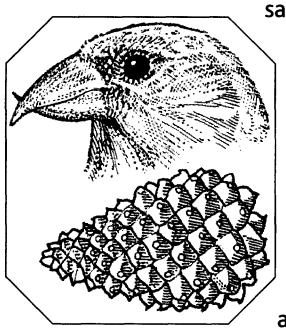
# EDITORS' CHOICE

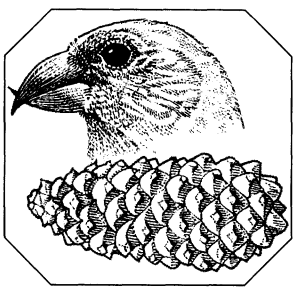
edited by Gilbert Chin

EVOLUTION

## Ménage à Trois

Coevolution between species (for example, between plants and seed predators) can occur in different ways and at different rates in different parts of a landscape. Benkman *et al.* have surveyed the geographic mosaic of interaction between red crossbills and lodgepole pine in the Rocky Mountains of North America. Where a preemptive and dominant seed predator, the red squirrel, is present there is a coevolutionary coldspot, meaning that the primary interaction occurs between the squirrels and the pines, leaving the crossbills to adapt to an averaged pine cone structure. Where squirrels are absent crossbills coevolve with the cones in a coevolutionary hotspot. This offers a clear case of the geographical distribution of one species (here, the squirrel) influencing and varying the selective regime for two others. — AMS





**Crossbill and pine cone morphologies from a coldspot (left) and a hotspot (right).**

*Evolution* **55**, 282 (2001).

ATMOSPHERIC SCIENCE

## Really High Clouds

Most clouds in Earth's atmosphere are found in the relatively dense and moist troposphere, but some, such as the polar clouds that are implicated in ozone destruction, form in higher (stratospheric) regions. Earth's highest clouds, which form in the mesosphere above the poles at altitudes of 82 to 86 kilometers, have been increasing in brightness and geographic extent during the past four decades, and these changes may be linked to anthropogenic emissions of carbon dioxide and methane.

Gardner *et al.* report measurements of the temperature, iron density, and altitude of polar mesospheric clouds (PMCs) from an aircraft campaign using iron Boltzmann temperature lidar (lidar is similar to radar, but uses laser light instead of microwaves). The observed midsummer temperature profiles are consistent with model predictions, but in the austral fall, the observations deviate from the model. Over the South Pole, PMCs were 2 to 3 kilometers higher than over the North Pole, which may be due to differences in the temperature profile or to stronger upwelling over Antarctica. These data are crucial for validating climate models and predicting how the upper atmosphere will respond to climate change. — JU

*Geophys. Res. Lett.* **28**, 1199 (2001).

PHYSICS

## Restraint Can Be a Turn On

The excitation and relaxation of carriers between the discrete energy levels of a quantum dot result in the absorption and emission, respectively, of light at discrete wavelengths. The ability to control and harness such spontaneous processes would provide many applications in optoelectronics, but doing so directly is difficult and has necessitated indirect approaches to the problem. Bayer *et al.* placed a quantum dot in a structured optical microcavity: a box in which the optical modes are confined. They found that matching the optical modes of the microcavity to those of the quantum dot led to an enhancement of the emission rate from the dot, thereby switching the dot on. When the photon modes of the microcavity and the quantum dot are off-resonance, the emission rate is suppressed, and the dot is switched off. — ISO

*Phys. Rev. Lett.* **86**, 3168 (2001).

ECOLOGY

## The Observer Effect in Herbivory

In field studies of animals, ecologists strive to minimize the potential confounding effects of the presence of the human observer. Now it seems that plant ecologists, too, might have to worry about this problem. In an experiment with six plant species in a temperate grassland community, Cahill *et al.* monitored the consequences of weekly observer visits on the rate of leaf damage by herbivores. Mean leaf damage from insects significantly decreased in one species and significantly increased in another when plants were visited and handled by observers. Although the mechanisms leading to these effects are not clear (and the effects may be mediated via the eater rather than the eaten), these results suggest that future studies of herbivory, a major ecological subdiscipline, might need to control for the effects of ecologists. — AMS

*Ecology* **82**, 307 (2001).

MATERIALS SCIENCE

## Biofunctional Magnetic Tweezers

The viscoelastic properties of cells and intracellular transport forces have been studied with micrometer-sized transducers that can handle relatively large forces (tens of nanonewtons). Abdelghani-Jacquin *et al.* have made magnetic cobalt and iron particles more cell-friendly by plating them with gold in a spontaneous electrodeless reaction to produce a uniform coating. Using thiol chemistry, they then functionalized the particles either by attaching biomolecules directly or by adding a polymer cushion formed of polysaccharides. These beads were used as magnetic tweezers to characterize the local viscoelastic properties of a soft biopolymer film, which showed a purely elastic response when a pulsed magnetic force was applied. They also measured the lateral stiffness, which is related to the shear elastic modulus. — MSL

*Langmuir* **17**, 2129 (2001).

PHYSIOLOGY

## Eating Less

Body weight in mammals is regulated by a neuroendocrine feedback loop. Fat tissue itself serves as an endocrine end-organ, secreting leptin, which acts in the hypothalamus of the brain and results in the stimulation of melanocortin receptors and inhibition of food intake, which in turn lowers the amount of body fat. Obesity can be caused by dysregulation at several points in this system: for instance, via loss-of-function mutations in the leptin gene or receptor and similar mutations in

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SOURCE: BENKMAN *ET AL.*, *EVOLUTION* **55**, 282 (2001).

melanocortin genes or their receptors. But how might this system cause too little food intake, as in the disorder anorexia nervosa?

Vink *et al.* posit that decreased activity in an endogenous melanocortin antagonist—agouti-related protein—could contribute to such starvation syndromes. They examine the gene for agouti-related protein in 145 patients with anorexia nervosa and 244 controls, and identify two polymorphisms that occur together and are found in a significantly greater percentage of the patients than in the controls. The presence of this haplotype confers a relative risk of 2.63 on its carriers and so does not apply to all cases of anorexia nervosa. Nevertheless, identification of a gene that, when dysfunctional, would decrease food intake presents a potential therapeutic target for treating eating disorders. — KK

*Mol. Psych.* **6**, 325 (2001).

DEVELOPMENT

## Stochastic Mosaics

Position effect variegation (PEV) in the fruit fly *Drosophila* is the silencing of gene expression caused by the proximity of a gene to heterochromatin (a condensed and transcriptionally inactive region of the chromosome). One intriguing feature of PEV is mosaicism, where an affected gene may be silenced in one cell but active in a neighboring, and apparently identical, cell. Ahmad and Henikoff have used a reporter gene that is subject to PEV and has binding sites for the GAL4 activator in its promoter region to tease apart the basis of PEV and mosaicism. By modulating GAL4 activator expression during development, they show that promoter activation can counteract the silenced state of the reporter, presumably by binding to and trapping transiently exposed GAL4 binding sites in the heterochromatin. Mosaicism then is a consequence of the spontaneous and stochastic derepression of the promoter in the presence of the activator. — GR

*Cell* **104**, 839 (2001).

ENVIRONMENTAL SCIENCE

## Scrubbing a Dirty Atmosphere?

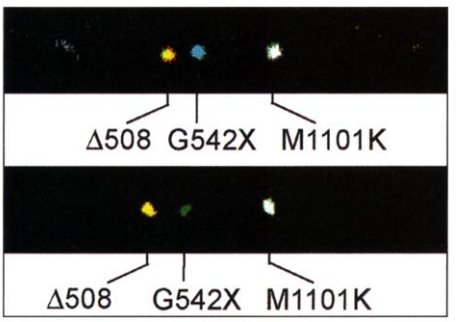
Of the various indirect schemes that have been considered for removing $CO_2$ from the atmosphere, one that has been discussed widely involves seeding parts of the oceans with iron to promote primary production; a second involves promoting terrestrial plant growth. In some situations, scrubbers can be installed, but it is difficult to control emissions from cars and homes. Elliott *et al.* examine whether it might instead be possible to scrub $CO_2$ directly from the atmosphere with a chemical extractor. Winds usually are westerly in the Northern Hemisphere, where most $CO_2$ emissions originate, so it might be feasible to remove $CO_2$ by passing air through a reactor containing calcium hydroxide or other bases. The authors evaluate the fluxes, kinetics, and size of reactors needed to consume current anthropogenic emissions. — BH

*Geophys. Res. Lett.* **28**, 1235 (2001).

GENETICS

## Hitting Singles

Fluorescence in situ hybridization has been instrumental in visualizing discrete regions (as small as several hundred nucleotides) of chromosomes in single cells, and, of course,




**Merged fluorescence images of the two flanking loci (yellow, white) and the target G542X locus (wildtype, blue; mutant, green).**

DNA sequencing and standard cloning techniques have been used to identify single nucleotide changes associated with genetic polymorphisms and disorders.

Now, Zhong *et al.* have developed a protocol in which single base changes can be visualized in single cells. As a test system, they focused on the G542X locus within the cystic fibrosis (CFTR) gene as it was represented in wild-type peripheral blood lymphocytes and in two mutant cell lines homozygous and heterozygous for this locus. Rolling circle DNA amplification (RCA) and specific oligonucleotide probes revealed two green (FITC) nuclear signals in wild-type cells, two red (Cy3) signals in homozygous cells, and one of each color in heterozygous cells. These results were confirmed in fiber DNA analyses with the addition of two flanking loci (Δ508 and M1101K) providing both color and relative distance markers. Wild-type and mutant alleles in the *p53*, *BRCA*, and *patched* genes also were visualized in single cells by RCA. — GJC

*Proc. Natl. Acad. Sci. U.S.A.* **98**, 3940 (2001).

CREDITS: ZHONG *ET AL., PROC. NATL. ACAD. SCI. U.S.A.* **98**, 3940 (2001).