

EDITORS' CHOICE

edited by Gilbert Chin

OCEANOGRAPHY

Aqueous, not Aeolus

During glacial periods, the productivity in the Southern Ocean rises. This increase has been attributed to the greater availability of iron, which serves to fertilize the Southern Ocean. By drawing carbon dioxide from the atmosphere, the increased productivity feeds back positively, leading to an even cooler climate. According to the "iron hypothesis," the iron is delivered via dust blown into the ocean from arid regions, and Antarctic ice cores do indeed show more dust during glacial periods.

Latimer and Filippelli now offer evidence for a different source of the all-important iron. They have analyzed sediment cores from the South Atlantic and southern Indian Oceans to determine changes in sediment fluxes and productivity. During glacial times, productivity and iron fluxes are indeed higher, but most of the iron does not originate from eolian (wind-borne) dust. Rather, it is attributed to substantially increased weathering

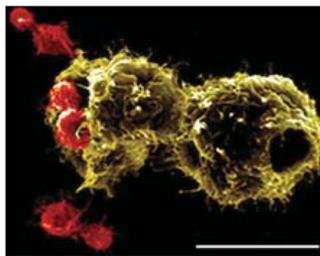
and delivery of material from continental shelves, indicating that increases in productivity may have been fueled by upwelling. Therefore, eolian iron might have constituted a much smaller contribution than previously proposed. — JU

Paleoceanography, 10.1029/2000PA000586.

MICROBIOLOGY

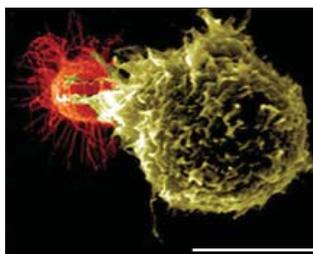
A Poison Capsule Defense

The soil fungus *Cryptococcus neoformans* can enter and persist within human macrophages, causing virulent infections if the person becomes immunocompromised. This fungus need not infect a vertebrate in order to complete its life cycle, so its pathogenicity is puzzling. A clue to its virulence may come from



its life in soil, where predatory microorganisms, such as amoebas, are present.

Steenbergen *et al.* have discovered remarkable parallels between the defensive strategies used by *C. neoformans* when eaten by *Acanthamoeba castellanii* and when surviving in human cells. Amoebas ingest the fungal cells, but the cells remain within vacuoles and produce a toxic polysaccharide, as they do when residing within macrophage vacuoles. The engulfed fungus possesses oth-



Amoebas (yellow) ingesting capsular *Cryptococcus* (red); bars, 10 μ m.

er unfriendly characteristics also exhibited during macrophage infection, and it ultimately kills its host amoeba,

whose death releases vital nutrients. Other soil fungi, such as *Histoplasma capsulatum*, that cause potentially fatal human infections are probably similarly armed because they, too, must run the gauntlet of voracious amoebas. — CA

Proc. Natl. Acad. Sci. U.S.A. 98, 15245 (2001).

PLANT SCIENCE

Early Decision Program

The initial cell division of the plant zygote produces an asymmetric outcome: the apical cell, from which most of the plant develops, and the larger basal cell that in part forms the suspensor, an embryonic tissue that anchors the developing embryo. Suspensor cells in the scarlet runner bean are particularly large and amenable to microdissection, and Weterings *et al.* have been able to identify two messenger RNAs that are specific to the suspensor cells and a third that is enriched in suspensor cells. These transcripts were not detected in the egg, but their asymmetric expression was apparent as early as the four-cell stage and may lead to clues about the molecular signals that establish the initial embryonic asymmetry. — PJH

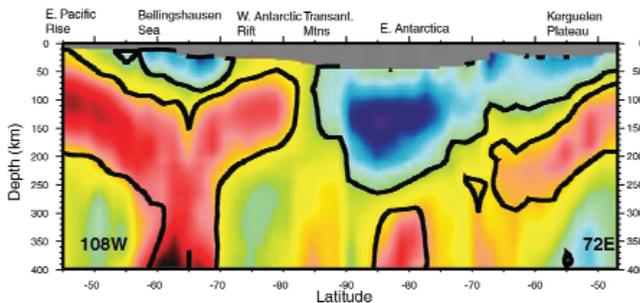
Plant Cell 13, 2409 (2001).

GEOPHYSICS

Reporting from the West Antarctic Rift

Our knowledge of the crust and upper mantle that lie under Earth's continents is poorest in the Southern Hemisphere, particularly beneath Antarctica. This region is important tectonically because Antarctica contains major crustal provinces and because rifting around Antarctica was instrumental in the formation of all of the major ocean basins. Recent volcanism and rifting may also be influencing the stability of the major ice sheets there.

Ritzwoller *et al.* have produced a new tomographic map of the upper mantle structure beneath Antarctica and the Southern Ocean using surface wave velocities. Their model implies that the mantle beneath eastern Antarctica transmits seismic waves rapidly (or is "fast") and thus is probably relatively cold and stiff. In contrast, the mantle beneath western Antarctica is "slower," and thus hotter, although not as slow as the regions at active, spreading ridges. This map is consistent with the presence of ongoing volcanism within a dormant rift zone. — BH



A west-east slice into Earth's interior (blue, fast; red, slow).

J. Geophys. Res., 10.1029/2001JB000179.

CHEMISTRY

Maintaining Mechanism

The replacement of volatile organic solvents with ionic liquids would reduce emissions of chemicals into the environment as well as promote energy-efficient separations. One concern, however, is that solvent interactions in an ionic medium may alter the mechanism (and hence the outcome) of classical organic reactions. Csihony *et al.* examined one workhorse reaction, the Friedel-Crafts acetylation of benzene, in an ionic liquid,

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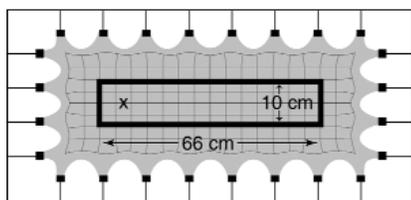
1-butyl-3-methylimidazolium chloride, with *in situ* infrared spectroscopy. They observed a temporal and spectral concordance of absorption bands associated with the expected intermediates for this reaction, such as the acetylium ion CH_3CO^+ in complex with the AlCl_4^- catalyst, for both the ionic solvent and a conventional organic solvent, 1,2-dichloroethane. — PDS

Green Chem. **3**, 307 (2001).

MATERIALS SCIENCE

Bursting the Balloon

When a crack propagates through a solid, it typically takes a straight-line path, as this requires the least amount of work from the system. However, when a balloon is popped, it shatters into fragments that have wavy patterned edges. Deegan *et al.* have constructed an apparatus to study crack propagation in a controlled manner. A series of notches are cut into a rectangular sheet of rubber, and these are annealed to prevent fracture at these points. The projecting tabs are clamped, and the sample is then stretched in both directions, with the greater tension in the short direction of the sheet. Piercing the rubber with a pin generates a crack that propagates along the long direction. At low strains there is an initial kink in the crack, but usually it straightens, following the centerline of the sample. Above a critical strain, the crack oscillates



The strained rubber sheet.

around the centerline with a wavelength that depends on the strain values in both directions. The authors rule out stress-induced crystallization of the rubber and out-of-plane motions as the cause of the instability, and instead show that it can be characterized as a Hopf bifurcation. — MSL

Phys. Rev. Lett. **88**, 014304 (2002).

ECOLOGY

The Decline of the Albatross

Populations of the wandering albatross species in the Southern Ocean have been declining for several decades. Commercial longline fishing for tuna ("by-catch") has been implicated in this decline; albatrosses often attempt to remove bait from fishing lines, the unsuccessful ones becoming en-

trapped themselves. However, because of the vast distances covered by albatrosses while foraging, it has proved difficult to establish the quantitative relationship between the distribution of longline fishing and albatross foraging.

Tuck *et al.* adopt a modeling approach to assess the impact of fishery by-catches on albatross populations, using 30-year data sets on albatross populations at two important breeding sites and parallel reported data on fishing activities in albatross foraging areas. The resulting simulations of albatross population dynamics appear to confirm a substantial impact of by-catch on one of the study populations (Crozet Islands), but indicate a less definite link with the observed population declines at the other (South Georgia). These models allow the integration of demographic and fishing data in a way that is impossible to achieve through direct observation, and, when developed further, will help to pinpoint regulatory and conservation priorities for the Southern Ocean. — AMS

J. Appl. Ecol. **38**, 1182 (2001).

GENETICS

Contextual Analysis

Dopamine is a biogenic amine that functions as a neurotransmitter in central systems underlying behavior. Disturbances in dopaminergic pathways occur in many mental disorders, and the 7R allele of the human dopamine receptor gene *DRD4* has been associated with an elevated incidence of attention-deficit/hyperactivity disorder (ADHD). The 7R allele is one of many such alleles (2R-11R), all of which appear to contain integral multiples of a 48-base pair segment, with single-nucleotide polymorphisms in some of the tandem repeats.

Having sequenced and analyzed 600 *DRD4* alleles from a global sample, Ding *et al.* propose that the most common 2R-6R alleles all derive from single mutation or recombination events operating on an ancestral 4R allele. In contrast, the 7R allele, which itself could give rise to some of the less frequent alleles (5R-8R), would have required a series of at least four mutations and gene conversions. Further analysis suggests that the 7R allele may first have appeared about 40,000 years ago and subsequently been maintained due to positive selective pressure applied by the social and environmental conditions encountered during that watershed period, presumed to differ considerably from the present-day classroom where ADHD is found. — GJC

Proc. Natl. Acad. Sci. U.S.A. **99**, 309 (2002).