# EDITORS' CHOICE

edited by Gilbert Chin

A diverse community of bryophytes (mosses and liverworts).

SOURCE: (LEFT) C.P.H. MULDER; (RIGHT) NATIONAL PARK SERVICE

ECOLOGY

## Plant Positivism

The relationship between species diversity and ecosystem productivity in plant communities remains a topic of intense debate. Partly at issue has been the extent to which experimentally constructed communities represent the real, complex world of plant-plant interactions. Mulder *et al.* have added a new element of realism to such experiments by investigating productivity-diversity relationships of the same group of plants under different environmental conditions. They constructed artificial communities of 1 to 32 species of New Zealand bryophytes (mosses and liverworts) and compared their performance under constant or variable moisture regimes. In drought conditions, biomass production increased with species richness. This result indicates that species that are "redundant" under equable conditions may interact in a complementary way when conditions become tougher. — AMS

*Proc. Natl. Acad. Sci. U.S.A.* **98**, 6704 (2001).

PHYSICS

## Confinement Without Walls

When particles such as electrons are placed in a confining potential ("box"), they exhibit a discrete ladder of energy levels. An intuitive description involves reflections of waves from walls: These discrete energy levels can be thought of as arising from fitting integer multiple half-wavelengths associated with the electron into the box. However, quantum mechanics dictates that a wall is not necessary for the reflection to occur, but that a simple step jump in the potential would work equally well. In this case, the electrons would be confined to a plateau and would be reflected at the boundary region. Barman *et al.* deposited a thin layer of sodium atoms on an aluminum substrate to mimic the plateau and step-down potential structure. They observed resonances in the photoemission spectrum that are in agreement with the scenario in which the electron wave functions are indeed reflected from the sodium-aluminum boundary. — ISO

*Phys. Rev. Lett.* **86**, 5108 (2001).

ENVIRONMENTAL SCIENCE

## Messy Mediterranean Outflows

Waters from the Mediterranean Sea are saltier and thus denser than those of the Atlantic Ocean. This difference results in a flow of water at depth through the Strait of Gibraltar, and this has been an important source of intermediate water in the Atlantic Ocean. This flow can be mapped for some distance and may even influence Atlantic Ocean circulation. Martí *et al.* now show that this flow may also be an important contributor to organic pollution in the northeastern Atlantic Ocean. Hydrophobic organic pollutants, including polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs), are transported primarily as small particles, and the total flux of such pollutants could amount to several tons per year. — BH

*Environ. Sci. Technol.*, in press.

PHYSIOLOGY

## Controlled Growth

Thyroid hormone (triiodothyronine or T3) is known to be involved in energy metabolism and growth, and it exerts its action through binding to specific transcription factors that regulate gene expression. Koritschoner *et al.* make a connection between thyroid hormone and the protein tubby, which is known to be involved in adult-onset obesity (for more on tubby, see Santagata *et al.*, Research Article, p. 2041 and Cantley, Perspective, p. 2019, this issue). Adult rats from which the thyroid had been removed surgically displayed a spectrum of changes in the expression of tubby. For instance, there was a substantial decrease of both messenger RNA and protein in cerebellar Purkinje cells that could be reversed by injection of thyroxine (a thyroid hormone precursor that crosses the blood-brain barrier). There were no clear T3-dependent changes in tubby levels in the hypothalamic region, although the in vivo phenomena were mirrored by T3-induced changes in tubby expression in the PC12 cell line. — GJC

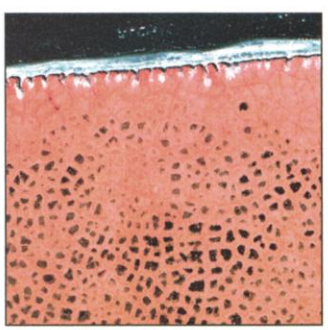
*EMBO Reports*, **2**, 499 (2001).

GEOPHYSICS

## Patterns of Stress

Many materials, when they cool or shrink, develop distinct but regular fracture patterns. These patterns are commonly observed in nature in the form of mud cracks, columnar jointing in basalt flows, or ice-wedge networks in frozen ground. The patterns may extend from a few centimeters across in mud cracks to hundreds of meters in length in ice-wedge networks.

Plug and Werner have developed a model of ice-wedge networks based on parameters that include the tensile stress associated with cooling, tensile strength, fracture depth, and a few other soil parameters. Fractures were placed sequentially on a lattice. Their model successfully reproduced the geometry and scale of observed ice-wedge networks, which implies that the patterns, at least in ice wedges, are dominated by stress interactions between individual ice wedges as they form. — BH



**A near-infrared aerial photograph of an ice-wedge network (red) on the Seward Peninsula, Alaska.**

*J. Geophys. Res.* **106**, 8599 (2001).

CHEMISTRY

## A Golden Chair

Inorganic molecules with intricate structures can be assembled from metal centers and multidentate ligands, with the latter forming two or more

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bonds to the metal. Cyclic compounds of this kind, termed metallacycles, may find applications as catalysts, sensors, and molecular electronic components. Unlike many organic cyclic molecules, metallacycles usually are rigid.

Yip and Prabhavathy have synthesized a metallacycle that has a structure and fluxionality reminiscent of cyclohexane. The molecular ring consists of three gold atoms and three bridging bidentate ligands (9,10-bis[diphenylphosphino]anthracene) with an overall diameter of about 1 nm and a chair conformation similar to that adopted by cyclohexane. Solution $^{31}P$ and $^{1}H$ nuclear magnetic resonance (NMR) spectra show that the ring is stable for several days and indicate that the ring converts between two conformations in which all of the phosphorus atoms but not all of the protons experience identical chemical environments. The authors conclude that a ring inversion occurs, and this interpretation is supported by two-dimensional NMR data, which show that a slow conversion occurs at 228 K. Hence, this fluorescent (475 nm) molecule mimics the structural and dynamic features of cyclohexane. — JU

*Angew. Chem. Int. Ed.* **40**, 2159 (2001).

**VIROLOGY**

## Genetic Meltdown

Ribavirin was identified as a broad-spectrum antiviral agent 30 years ago, but its mode of action remains obscure. Crotty *et al.* now show that the drug accelerates the already high mutation rate of RNA viruses (about $2 \times 10^{-4}$) so as to precipitate a genomic crisis and ultimately to destroy the infectivity of the viral genomic RNA. This is possible because RNA viruses reside at the cusp of a phenomenon called error catastrophe. RNA viruses exist as an assemblage of related quasispecies that, because of their high inherent mutation rate, can adapt rapidly to new environments. Nevertheless, despite their rapid response capacity, this is a dangerous place to inhabit. There is a limit to how much variation a genome can tolerate without irretrievably degrading its genetic information. If a virus population is replicating at the brink, then just a bit of extra pressure from a mutagen, such as ribavirin, may push it into the abyss of genetic meltdown, resulting in an inability to replicate and loss of viability. — CA

*Proc. Natl. Acad. Sci. U.S.A.* **98**, 6895 (2001).

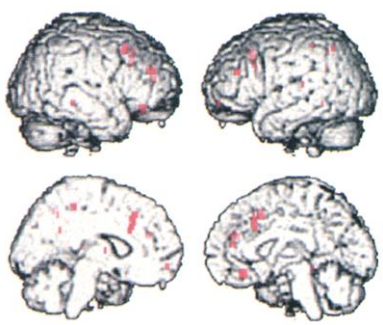
**PSYCHIATRY**

## From Genotype to Risk

The complexity and heterogeneity of psychiatric disorders have contributed to the difficulty in identifying the underlying genetic factors. Egan *et al.* have taken a bold step forward in proposing a tenuous, yet plausible linkage of a polymorphism in the gene encoding catechol-*O*-methyl transferase (COMT) to an elevated risk for schizophrenia.

An evolutionarily recent mutation in this gene results in the replacement of a valine residue with a methionine. This newer enzyme is less stable and exhibits only a quarter of the activity of COMT(Val). The anticipated biochemical result is that dopamine, the substrate of this enzyme, would be inactivated less rapidly. In turn, this would have the consequence in vivo of elevating dopamine levels, particularly in the prefrontal cortex where synaptic transporters that retrieve and sequester released dopamine are less abundant than in other areas of the brain. Dopamine is known, from animal and human studies, to be important for executing cognitive tasks involving working memory. Thus, it was expected that individuals homozygous for the Met allele would display enhanced performance in behavioral tests and that functional brain imaging would reveal larger areas of activation in Val/Val subjects (due to relatively "inefficient" processing in the prefrontal cortex).

Behavioral and genetic analysis of a sample of 175 schizophrenic patients, 219 healthy siblings, and 55 controls revealed an association of the Met allele with better performance on the Wisconsin Card Sorting Test and an association of the Val allele with schizophrenia; both were weak, but significant, effects. Imaging analysis of two groups of siblings showed the anticipated "excess" brain activation in Val/Val individuals. The authors emphasize that the Val allele is not an all-or-none determinant, but rather that it may increase the risk for schizophrenia by slightly compromising prefrontal function. — GJC



**Brain areas displaying more activation in COMT(Val) subjects.**

*Proc. Natl. Acad. Sci. U.S.A.* **98**, 6917 (2001).

CREDITS: EGAN *ET AL.*, *PROC. NATL. ACAD. SCI. U.S.A.* **98**, 6917 (2001).