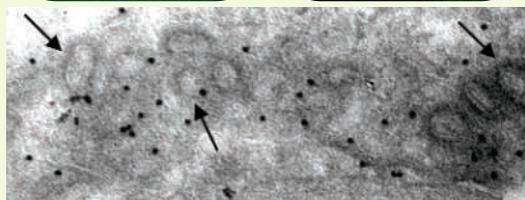
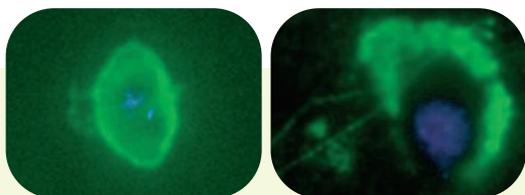


edited by Gilbert Chin



An early (top left) and late (top right) parasite (blue)-containing vacuole with p47 (green) localized at the membrane; p47 (bottom, black dots)-positive vesicles separating from the parasitophorous vacuolar membrane.

sitophorous vacuole and the enclosed parasites. After invasion, several p47 GTPases accumulate in a GTP-dependent fashion on the parasitophorous vacuole membrane, which then suffers vesiculation, and eventually the vacuole and the parasite are destroyed. Elevated expression of the GTPases accelerates the disruption process, and inhibition of the GTPase activity by the expression of a dominant negative form interferes with interferon- $\gamma$ -induced killing of the pathogen.

In a separate study, Bekpen *et al.* looked at the species distribution of p47 GTPases and explain why humans are more susceptible than mice to *T. gondii* infections. Humans express only a single form of the p47 GTPase, compared with more than 20 in the mouse, and it is not induced in response to interferon- $\gamma$ ; hence, humans lack an innate form of defense against protozoan parasites.—SMH

## PARASITOLOGY

## Vacuolar Deconstruction

The protozoan parasite *Toxoplasma gondii* actively invades host cells during infection and sets up house within a cytoplasmic structure known as a parasitophorous vacuole, created from the host cell plasma membrane. The host cells repel the invader, of course, and mice display an interferon- $\gamma$ -induced cell autonomous immunity that depends on a class of GTPases: the p47 GTPases.

Martens *et al.* describe the mechanism of protection conferred by the p47 GTPases. These proteins appear to promote the disruption of the para-

*PLoS Pathog.* 1, e24 (2005); *Genome Biol.* 6, R92 (2005).

can still effect  $H_2$  oxidation at ambient oxygen levels. As a preliminary indication of its potential use in fuel cells, two electrodes, one coated with the *Ralstonia* hydrogenase and the other with laccase, immersed in aqueous solution and flushed with  $H_2$  and air, work together to convert  $H_2$  into  $H_2O$  with an open-circuit voltage of almost 1 V.—GJC

*Proc. Natl. Acad. Sci. U.S.A.* 10.1073/pnas.0504499102 (2005).

GEOCHEMISTRY  
Shifting Grasses

One of the major ecological changes in the recent past in East Africa was a great expansion of grasslands from about 10 to 15 million years ago (Ma) to the present. This change had a pronounced effect on the evolution of many African species, including humans. Feakins *et al.* reveal some important details about this expansion by analyzing carbon isotope ratios in organic compounds derived uniquely from African terrestrial plants preserved in a marine core in the Gulf of Aden. Because grasses photosynthesize using the  $C_4$  pathway, they produce a diagnostic shift in carbon isotopes in plant material when compared to  $C_3$  plants—mostly trees and shrubs. The record, although discontinuous, shows that although some grasses were present by 9 Ma, the major expansion occurred after about 3.4 Ma. Interestingly, the detailed record shows dramatic oscillations in the abundance of grasses, likely tied to Milankovitch cycles, beginning about 3.8 Ma, before the onset of glacial cycles. Evolving African mammalian species would have to have adapted to these shifts.—BH

*Geology* 33, 977 (2005).

## ECOLOGY

## It's Not Always a Bed of Roses

Many plants maintain mutualisms with systemic fungi (endophytes): The fungi gain nutrients and the plants gain resistance via fungal alkaloids against stress, pathogens, and herbivores. But the benefit/cost equation can be pulled from mutualism toward antagonism by the effects of other variables in the community.

Lehtonen *et al.* found that when a hemiparasite, in this case yellow rattle, enters a grass/endophyte system, the yellow rattle becomes more successful at deterring aphid attack. Ultimately, the endophyte-positive grass suffered more from parasitism and grew less than similarly parasitized but endophyte-free grass. What seems to be happening is that the yellow rattle

is not only taking nutrients from the grass but also obtaining the fungal alkaloids, which then repel the aphids. So together the yellow rattle and the fungus are sapping nutrients from the host grass, and the fungus no longer supplies as much protective benefit to its grass host.—CA

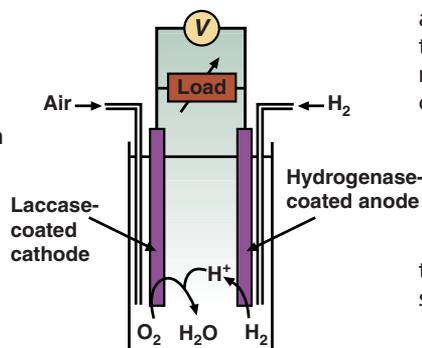
*Ecol. Lett.* 8, 1256 (2005).

## BIOCHEMISTRY

## Controlled Combustion

Diatomic molecules are mostly not too different in size and shape, yet they can be vital nutrients, such as  $O_2$ , or inimical to aerobic energy metabolism, as when CO blocks  $O_2$  binding to the heme Fe in hemoglobin or when  $CN^-$  poisons mitochondrial cytochrome c oxidase. Nevertheless, both CO

and  $CN^-$  can be found as stable Fe ligands in the [NiFe] hydrogenases, which use a bimetallic cluster to extract energy from the oxidation of  $H_2$ . Most hydrogenases operate only in the absence of oxygen, but Vincent *et al.* use protein film voltammetry to show that the membrane-bound hydrogenase of the bacterium *Ralstonia eutropha* is essentially insensitive to CO and



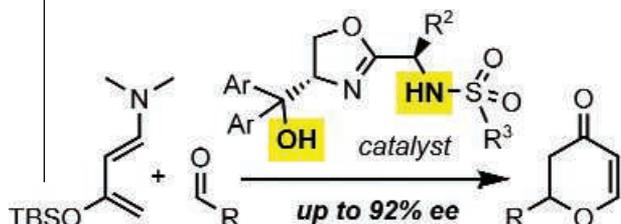
A simple fuel cell.

CONTINUED ON PAGE 1249

## CHEMISTRY

## Two-Handed Catalysts

Enzymes derive some of their effectiveness by orienting substrates into reactive conformations. This technique can be challenging to mimic using small molecule catalysts, which lack the structural complexity of a protein. However, hydrogen bonding has recently shown promise in achieving enzyme-like directing effects with a simpler scaffold, and Rajaram and Sigman have developed chiral oxazoline-derived catalysts with



Catalyst structure and Diels-Alder reaction.

two proximal hydrogen bond donor sites: a hydroxyl group and a secondary amine. The catalysts are efficiently prepared from amino acids and feature tunable donor strength through variation of the nitrogen substituent. Initial work has produced an optimized structure for the catalytic asymmetric hetero Diels-Alder addition of aryl aldehydes to substituted dienes. Appending a camphor sulfonyl group to the amine drives the reaction with enantiomeric excesses up to 92%. Products of this reaction can then be efficiently elaborated to useful pyranone intermediates. The dual hydrogen-bonding sites proved crucial for grasping the substrates, because catalysts lacking either the hydroxyl or the amine group afforded significantly diminished yields and selectivities. — JSY

*Org. Lett.* 10.1021/ol052300x (2005).

## CLIMATE SCIENCE

## Estimates, Uncertainties, and Noise

Reconstructing a temperature record for the past from proxy data (e.g., tree rings, corals, and ice cores) is difficult because proxies are imperfect thermometers, and the noise that contaminates the temperature signal can introduce large uncertainties into any estimate. The two most common statistical techniques used to interpret these noisy data sets are the climate field reconstruction (CFR, well

suiting for spatial patterns) and composite-plus-scale (CPS, with a simpler statistical procedure) methods. Evaluating the fidelity of those approaches is difficult, however, because the direct observational temperature record is too short and too incomplete to allow them to be verified thoroughly. Climate models can be used to do this, though, because their temperature outputs can be made arbitrarily long and geographically complete, so that the CFR and CPS methods can be tested using a virtual climate record that is essentially perfect.

Mann *et al.* conducted such tests in order to address a recently made claim that real-world proxy-based temperature reconstructions might tend to systematically underestimate century-scale temperature variability. They find that neither method is prone to such behavior and that both

can provide an accurate estimate of actual long-term hemispheric temperature histories, within estimated uncertainties. Therefore, although each method has its own strengths and weaknesses, some concerns about their basic utility seem unfounded. — HJS

*J. Clim.* 18, 4097 (2005).

## PSYCHOLOGY

## A Dating Rating

Why people choose the mates they do can be a topic of endless discussion. Three of the best-known explanations are (i) that opposites attract; (ii) that we look for someone just like ourselves; and (iii) that there are cross-cultural attributes that everyone would like to have in their partners (but that only a lucky few do).

Zentner has developed an inventory to measure the personality characteristics of one's ideal mate and applied it to college students in conjunction with an established questionnaire for reporting one's own personality facets. He finds that there is roughly the same variability across individuals in the two measures, arguing against the existence of a universally desired set of attributes. Furthermore, in a longitudinal sampling, the similarity of one's actual mate and one's idealized choice along the dimensions of agreeableness and openness was important and predictive of satisfaction with the relationship. — GJC

*J. Pers. Soc. Psych.* 89, 242 (2005).