EDITORS' CHOICE

edited by Gilbert Chin

ECOLOGY

Thinning a Stand of Goldenrod

Ecologists have long been aware of the potential importance of interactions between species in controlling diversity and community composition. One of the most common of interactions is herbivory—the primary link in almost every food web—so insect herbivores might influence the dynamics of plant communities.

In a ten-year study of an old-field habitat dominated by goldenrod (*Solidago altissima*) in the northeastern United States, Carson and Root compared the plant community structure of experimental plots from which insect herbivores were excluded with insecticide, with control plots that were subject to periodic outbreaks of a herbivorous beetle fond of goldenrod. Plant species richness and abundance decreased in the insecticide-treated plots, and the differences persisted for years following the herbivore outbreaks. The levels of light reaching the ground were enhanced by goldenrod defoliation, and this in turn promoted fecundity and productivity of other herbaceous species and, indirectly, the recruitment of tree seedlings. Thus, a specialist interaction between one plant and one insect species can have a clear effect on the trajectory of community composition and succession. — AMS

Ecol. Monographs **70**, 73 (2000).

GEOCHEMISTRY

Helium Tracks the Heart of Iceland's Plume

Beneath Iceland's snow and ice are many active volcanoes created by the Mid-Atlantic Ridge rift zone and a hot spot plume. Geophysical evidence, such as gravity and seismic tomography, has distinguished the hot spot plume as a cylinder of upwelling, hot mantle material centered beneath southeastern Iceland. Because the basalts that erupt from the volcanoes can derive from the rift zone, the plume, or a mixture of the two, geochemical evidence can be used to refine or confirm the geophysical models.

A world of fire and ice

SOURCE: FREYSTEINN SIGMUNDSSON (LEFT), KRISHNAMOHAN *ET AL.*, *J. AM. CHEM. SOC.* **122**, 1558–1559 (RIGHT).

Breddam *et al.* used the ratio of $^3He/^4He$ to distinguish basalts derived solely from the plume. This ratio should be higher for plume basalts because the plume samples the deeper, more primitive and undegassed part of the mantle where more ^3He is trapped. Indeed, the helium ratio increased in a systematic way as they sampled basalts nearer to the center of the geophysically defined plume, indicating that the plume is about 100 kilometers in diameter and centered under southeastern Iceland. The high helium ratios represent melt formed in the deeper parts of the plume (below 125 kilometers) and brought directly up to the surface through the center of the plume cylinder. Moderately high helium ratios that have been measured outside of the plume center by other research groups represent denser, less ^3He-enriched melts formed in the shallower parts of the plume that have been deflected laterally away from the heart of the hot spot and that may also have mixed with the rift zone melts. — LR

Earth Planet. Sci. Lett. **176**, 45 (2000).

ATMOSPHERES

Relating CO_2 and Temperature Variations

The puzzle of climate has many pieces that need to be assembled before it is solved, including how to relate changes in the concentration of atmospheric CO_2 over time to corresponding changes in atmospheric temperatures. Indermühle *et al.* measured atmospheric CO_2 concentrations for the period between 60,000 and 20,000 years ago by using ice samples from Taylor Dome, Antarctica. This cold glacial interval is of great interest in part because it was punctuated by a handful of global temperature increases. The authors compared their results with the temperature record of ice from Vostok, Antarctica and found that the four distinct peaks, during which CO_2 concentrations rose by as much as 20 parts per million, occurred contemporaneously with the Vostok temperature maxima. These higher resolution measurements will help researchers to better understand the mechanisms that produced concentration changes of that magnitude. — HJS

Geophys. Res. Lett. **27**, 735 (2000).

CELL BIOLOGY

Getting Back What You've Put In

During stimulated secretion, intracellular vesicles fuse at the cell surface and release their contents. Cells have developed efficient mechanisms to retrieve the vesicular membrane components for reuse; in sea urchin eggs, fertilization triggers a wave of secretory granule exocytosis that is followed rapidly by a compensatory wave of endocytosis.

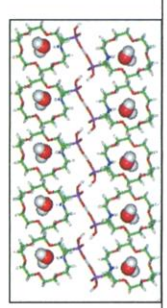
Smith *et al.* have examined the mechanism controlling the endocytic burst by direct observation in a confocal microscope. Granule membranes contain a P-type voltage-sensitive calcium channel, which is incorporated into the plasma membrane during exocytosis. This generates localized entry of calcium, which in turn stimulates a localized burst of endocytosis that specifically retrieves granule membrane components. Thus, sites of endocytosis are restricted to sites of exocytosis, and plasma membrane proteins are excluded from the endocytic vesicles. Similar mechanisms marrying sites of exocytosis to sites of compensatory endocytosis may occur generally. — SMH

J. Cell Biol. **148**, 755 (2000).

CHEMISTRY

Self-Assembling Leaflets

Macrocyclic molecules such as crown ethers have useful ion-binding properties, and their incorporation into a matrix can create materials with new properties, especially if these ring structures are left free for binding metals. Sharma and Clearfield have now found that derivatized crown ethers bearing a phosphonate group can self-assemble into well-defined "leaflet" structures in the presence of the divalent metal ions Co^{2+} and Cd^{2+}. In the Co^{2+} complex (**2**), the metal does not coordinate with the phosphonates; the self-assembly



Macrocyclic leaflets (2)

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proceeds through hydrogen bonding to form a polyphosphonate chain. In the Cd^{2+} complex, the Cd cations form part of a more complicated one-dimensional polymer network. — PDS

J. Am. Chem. Soc. **122**, 1558 (2000).

APPLIED PHYSICS

Directing Light

One of the future goals for all-optical circuitry is the miniaturization of the waveguides that direct light to where it is needed in a way that could be integrated with conventional electronic circuitry. One approach is to use photonic band gap materials, which consist of structures of periodically contrasting refractive indices. These materials prevent the propagation of electromagnetic waves with wavelengths on the order of the spatial periodicity of the structure. However, introduction of a "defect" to the periodicity produces a conduit for these otherwise excluded waves to propagate.

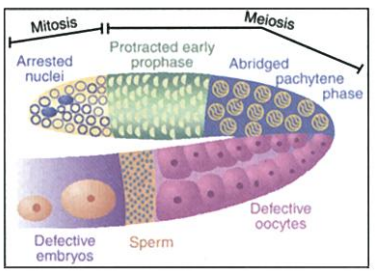
Previous work with relatively large periodicity structures (for example, a square array of 0.25mm diameter alumina rods arranged with a lattice constant of 1.27mm) have shown the ability to direct millimeter waves around 90° corners. Extending this idea to a much smaller scale, with submicrometer periodicity (0.8 μm), Tokushima *et al.* have etched an array of holes into a silicon wafer. Introducing a break in the periodicity of the array as the defective region, they have demonstrated the ability to direct 1.55 μm infrared light around sharp bends. The ability to direct light at this technologically important wavelength, the standard used in present optical communications, may spur the development of on-chip, all-optical waveguides. — ISO

Appl. Phys. Lett. **76**, 952 (2000).

DEVELOPMENT

An Interfering Ego?

Posttranscriptional gene silencing (PTGS) is a poorly understood form of gene regulation that can be triggered when foreign nucleic acid is introduced into an organism, and that has been observed in plants, fungi, flies, and nematodes. PTGS involves activation of a sequence-specific mechanism of RNA turnover that results in reduced expression of endogenous genes. The proposed mechanism relies on an RNA-dependent RNA polymerase (RdRP), and, in agreement with this model, PTGS in *Neurospora* was recently shown to require a protein called QDE-1, which is related to RdRPs.



Developmental loss of ego.

Work by Smardon *et al.* adds the tantalizing suggestion that RdRP-mediated PTGS may play a fundamental role in animal development. These authors find that *ego-1*, a gene required for germline development in the nematode *Caenorhabditis elegans*, encodes a protein with sequence homology to RdRPs and to QDE-1, and that a subset of germline-specific genes are resistant to RNA interference (a form of PTGS) in *ego-1* mutants. Further genetic analyses may lead to a better understanding of RdRPs, enzymes that have been studied intensively in the context of RNA viruses but whose function and even existence in eukaryotic cells has been debated. — PAK

Curr. Biol. **10**, 169 (2000).

Science's stke

Preventing Inbreeding

It is not uncommon for plants to fertilize themselves. However, several species of *Brassica* reject their own pollen and thus are self-incompatible. Self-incompatibility is controlled by the highly polymorphic *S* locus, which contains two genes that encode the *S* receptor kinase (SRK) and *S* locus glycoprotein (SLG). Takasaki *et al.* transfected self-incompatible plants (bearing the S^{60} or $S^{52/60}$ haplotypes) with SRK or SLG (bearing the S^{28} haplotype) separately and determined that the expression of SRK^{28} alone conferred incompatibility to S^{28} pollen. Although expression of SLG^{28} alone was incapable of promoting self-incompatibility, coexpression of SLG^{28} with SRK^{28} resulted in greater self-incompatibility than that observed with SRK^{28} alone. Therefore, expression of SRK is necessary and sufficient to control self-incompatibility, whereas SLG can augment the response. By having a mechanism that prevents inbreeding, plants increase their robustness through hybrid vigor. — JN

Nature **403**, 913 (2000).

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