Quaternary land snails.

ECOLOGY/EVOLUTION

Not Kept Apart by Competition

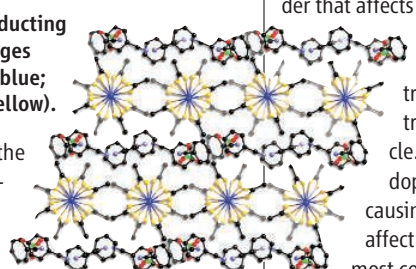
According to the theory of limiting similarity, in order to minimize competition, species coexisting in the same habitat must differ enough in size, shape, or other variables. Ecologists and paleontologists have reported such differences in a wide range of organisms in modern environments or time-averaged deposits. To provide a temporal context, Huntley *et al*. examined the size and shape of Quaternary endemic land snails from the Canary Islands through the past 42,500 years. They considered two types of limiting similarity: ecological character displacement (differences between two closely related species are greater when speciation is ongoing in the same location) and community-wide character displacement (particularly large size or morphology variation among potentially competing species). The data showed that the two most abundant species of the pulmonate gastropod *Theba* exhibited a parallel reduction in size, but when one went extinct the other did not show convergence (a shift toward the other) or release (increased variation). Thus, limiting similarity appears to be a transient ecological phenomenon rather than a long-term evolutionary process. — SJS

Paleobiology **34**, 378 (2008).

CHEMISTRY

Odd Electron Chains

Organic materials that contain linear chains of metals in different valence states can behave as semiconductors or even exhibit metallic conductivity. Mitsumi *et al*. have explored a strategy for creating mixed-valence platinum (Pt) compounds by electrochemically oxidizing Pt(II) dimer precursors in organic solvents with noncoordinating ClO_4^- counterions. These dimers are stabilized by bridging dithiocarboxylato ligands (RCS_2–where R is an alkyl group), and, in the mixed-valence form, the Coulomb barrier that limits conductivity should be reduced by the presence of a shared unpaired electron in the Pt-Pt bonds and delocalized orbitals on the S atoms. For both methyl and ethyl analogs, the Pt dimers form linear chains with a mix of Pt_2^+ and Pt_3^+ centers (average oxidation states of 2.125 and 2.2, respectively). Crystal structures reveal that in the methyl analog, the chains arrange in parallel stacks separated by layers of solvent and ClO_4^- counterions. This compound, with one unpaired electron per chain repeat, exhibits high metallic conductivity at room temperature that persists to about 125 K (between 4 and 8 Siemens per cm). In the ethyl analog, in contrast, each chain is surrounded by solvent and counterions, and a longer repeat unit leads to pairing of the odd electrons and semiconducting behavior. — PDS



Conducting bridges (Pt, blue; S, yellow).

J. Am. Chem. Soc. **130**, 10.1021/ja805794a (2008).

CELL BIOLOGY

Losing Control

Parkinson's disease is a neurodegenerative disorder that affects 1% of people over 65, rising to 5% of those over 85. Nerve cells in the brain produce the neurotransmitter dopamine, which controls the smooth movement of muscle. In Parkinson's patients, these dopaminergic neurons are damaged, causing them to fire inappropriately and affect controlled body movements. The most common molecular cause of Parkinson's disease is a mutation in the gene encoding leucine-rich repeat kinase 2 (LRKK2); however, how this causes neuronal degeneration has been unclear. Now Imai *et al*. find that LRRK2 regulates the production of proteins in the cell during a stress response. When environmental conditions change, a cell needs to rapidly respond in order to survive. One effective way of doing this is by quickly generating additional proteins by translating existing mRNA. Both human and *Drosophila* forms of LRRK2 phosphorylated the translational regulator, eukaryotic initiation factor 4E-binding protein. This caused an increase in protein translation and attenuated resistance to oxidative stress and survival of dopaminergic neurons. In some patients, mutant LRRK2 has increased kinase activity, which could cause cells to lose control of translation. Thus, deregulated protein translation could affect the neurodegeneration seen in Parkinson's disease. — HP*

EMBO J. **27**, 2432 (2008).

IMMUNOLOGY

Mosaic Vaccines Are Not To Be Sneezed At

One of the few effective treatments for allergies to common substances such as pollen is allergen-specific immunotherapy. Doses of allergen too small to produce full-blown allergic reactions are administered to patients in an attempt to stimulate their immune systems to produce immunoglobulin G (IgG) molecules capable of blocking allergen recognition by the IgE molecules that orchestrate the inflammatory symptoms. Mothes-Luksch *et al*.

CREDITS (TOP TO BOTTOM): HUNTLEY *ET AL.*, *PALEOBIOLOGY* **34**, 378 (2008); MITSUMI *ET AL.*, *J. AM. CHEM. SOC.* **130**, 10.1021/JA805794A (2008)

report an alternative approach to modify allergens to produce immune response without triggering inflammation, making them potentially suitable for use as vaccines. A pollen allergen from timothy grass, Phl p 2, was divided it into equal-length peptides, none of which was recognized by IgE-containing serum from allergic patients. Neither Phl p 2 nor the peptide fragments produced an immune response in rabbits. However, a protein assembled from these peptides but in a different order produced a plentiful supply of IgG molecules capable of binding Phl p 2 and of blocking the binding of IgE. Changing the order of peptides stopped the mosaic protein from adopting the same three-dimensional structure as Phl p 2, making it hypoallergenic because it was effectively invisible to anti-Phl p2 IgE molecules. — CS*

J. Immunol. **181**, 4864 (2008).

ECOLOGY

Going My Way?

Genetic hitchhiking refers to the non-neutral fixation of nonselected alleles because of their physical proximity to loci under selection. If ecologically relevant loci are under divergent selection between populations, such as may occur during speciation, it may reduce recombination and further isolate these genomic regions, which in turn can facilitate the evolution of reproductive isolation. Via and West have tested this theory by measuring genetic differentiation in diverging host races of pea aphids found on clover and alfalfa. The authors identified highly diverged markers between aphids found on the different host plants, in particular near putative loci associated with ecologically important traits, and found that genetic differentiation between races extended much farther away from the loci under selection than expected. Divergence was also much less pronounced at markers linked to selected loci among aphids that shared the same crop type, even when these crops were geographically distant. — LMZ


Pea aphid.

Mol. Ecol. **17**, 4334 (2008).

CHEMISTRY

How Holes Move

Quantum mechanics can explain how a single electron behaves in the presence of an oppositely charged proton. Add just one more electron, however, and the analysis becomes vastly more complicated. Because electrons affect one another, any motion by one of them must be considered in the context of correlated motion by the other—a scenario that proves ever more challenging to model as the number of electrons grows to molecular proportions. Lünnemann *et al*. explore the underlying effects of this correlated behavior in a computational study of how three molecules respond to ionization. After removing the most weakly bound electron from a phenyl, ethylene, or butadiene group tethered to an amine, the rate at which the resulting positive charge migrates to the nitrogen center was calculated. Because this delocalization is mediated by correlation effects rather than charge flow kinetics, the rates are extremely rapid (several femtoseconds). Migration is effectively total for the butadiene substrate, partial for the phenyl substrate, and minimal for the ethylene substrate. These trends are highly sensitive to molecular conformation and vary when the torsion angle of the amine is shifted. — JSY

J. Chem. Phys. **129**, 104305 (2008).

PHYSIOLOGY

Tick Tock Liver Clock

Rodents harbor an endogenous cycling clock with a period of about 24 hours. The so-called "master clock" in the brain is set by light, whereas subsidiary "peripheral" clocks are entrained by the animals' feeding schedule. Without these clocks, animals show impaired sleeping, eating, and activity rhythms, as well as pronounced problems in energy balance and glucose homeostasis. To understand how circadian clocks participate in glucose homeostasis, Lamia *et al*. selectively inactivated the clock in the liver by engineering mice with a conditional knockout allele for an essential clock component, the protein Bmal. These mice were unable to maintain steady levels of blood glucose, showing a drop in glucose during the fasting segment of their daily feeding cycle. This drop is normally prevented by a daily increase in the transcription of glucose transporter 2, a gene coding for the membrane protein that exports stored glucose from the liver into the blood. Other similarly regulated genes contribute to metabolic homeostasis. Thus, the liver circadian clock, entrained by the feeding cycle, has daily cycles of metabolic activity that ensure a steady supply of energy for the organism. — KK

Proc. Natl. Acad. Sci. U.S.A. **105**, 15172 (2008).

*Helen Pickersgill and Chris Surridge are locum editors in *Science*'s editorial department.

CREDIT: SARA VIA