Enhancing Magnetization Reversal with Some Bias

In a hard drive, the bits that represent data are written with a magnetic field in close proximity to the recording surface. However, the area written and hence the information density are limited by the size of the head carrying the magnetic field, and thus other data storage methods are being explored. **Chiba *et al.*** (p. 943) report that an electrical bias can be used to enhance the magnetic properties of a ferromagnetic semiconductor, manganese-doped indium arsenide. In a field-effect device structure, the coercive field and Curie temperature of the material could be controlled by application of a gate voltage. Such manipulation even reversed the magnetization in the magnetic semiconductor, which would allow for multifunctional devices and smaller magnetic memories.

A Pinch Is All It Takes

When metals are used in heterogeneous catalysts, it is usually assumed that their properties result from interactions between small metallic clusters and the oxide support. **Fu *et al.*** (p. 935; see the Perspective by **Davis**) show that when the water-gas shift reaction, which produces hydrogen from water and carbon monoxide, is run with gold- or platinum-impregnated cerium oxide, metallic species are mere spectators. Even after leaching the metals with cyanide, the catalysts remained active, apparently through the remaining oxidized metal species tightly bound to Ce-O groups. Hence, low loadings of these metals should work just as well as (and more economically) than higher loadings.

Coral Reefs Under Siege

Coral reefs across the globe are widely perceived to be undergoing serious degradation brought about by warmer climate conditions, and three reports document these declines (see also the Review by **Hughes *et al.***, p. 929). Much of the data to support this contention are from fragmented small-scale studies of individual reefs or are of an anecdotal nature. **Gardner *et al.*** (p. 958) performed a meta-analysis of the decline of coral reefs on a broad geographic scale. They analyzed within-site changes in coral cover across the Caribbean based on data from 263 sites for a period of 25 years and found a dramatic decline in coral cover (from ~50 to 10%) during this period. These declines are consistent across the Caribbean region, with variation in the timing of onset of the declines providing clues as to the likely causes. **Pandolfi *et al.*** (p. 955) used an exhaustive historical data set to document the global decline of coral reefs during the past several thousand years. Trajectories of ecosystem decline were strikingly similar among regions that were all substantially degraded before the 20th century. Such historical analyses can allow management programs to anticipate probable losses of species and habitats at individual locations through an understanding of the characteristic pattern of ecosystem decline. A particularly striking example of the widespread, rapid death of coral reefs, and how it may be connected to global warming, is presented by **Abram *et al.*** (p. 952), who found that the escalating phenomenon of tropical wildfire represents a new threat. By using coral growth, paleothermometry, and trace element signals, they attribute an episode of catastrophic reef death in Indonesia in 1997 to a giant algal bloom (red tide), which they argue was caused by atmospheric fallout of nutrients from the 1997 Indonesian wildfires. Although they note that the wildfire event was highly unusual, the climatic conditions at the time were not exceptional.

Certain Travel Restrictions Apply

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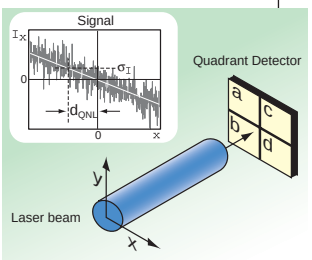
One school of thought suggests that geographic barriers do not limit the dispersal of organisms smaller than 1 millimeter, and suggests that there are a relatively low number of microbial species distributed globally. However, for multicellular, eukaryotic macroorganisms, spatial distribution is a primary determinant of biodiversity. **Whitaker *et al.*** (p. 976; see the Perspective by **Fenchel**) examined the genetics of microbial populations from hot spring sites around the world and found that the dispersal of thermophilic archaea is limited by geographic barriers. These results imply a vastly greater prokaryotic diversity than has been recognized previously.

Springboard for Prebiotic Synthesis

One of several models for the origin of life is that the building organic chemicals were synthesized and concentrated by mineral catalysts in hot springs. Indeed, previous work has shown that under reducing conditions, iron-nickel sulfides can polymerize CO into amino acids, peptides, and other complexes. **Huber *et al.*** (p. 938) now show that these sulfide minerals can drive a peptide cycle—a precondition for a metabolic cycle. Peptides are both formed from amino acids and degraded to urea under the same conditions, and the energy for both reactions comes from the oxidation of CO to CO_2.

Doubly Squeezed Laser Light

The precision with which the light from a conventional laser beam can be positioned is limited by quantum mechanics. Noise, or fluctuations, in the position of photons within the light beam results in a spatially extended spot. However, the Uncertainty Principle allows "squeezing," in which the fluctuations of one quantum parameter can be improved so long as they are gained at the expense of another, and correlations between quantum-mechanical noise in different directions can be engineered so that they cancel out. **Treps *et al.*** (p. 940) used these approaches to squeeze a light spot in both the horizontal and vertical directions so that it could be positioned with a precision of 1.6 angstroms.



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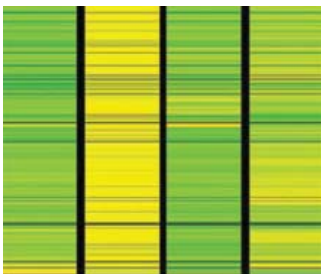
Hemispheric Climate Connections

The relative scarcity of high temporal resolution marine records of climate change from the Southern Hemisphere has hampered efforts to determine the relative timing of climate-related changes in the oceans of the Southern Hemisphere and in the Arctic and the Antarctic. **Pahnke *et al.*** (p. 948) present a series of paleoceanographic records from the subantarctic Southwest Pacific Ocean that show abrupt swings of high amplitudes. They document that such intense and abrupt climate changes were a persistent Southern Hemisphere feature during the past 340,000 years. Thus, climate in some parts of the Southern Hemisphere oscillated at far larger amplitudes than is documented in ice cores from Vostok, Antarctica. The authors suggest that these rapid swings changed from occurring in-phase with Northern Hemisphere variability to occurring in-phase with high-latitude Southern Hemisphere variations.

Changing Lizards

In adaptive radiation a group of species diverge rapidly from a common ancestor to fill a range of ecological niches. **Harmon *et al.*** (p. 961) describe a phylogenetically based comparative method to study adaptive radiation using DNA-based phylogenies in concert with data on morphological evolution for several lizard clades. Each clade exhibited its own pattern of evolutionary diversification, but general—and potentially predictable—patterns of evolutionary diversification were also evident.



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Help or Hinder?

Plants respond to pathogen-induced damage by producing callose, which has long been assumed to be important in protecting the plant from further damage caused by opportunistic infections at the wound site. However, **Nishimura *et al.*** (p. 969) now present paradoxical evidence indicating that a lack of callose synthesis can actually render plants less susceptible to disease. It appears that somehow the callose synthesis pathway interferes with another plant defense pathway, the salicylic acid signaling pathway.

Splicing in the Background

The severity of many inherited diseases is influenced by genetic background. The "modifier genes" that contribute to this variability are of great interest but are notoriously difficult to identify. **Buchner *et al.*** (p. 967; see the Perspective by **Nadeau**) now identify one such modifier. C57BL/6J mice, which are widely used in biomedical studies, that carry a splice site mutation in a sodium channel gene exhibit a more severe neurological disorder than do other inbred strains with this mutation. The mice carry a modifier mutation in a gene encoding a putative RNA splicing factor. Conceivably, this splicing modifier could explain the phenotypic variability seen with splice site mutations in other genes.

Migration Defects

As the gut develops, neural crest stem cells migrate from the esophagus to form ganglia that will innervate the hind gut. In Hirschsprung disease, these enteric ganglia are missing. **Iwashita *et al.*** (p. 972) tested whether this disease could be caused by defects in the ability of the neural crest cells to migrate to the hindgut. Gene-expression profiling of the RNA content of isolated gut neural crest stem cells revealed elevated expression of genes known to be defective in Hirschsprung disease patients. One of these, *Ret*, is a receptor for glial-derived neurotrophic factor (GDNF) and, like GDNF itself, is necessary for stem cell migration. Thus, *Ret* deficiency causes Hirschsprung disease by impairing the migration of neural crest stem cells into the distal gut.

CREDIT: NISHIMURA *ET AL.*