EDITORS' CHOICE

edited by Gilbert Chin

ECOLOGY/EVOLUTION

Planting the Seeds of Chaos

Most perennial plant species reproduce every year, but some produce flower and fruit only at longer intervals, sometimes many years apart. This phenomenon, known as masting, involves the synchronous flowering of all the individuals in a population, and has long remained an evolutionary and mechanistic puzzle. What do masting plants gain from such behavior, and how do they achieve the synchrony necessary for masting to occur at all?

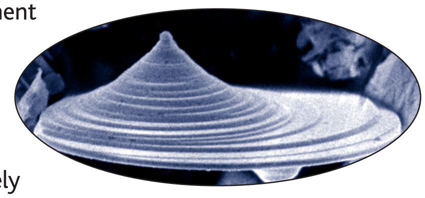
Rees *et al.* have studied the masting grass species *Chionochloa pallens* in New Zealand, using data from individual plants gathered over a decade. Models based on the variation in the plants' resources or on environmental cues failed to reproduce the observed masting pattern. However, models incorporating both resource and climatic cues produced patterns in agreement with the data at the individual and population levels. The resource-based component of the model produced chaotic dynamics in flowering, which were synchronized across individuals by the environmental cue. The resulting pattern is selectively advantageous in reducing the proportion of seeds lost to predators. — AMS

Am. Nat. **160**, 44 (2002).

CHEMISTRY

Tin Oxide Diskettes

The controlled synthesis of a variety of nanosized objects has been reported for several oxide materials. For tin oxide, there have been previous reports on the synthesis of nanoscale tubes, wires, and ribbons. Dai *et al*. report on the preparation of single-crystalline disks, starting from either SnO or SnO_2; the disks formed at temperatures between 200° and 400°C and had a final composition of SnO. Two morphologies were observed: Two solid "wheels" fused together to form a drop-center rim, or a cone-like structure formed from a main disk and a series of spiral-stepped ridges.



Terraces and spiral steps on a SnO diskette.

The latter morphology is thought to be produced by the presence of impurities during the growth cycle. During a subsequent annealing step, the disks oxidized through a complex transformation process, with Sn_3O_4 observed as an intermediate oxide material, and became polycrystalline. — MSL

J. Am. Chem. Soc., 10.1021/ja026262d (2002).

CLIMATE SCIENCE

Heating the Poles

Paleoclimate data indicate that during the Eocene epoch [55 to 38 million years ago (Ma)] and the Cretaceous period (135 to 65 Ma), land and surface ocean temperatures at high latitudes were much higher than they are at present, and tropical flora and fauna extended into much higher latitudes than they do now. Tropical temperatures, however, were similar to or only slightly higher than they are today. Global climate models with Eocene-like boundary conditions predict much lower polar temperatures than those inferred from the geological record and do not reproduce the warm winters seen in continental interiors. This suggests that the models have neglected a strong warming mechanism and that climate predictions for a warmer future might also underestimate temperatures at high latitudes and in continental regions.

Kirk-Davidoff *et al.* propose that this discrepancy may be due to a failure of the models to reproduce the development of the polar stratospheric clouds (PSCs) that form in response to changes in stratospheric circulation and water content. In their model, which invokes polar stratospheric cooling and tropical stratospheric warming caused by a reduced equator-to-pole temperature (from higher atmospheric CO_2 concentrations), an optically thick layer of PSCs forms owing to cooler temperatures and increased moisture in the polar stratosphere. The additional heat trapped by these clouds further increases high-latitude surface temperatures, leading to continued high CO_2 concentrations and low equator-to-pole temperature gradients in a positive-feedback loop. — HJS

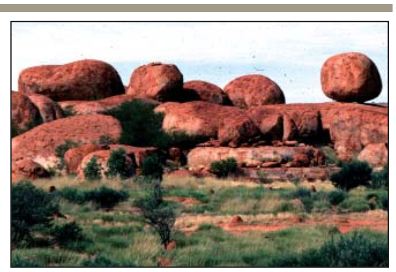
Geophys. Res. Lett. **29**, 10.1029/2002GL014659 (2002).

GEOLOGY

Wear-Resistant Rock

Long-term erosion rates of hills and mountains range from highs of centimeters or more per year in active mountain belts such as the Himalayas to lows of a millimeter per year in stable cratons. It has been suggested that, in parts of Australia, prominent granite domes known as inselbergs have persisted for 100 million years, during which almost no erosion has occurred, preserving a Mesozoic erosion surface.

Bierman and Caffee measured the accumulation of cosmogenic nuclides in several inselbergs to determine their long-term erosion rate. These nuclides accumulate in a rock when it is exposed on the surface and bombarded by cosmic rays. The data imply that the tops of the inselbergs are eroding at rates as low as 0.3 mm per year, one of the lowest rates in the world. Nonetheless, this process is still fast enough that it is unlikely that a Mesozoic erosion surface has been preserved, and thus inselbergs are indeed dynamic landforms. However, because the tops of the inselbergs are eroding no faster (or even slower) than their sides and the valleys, it is likely that the dramatic topography has persisted over that time. — BH



Devil's Marbles, Northern Territory (above) and lichen-mantled granite on Yarwondutta Rock, South Australia.

Geol. Soc. Am. Bull. **114**, 787 (2002).

APPLIED PHYSICS

All-Plastic Electronics

Organic thin-film transistors have substantial benefits over their inorganic counterparts in terms of the ease of processing, weight, and cost, but tend

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CREDITS: (TOP) DAI *ET AL.*, *J. AM. CHEM. SOC.*, 10.1021/JA026262D (2002); (BOTTOM PHOTOS) PAUL BIERMAN

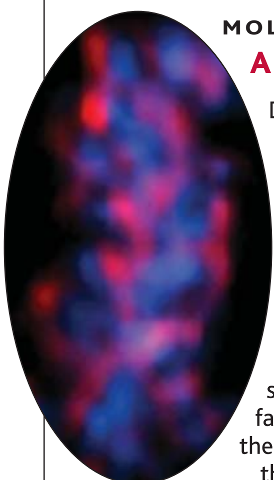
CONTINUED FROM 159

to have low speed because of their low carrier mobility. To date, the best performance for transistors with an organic active layer has been obtained with metallic source, drain, and gate contacts, and with an inorganic gate dielectric. Halik *et al.* describe progress in using organic components to form all-organic transistors yielding carrier mobilities rivaling those of the hybrid devices. Using the conducting material poly (3,4-ethylenedioxythiophene) for the electrodes and poly-4-vinylphenol as the gate dielectric, they demonstrate that transistors with pentacene or poly-3-hexylthiophene in the active layer exhibit mobilities around 0.1 centimeter squared per volt-second. — ISO

Appl. Phys. Lett. **81**, 289 (2002).

MOLECULAR BIOLOGY

A Tug of War



During cell division it is critical that each pair of sister chromatids (the replicated chromosomes) be accurately partitioned between the two daughter cells. This is achieved by orienting the centromeres of the sister chromatids to face opposing poles of the dividing cell; they are then captured by microtubules that radiate from the poles and pull the pairs apart. How is this back-to-back orientation attained?

Stear and Roth show that, in *Caenorhabditis elegans* mutant for the gene *holocentric protein 6* (*hcp6*), individual chromatids can attach to microtubules from both poles, creating a tug-of-war—like arrangement. The centromeres that normally face away from each other become highly disorganized, and the chromatin is partially decondensed in *hcp6* mutants, suggesting that failure of chromosome rigidity is responsible for the sloppy segregation. — GR

DNA (blue) and centromeres (red) in wild-type (below) and *hcp6* cells (above).

Genes Dev. **16**, 1498 (2002).

CREDITS: STEAR & ROTH, *GENES DEV.* **16**, 1498 (2002)

BIOCHEMISTRY

Peptide versus Saccharide

Designing enzyme inhibitors on the basis of crystal structures of substrate complexes remains a challenging task. Taking advantage of naturally occurring inhibitors has been fruitful, especially because microorganisms have, in some cases, used synthetically-accessible building blocks. Chitinases, which hydrolyze linkages in insect and fungal polysaccharides, are an attractive target given the potential for selective inhibition of enzymatic function in pathogens such as *Plasmodium*. Houston *et al.* describe the structure of the complexes between chitinase and two cyclic pentapeptide inhibitors derived from fungi. The differences in how argifin and argadin fit within the active site help to explain their relative affinities and may provide clues for the development of drugs. — GJC

Proc. Natl. Acad. Sci. U.S.A. **99**, 9127 (2002).

BIOMEDICINE

Placental Malaria

Pregnant women are particularly vulnerable to malaria because *Plasmodium* parasites, usually resident in red blood cells, readily respond by switching tissue tropism to colonize the placenta, where heavy infections develop with malign consequences for mother and child. Infected red blood cells display adhesive parasite ligands, encoded by the *var* genes, on their surface. These ligands mediate attachment to vascular epithelium, thus ensuring the parasites are sequestered and can avoid clearance via the spleen. The adhesive ligands mediate tissue tropism and, like many *Plasmodium* proteins, have a huge capacity for variation—another means of immune evasion. Malaria parasites respond to pregnancy by switching expression to a surprisingly conserved gene, *var*CSA, encoding a ligand for chondroitin sulfate A, which is present in the placenta. Vázquez-Macías *et al.* have shown that, unlike most subtelomeric genes, *var*CSA is transcribed in the opposite direction to other *var* genes and is under the control of a distinct flanking element. These attributes might explain its conservation among genetically distinct malaria strains and might offer a route to therapy. — CA

Mol. Microbiol. **45**, 155 (2002).