein 3 (JIP3), a scaffold protein that regulates the activity of JNK, a protein kinase that can promote apoptosis. ROCK phosphorylated JNK in vitro, and pharmacological inhibition of ROCK in cultured cells blocked the association of JIP3 with ROCK and also the phosphorylation of JIP3 in response to irradiation. Epidermal cells from ROCK^{+/-} mice, which have about half the normal amount of ROCK, showed decreased phosphorylation of JNK and decreased apoptosis after exposure to ultraviolet radiation. Thus, the authors propose that signaling from ROCK to JNK through JIP3 may constitute an important part of the cell death pathway that gets rid of damaged skin cells and protects organisms from skin cancer. — LBR

Sci. Signal. 1, ra14 (2008).

GEOLOGY

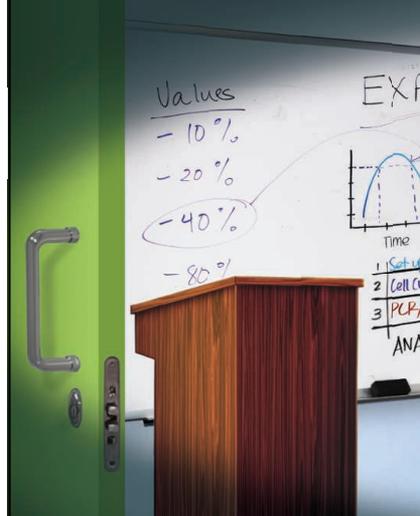
Volcanic Vetting

Two major extinctions, at the end of the Permian and end of the Cretaceous, appear to have been coincident with massive volcanic eruptions, of the Siberian and Deccan flood basalts respectively. Two studies provide tighter constraints on these associations, the duration of these events, and their potential climatic consequences. Reichow *et al.* provide new Ar-Ar dates on the main eruption of the Siberian flood basalts. The data imply that the eruptions occurred in less than 2 million years, and perhaps a few hundred thousand years, beginning shortly before the extinction (about 250 million years ago) and extending into it. Chenet *et al.* analyzed paleomagnetic data through individual flows in the upper part of the thick Deccan sequence. Their data show that many separate flows have the same paleomagnetic direction, implying that they erupted together in a time shorter than the inferred drift of the orientation of Earth's magnetic field. Four thick packages of flows may have each erupted in as little as a few decades, and the 1200-m section sampled, containing some soil layers, may have formed in less than 100,000 years. Such rates would have emitted copious amounts of sulfur dioxide. — BH

Earth Planet. Sci. Lett. 10.1016/j.epsl.2008.09.030 (2008); *J. Geophys. Res.* 113, B04101 (2008).

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