

edited by Gilbert Chin

## MICROBIOLOGY

### Sensing SAM

Living life as a single cell leaves little margin for error; an uneven supply of basic building blocks simply cannot be tolerated. A variety of feedback mechanisms that tightly couple biosynthetic pathways to metabolite concentrations have evolved, and how methionine is monitored in *Bacillus subtilis* illustrates the versatility of RNA. Upstream of the regions encoding proteins central to methionine metabolism lies a structural motif called the terminator, which promotes premature termination of transcription. This activity is regulated by an adjacent element that can switch between two secondary structural configurations, referred to as the antiterminator and the anti-antiterminator. What McDaniel *et al.* show in vivo and in vitro is that S-adenosyl methionine (SAM) binding to this element favors the anti-antiterminator structure, which unmasks the terminator and results in no transcript (and no protein) being made. This interaction is specific for SAM versus S-adenosyl

homocysteine, raising the prospect of RNA-based crosstalk with methylation processes. — GJC

*Proc. Natl. Acad. Sci. U.S.A.* **100**, 3083 (2003).

## ECOLOGY/EVOLUTION

### Conquest by Disease Carriers

Invasions by alien species are considered to be one of the greatest threats to native biodiversity and can have severe economic repercussions. The widescale replacement of the native red squirrel in the United Kingdom by the North American grey squirrel over the past century exemplifies these concerns. Until recently, the ousting of the red squirrel was thought to be a straightforward result of the invader's superiority. However, a numerical simulation had suggested that competition alone could not account for the observed decline. Tompkins *et al.* use a mathematical model to show that the pattern of the red squirrel's decline more closely resembles the effects of disease than those of competition. The paroxvirus, which is carried by the grey squirrel without ill effect, is harmful to the red squirrel, suggesting that current

conservation efforts to link the fragmentary habitats still harboring the red squirrel could, in fact, hasten its demise through the more rapid spread of disease. More generally, the fate of the red squirrel highlights the need for greater attention to the potential for disease to exacerbate the consequences of species invasions: another headache for conservationists. — AMS

*Ecol. Lett.* **6**, 189 (2003).

## BIOMEDICINE

### Ephedra—Weighing the Evidence

The herbal product ephedra is a component of many dietary supplements that have been aggressively marketed as promoting weight loss and boosting athletic performance. Recurrent anecdotal reports of adverse effects associated with use of these supplements have prompted investigations into their safety and efficacy.

After an extensive literature review of controlled trials of ephedra or its active ingredient ephedrine, Shekelle *et al.* concluded that the agents promoted only modest short-term weight loss and were associated with a two- to three-fold in-



The ephedra plant.

creased risk of psychiatric, cardiac, and gastrointestinal symptoms. There were no controlled studies assessing the effect of ephedra on long-term weight loss or athletic performance. Compiling data from poison control centers, Bent *et al.* found that although ephedra-containing products represent less than 1% of herbal product sales, they nevertheless accounted for 64% of all adverse reactions to herbs in the United States. — PAK

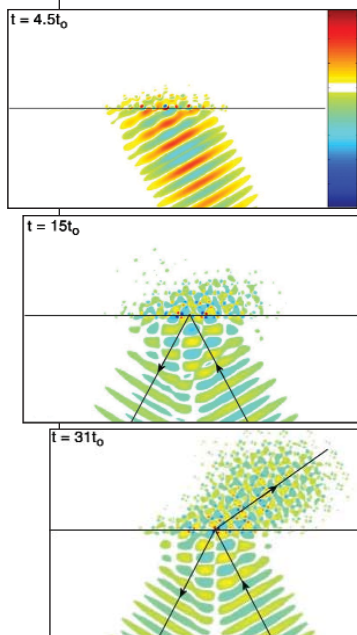
*J. Am. Med. Assoc.* **289**, 1537 (2003);  
*Ann. Intern. Med.* **138**, 468 (2003).

## GEOPHYSICS

### Why Are Old Mountains High?

Many ancient mountain belts are still mountainous. For instance, the last major orogenic activity in the Appalachians, Urals, and parts of Canada and Australia was several hundred million years ago, yet these regions still have mountains and locally high relief (though not as imposing as the younger ranges of the Himalayas, Alps, or Rockies). Simple calculations imply that, at reasonable erosion rates, rivers alone should level this topography in a few tens of millions of years.

Baldwin *et al.* explore this longstanding conundrum in a series of river topography models. Their analysis identifies processes that may serve to extend the times required for



## PHYSICS

### Left-Handed But Not in Left Field

Two years ago, an experiment was devised using a combination of dielectric and conductive elements put together in a specific geometry such that the material would possess negative electric permittivity and magnetic permeability. The result was a demonstration that microwaves entering the material were refracted according to Snell's law, but in the opposite direction to that for "normal" materials, thus confirming an idea first proposed in 1968. Lively discussion ensued, however, about whether these materials really could exist and exhibit these observed properties without breaking the laws of physics. That debate now appears to be put to rest.

Several talks at the March meeting of the American Physical Society and the experimental evidence provided by Parazzoli *et al.* with the simulation work of Foteinopoulou *et al.* together provide strong evidence supporting the existence of negative index of refraction (also called left-handed) materials. — ISO

*Phys. Rev. Lett.* **90**, 107401; 107402 (2003).

Simulation showing incident, reflected, and refracted waves at the surface of a left-handed material.

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removing mountains. First, some uplift or rebound of the crust after the initial erosion (as a result of decreased mass) helps to preserve mountain height. Two factors reduce the efficiency of river erosion: The channel bed becomes protected by alluvium, and increasingly larger flows, which require major floods, are required to entrain significant sediment as relief drops even slightly. These additive factors can explain the persistence of mountains in Paleozoic orogens, and perhaps the absence of even older Precambrian ranges. — BH

*J. Geophys Res.* 108, 2158 (2003).

## NEUROENDOCRINOLOGY

### Hormones, Learning, and Memory

Mammalian motherhood brings a multitude of responsibilities in ensuring the survival of newborns—finding provisions and safe dwellings, and then remembering these locations. In fact, pregnancy and motherhood are thought to enhance cognition, and Tomizawa *et al.* report that the hormone oxytocin can improve late-phase long-term potentiation (L-LTP) in female mice that have given birth and are nursing. Oxytocin is known to control uterine contractions during labor, as well as behaviors such as grooming and nursing. Oxytocin is also produced in neurons that innervate the hippocampus, a brain region important for memory formation. Exposure of hippocampal brain slices to oxytocin increased L-LTP and phosphorylation of the cyclic AMP response element-binding protein (CREB), a change known to be associated with L-LTP induction, and pharmacological inhibitors implicated mitogen-activated protein kinase as mediating an oxytocin signaling pathway. Finally, CREB phosphorylation, L-LTP, and spatial memory all were reduced when female mice were injected with an oxytocin antagonist during pregnancy and then examined 10 days postpartum. — LDC

*Nature Neurosci.* 10.1038/nn1023 (2003).

## MATERIALS SCIENCE

### An Antisticking Adhesive

A common problem with artificial biomedical implants is the progressive nonspecific attachment of cells or proteins onto sur-

faces, referred to as fouling. A common strategy for overcoming this problem is to coat the surface with an immobilized layer of polyethylene glycol (PEG); however, getting the PEG to adhere properly is not easy. Dalsin *et al.* have turned to mussels, which are known for their ability to stick to boat hulls and water pipes. The mussels secrete protein adhesives, which contain 3,4-dihydroxyphenylalanine (dopa) and rapidly harden to form a solid adhesive plaque. Conjugates of PEG and dopa or PEG and a peptide-dopa construct adhered to gold and titanium surfaces and decreased cell absorption by up to 98%; this protective effect persisted for 2 weeks in culture. — MSL

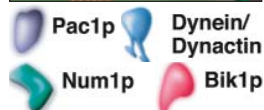
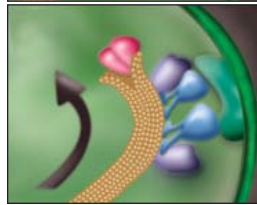
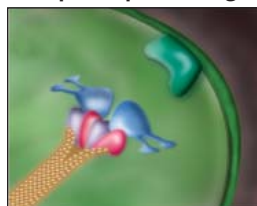
*J. Am. Chem. Soc.* 10.1021/ja0284963 (2003).

## CELL BIOLOGY

### Spindle Positioning

The molecular motor dynein helps to position the mitotic spindle during the later

**Role of dynein in microtubule capture and spindle positioning.**



stages of cell division in budding yeast. At anaphase, when chromosomes are partitioned between the mother cell and the bud, dynein is important in placing the mitotic spindle across the bud neck. This process involves the recruitment of astral microtubules and the association of dynein with the cell cortex.

Sheeman *et al.* detail how dynein is delivered to the cortex of the cell on the tips of polymerizing astral microtubules and then activated via an interaction with the Num1 protein. Num1 is thought to act as an anchor for dynein at the cortex and also appears to enhance the processivity of the dynein motor. Mutations of cargo-binding proteins (Bik1)

interfere with the loading of dynein onto astral microtubules, and mutations that interfere with Num1 cause the accumulation of dynein on the plus ends of astral microtubules during anaphase. — SMH

*Curr. Biol.* 13, 364 (2003).