EDITORS' CHOICE

edited by Gilbert Chin

APPLIED PHYSICS

Switching Carriers on Contact

Carbon nanotube field-effect transistors (CNT-FETs) are ambipolar devices—they can use either negatively or positively charged current carriers (electrons or holes) and thus can be biased in either direction. If carbon nanotubes are to replace semiconductors in even smaller FETs, then ways must be found to make them ambipolar as well. Adsorption or desorption of certain gases at the CNT surface can reverse the carrier type, but such a route to control the electronic properties does not seem practical.

Martel *et al.* have now prepared an ambipolar CNT-FET in which the titanium (Ti) source and drain contacts to the CNT are modified by annealing at high temperature to form abrupt crystalline TiC contacts. Subsequent modulation of the barrier height of TiC/CNT junction by the gate bias allows switching of the conduction along the CNT between holes and electrons. Such robust and controllable ambipolar action is analogous to the complementary metal oxide semiconductor technology of today's microelectronics sector. — ISO

Phys. Rev. Lett. **87**, 256805 (2001).

ASTROPHYSICS

Boo, I See You

The solar corona, the extremely hot gaseous outer shell of the Sun, produces flares and mass ejections that can disrupt communication on Earth. Although observations of the Sun are helping to connect coronal variability with the magnetic field, researchers would also like to observe the detailed structure of other stars to explore their similarities and differences.

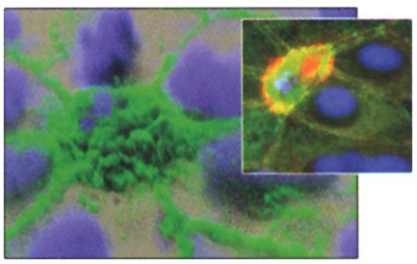
Brickhouse *et al.* have used the dynamics of a nearby binary system, 44i Bootis, in constellation Bootes, and the high resolution afforded by the Chandra x-ray observatory to image the structure of a stellar corona. The two stars of 44i Bootis are in close orbit and pass in front of each other every 3 hours. These authors analyzed Doppler-shifted lines in the x-ray emission spectrum from coronal structures on the primary star as the secondary moved in front of it and behind it, in an observationally fortuitous game of hide and seek. The strength of coronal activity at high latitudes (the polar regions of these stars) was unexpected and contrasts with the behavior of the Sun. — LR

Astrophys. J. **562**, L75 (2001).

CELL BIOLOGY

Just Being Neighborly

In tissues and organs, epithelial cells form tight barriers that demarcate extracellular compartments. On occasion, one of these cells may undergo apoptosis (programmed cell death). Clearance of apoptotic cells by phagocytosis is known to occur elsewhere, but in an epithelium this process might create a hole or promote leakage with deleterious consequences.



Apoptotic cells being expelled from an epithelium (membranes, green; nuclei, blue) (inset: myosin, green; actin, red; nuclei, blue).

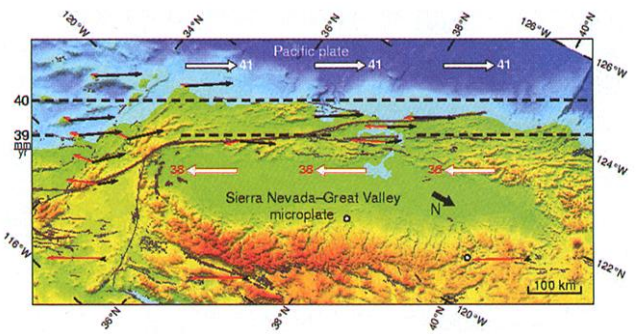
Rosenblatt *et al.* describe how an epithelium actively evicts dying cells. When a cell enters the apoptotic pathway, its neighbors construct and contract an encircling network of actin and myosin. It appears that apoptotic cells directly signal their neighbors to expel them; indeed, an apoptotic cell simply placed on top of an epithelial layer also stimulates the formation of these actin cables. Precisely how the contraction of the surrounding cells is orchestrated to retain epithelial integrity is not yet clear, but even when multiple cells simultaneously undergo apoptosis, electrical integrity of the epithelial barrier is maintained. — SMH

Curr. Biol. **11**, 1847 (2001).

GEOLOGY

Tolerant to a Fault

The San Andreas fault is the boundary where the Pacific plate slides horizontally past the North American plate. Although most of the motion is parallel to the fault (or strike-slip), in several places, including the prominent bends in the fault trace, some of the motion is directed across the fault and has led to the formation of prominent mountain ranges. This convergence across parts of the fault may also influence where it becomes locked; rupture at these sites could then give rise to large earthquakes.



Arrows (black, red) represent velocities relative to the Sierran and Pacific microplates along the San Andreas fault.

Argus and Gordon apply several years of measurements recorded by the Global Positioning System to investigate how the motion of the North American and Pacific plates is reflected in the dynamics of the fault and to test the relation between convergence across the fault and earthquake hazards and topography. The data imply that the fault is slipping at an average of 39 ± 2 millimeters per year. An analysis based on the size of mountains along the fault and the amount of convergence seen implies that the motion between the two plates changed about 6 to 8 million years ago, and it also finds that not all of the locked sections of the fault occur where convergence is high. — BH

Geol. Soc. Am. Bull. **113**, 1580 (2001).

EVOLUTION

Surprises in Simple Packages

Giardia lamblia is familiar to hikers and campers as an intestinal parasite best avoided by filtering one's drinking water. To biologists, *Giardia* is of interest because it lacks mitochondria and has been thought to be representative of simple, modern-day eukaryotes (others of which lack peroxisomes or the Golgi apparatus) that are descended from early

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CREDITS: (LEFT) ARGUS AND GORDON, *GEOL. SOC. AM. BULL.* **113**, 1580 (2001); (RIGHT) ROSENBLATT *ET AL.*, *CURR. BIOL.* **11**, 1847 (2001)

branches of the eukaryotic limb of the "tree of life."

Arkhipova and Morrison have looked for the presence of transposable elements; the issue here is that *Giardia* reproduce asexually and that transposition of regions of the genome would be deleterious. They find evidence of retrotransposons—which encode a reverse transcriptase—and locate these elements next to the telomeric regions of the *Giardia* chromosomes, revealing a similarity to *Drosophila* retrotransposons, which have assumed the role of maintaining telomeres in the absence of the telomeric repeats and telomerase enzyme found in other organisms. This unexpected coincidence of apparently functional transposons in an asexual organism adds to the surprises these deep-branching eukaryotes are anticipated to provide as their genome sequencing projects are completed, as recently reviewed by Dacks and Doolittle.

The genome of another minimalist parasite, *Encephalitozoon cuniculi*, has been sequenced by Katinka *et al.* In this case, metabolic functions of the missing mitochondrion appear to have been cobbled together from a mix of host and parasite components in the absence of the critical enzyme pyruvate:ferredoxin oxidoreductase (for more on this protein, see Chabriere *et al.*, Reports, this issue). As it turns out, *Giardia* do contain this enzyme, whereas *Encephalitozoon* lack transposons. — GJC

Proc. Natl. Acad. Sci. U.S.A. **98**, 14497 (2001); *Cell* **107**, 419 (2001); *Nature* **414**, 450 (2001).

ECOLOGY

Unpredictable Invasions

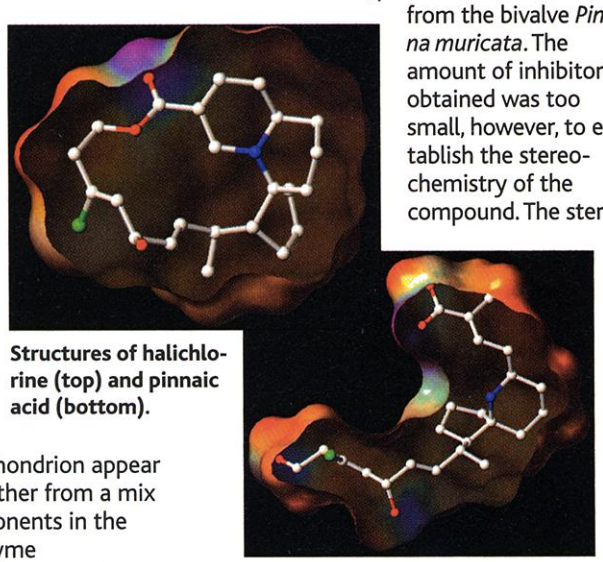
When Europeans settled in New Zealand in the late 18th century, they brought with them browsing mammals, notably goat and deer, and thereby initiated a long-term experiment on the effects of introducing an alien life form on the ecology of native forests. Wardle *et al.* examined how the introduced browsers influenced below-ground and litter-layer biodiversity and ecosystem processes, comparing browsed forest with exclosures set up 25 to 50 years ago. There were consistently adverse effects on particular elements of the forest community, especially populations of indigenous plants and litter-dwelling fauna. Nevertheless, the survey revealed a mosaic of browser effects, with soil biodiversity and soil nutrient dynamics being affected differently in different locations and in idiosyncratic ways. This unpredictability highlights the importance of preventing the establishment of alien species. — AMS

Ecol. Monogr. **71**, 587 (2001).

CHEMISTRY

Long-Distance Stereochemistry

Cytosolic phospholipase A_2 plays an important role in cell proliferation and inflammation, so there was much interest when in 1995 an inhibitor, pinnaic acid, was isolated from the bivalve *Pinna muricata*. The amount of inhibitor obtained was too small, however, to establish the stereochemistry of the compound. The stereochemistry of one carbon center (C-14) remained uncertain, and another (C-17) could not be assigned at all.



Structures of halichlorine (top) and pinnaic acid (bottom).

To resolve this issue, Carson *et al.* embarked on a total synthesis of pinnaic acid. At the outset, the authors assumed that the initial tentative assignment of stereochemistry of pinnaic acid (14*R*) was unlikely to be correct because it differed from that of the structurally related alkaloid halichlorine, another phospholipase inhibitor isolated from the sponge *Halichondria okadai*. Through a combination of synthesis and degradation steps, the authors synthesized pinnaic acid and determined its stereochemistry (14*S*, 17*R*) to be the same as that of halichlorine. They also found a remarkable instance of asymmetric induction during reduction of the C-17 ketone; long-range interactions between other parts of the molecule and the chiral center at C-14 led almost exclusively to the *R* configuration of the alcohol. The biological activity of pinnaic acid can now be pursued, and new therapeutic lead compounds can be developed and tested. — JU

Angew. Chem. Int. Ed. **40**, 4450; 4453 (2001).

CREDITS: CARSON ET AL., ANGEW. CHEM. INT. ED. 40, 4450; 4453 (2001)