Poison ivy (above) and poison oak (right).

IMMUNOLOGY

Managing Contact Dermititis

Mast cells are traditionally, and perhaps unfairly, associated with the unwanted face of immunity: namely allergies. Yet these cells perform a variety of vital front-line roles, from ejecting worms from the gut, to regulating T cell responses, to protecting us against the toxic effects of animal venoms. Grimbaldeston *et al.* extend this list of virtues to the attenuation of skin inflammation caused by toxins and ultraviolet (UV) radiation. Mice deficient in mast cells were found to develop a severe form of contact hypersensitivity—similar to the T cell–dependent contact dermatitis seen in humans—after exposure to the hapten dinitrofluorobenzene or to the allergenic plant compound urushiol. Replenishing the mast cell population in these animals with cells cultured from wild-type mice, but not from mice deficient in the immune regulatory cytokine IL-10, was sufficient to significantly reduce the degree of skin inflammation. The ability of mast cells to produce IL-10 depended on engagement of the immunoglobulin Fc γ receptor and corresponded with the suppression of inflammation achieved by administering antigen-specific immunoglobulin. Inflammation caused by UVB irradiation was also dampened by mast cell activities but in this case appeared generally independent of the ability to produce IL-10. These findings may open up new avenues for harnessing the anti-inflammatory power of mast cells to treat inflammatory skin disorders. — SJS

Nat. Immunol. **8**, 10.1038/ni1503 (2007).

GEOCHEMISTRY

Charting Sorption Variations

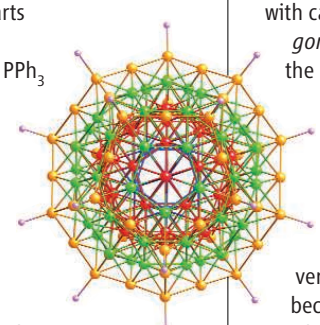
The extraordinary diversity of organic matter in soil and aquatic environments has posed a considerable challenge to researchers seeking to predict the fate of specific molecular contaminants. As a starting point, the enormous array of functionalized hydrocarbons has traditionally been divided into three broad classes of material: humin, humic acids, and fulvic acids. Even within these categories, however, chemical and physical properties can vary from place to place. Niederer *et al.* have undertaken a systematic survey of the differing sorption properties of 10 distinct terrestrial and aquatic humic and fulvic acids. Using inverse gas chromatography, they measured the air/sorbent partition coefficients characteristic of these materials for ~100 small organic molecules of widely varying polarities. The coefficients varied by as much as a factor of 10, but somewhat surprisingly, the changes were manifested as constant shifts. This result implies that despite the chemical diversity of the samples, sorption is primarily a function of the abundance of available binding sites. The authors rationalize this finding by invoking the high degree of cross-linking tying up functional groups beneath the surface of the material. A series of parametrized linear free-energy relations derived from the data shows promise for predictive applications. — JSY

Environ. Sci. Technol. **41,** 10.1021/es0709932 (2007).

CHEMISTRY

Bigger with Platinum

Palladium is exceptional in its tendency to form large well-defined clusters capped with CO and phosphine ligands; clusters with up to 145 Pd atoms have been characterized. Mednikov *et al.* now report that platinum can get into the act if the synthesis starts with a smaller Pd cluster, $Pd_{10}(CO)_{12}(PPh_3)_6$ (where PPh_3 is triphenylphosphine), which reacts with added $Pt(CO)_2(PPh_3)_2$ to yield a 165-atom Pt-Pd cluster, nominally $Pd_{157}Pt_8(CO)_{72}(PPh_3)_{20}$. The crystallographic occupancy analysis was augmented by wide-angle dispersive spectroscopy to establish the Pt stoichiometry. The structure can be described as four concentric shells. At the center is a Pt atom, surrounded by a 12-atom Pd icosahedron, and the second shell is a 42-atom icosahedron with either 3 or 4 Pt atoms; the third and fourth shells are high-symmetry structures with 60 and 50 atoms, respectively. This cluster is unusual in that its outermost shell has fewer atoms than the underlying shell, and CO ligands bridge inter-shell metal atoms. — PDS



J. Am. Chem. Soc. **129**, 10.1021/ja073945q (2007).

GENETICS

Sweeping Through Toxoplasma

Though particularly notorious for its association with cats, the protozoan parasite *Toxoplasma gondii* is ubiquitous among vertebrates, to the extent that a quarter of the human population is infected. Unusually, it propagates both sexually and asexually, but tends to have a clonal population structure with three geographically distinct lineages. Unexpectedly, all lineages share a nearly monomorphic version of one chromosome, which has become fixed in natural populations. Khan *et al.* have traced the population structure of *T. gondii* by sequencing introns and find that South American strains show variation not seen in other lineages. The date of this divergence correlates with the reappearance of the Pana-

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manian land bridge roughly 1 million years ago and the southerly migration and diversification of the Felidae. The lineages appear to have evolved in two phases, first by the generation of northern and southern haplogroups emerging by rare recombination events, and second by a global sweep spreading the monomorphic chromosome into the South American haplogroups. The selective advantage of the monomorphic chromosome has yet to be revealed, although it is probably involved in virulence and transmission. — CA

Proc. Natl. Acad. Sci. U.S.A. **104**, 14872 (2007).

GEOLOGY

Carved from the Surface

Hawaii is sometimes referred to as Earth's greatest mountain because its height above the seafloor exceeds the height of Mt. Everest above the plains of India. Recent work has identified several huge submarine slides extending off of several of the Hawaiian islands, and the large-scale topography of these islands, including underwater features, in

Kohala, Hawaii.

CREDIT: USGS

part reflects the feedback between growth of the islands by volcanism and this mass wasting. Lamb *et al.* argue that these slides may trigger some of the more dramatic smaller topographic features found in some of the wetter parts of the islands, specifically, amphitheaters containing a series of large waterfalls. They show that waterfalls can drill into the Hawaiian basalt at a rate sufficient to cut these amphitheaters from a cliff produced by a slump in a few hundred thousand years. An alternative model has been that erosion from groundwater seepage or springs produced these features, and that this process may have produced similar features on Mars, but the rates of spring flow and other features seem insufficient to have produced the observed features on Hawaii. — BH

Geol. Soc. Am. Bull. **119**, 805 (2007).

CHEMISTRY

Blocks on the Move

Living polymerization is a double-edged sword. On the one hand, this class of techniques—all of which feature a tight association between catalyst and growing chain that inhibits termination—affords exquisite control over the molecular structure of the polymer and the uniformity of the bulk product distribution. On the other hand, such control comes at the expense of cost and throughput efficiency, as each chain requires its own appended catalyst and monomers must be added in batches. Hustad *et al.* present an alternative approach to the preparation of diblock copolymers, in which, rather than adding consecutive batches of different monomers to a living system, they set up successive continuous reactors and limit polydispersity by using a chain shuttling agent. Rapid chain transfers between a hafnium catalyst and zinc shuttling agent allow each catalyst molecule to extend >300 chains while keeping the chain lengths roughly uniform across the sample. By feeding pure ethylene into the first reactor and adding a longer α-olefin to the second, the authors achieve a product distribution with two distinct segments (high- and very-low-density polyethylene) in each chain and a polydispersity of only 1.67. — JSY

Macromolecules **40**, 10.1021/ma0717791 (2007).

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<< Helping Plants Survive Heat

Plants rely on microorganisms in the local environment for various important processes, one of which is nitrogen fixation by symbiotic bacteria that colonize the roots of some plants. McLellan *et al*. provide evidence that fungi in the rhizosphere (the soil surrounding the plant roots) may also contribute to heat tolerance. Previously, two inhibitors of mammalian heat shock protein 90 (Hsp90) were discovered in extracts from Sonoran desert plant–associated fungi. McLellan *et al*. follow up this result by showing that monocillin I specifically binds and inhibits the chaperone activity of *Arabidopsis* Hsp90 in vitro. Exposure of *Arabidopsis* seedlings to monicillin increased the expression and abundance of the heat shock response protein AtHsp101. Pretreatment of seedlings with monicillin before what would be a lethal heat stress for untreated plants increased survival, and this protective effect required Hsp101. When *Arabidopsis* seedlings were cultured with the fungus that produces monicillin, hypocotyl elongation decreased; however, the plants tolerated heat stress much better in the presence of the fungus. — NRG

Plant Physiol. **145**, 174 (2007).

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