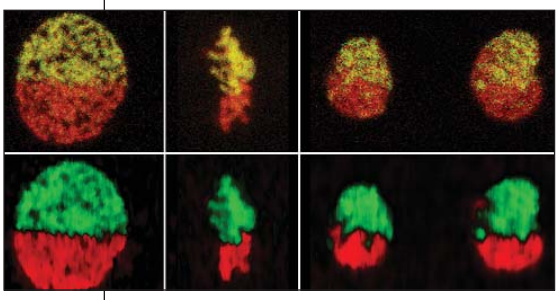
EDITORS' CHOICE

edited by Stella Hurtley

CELL BIOLOGY

Knowing Your Place

During cell division, replicated chromosomes condense and are separated to daughter cells by the mitotic spindle. The dynamics of chromosome condensation and partitioning has been subjected to much scrutiny. Now two papers, by Gerlich *et al*. and Walter *et al*., independently confirm that chromosome arrangements are retained through mammalian cell division. By bleaching fluorescently labeled chromosomes in a variety of living mammalian tissue culture cells just before mitosis, Gerlich *et al*. revealed that a general retention of the chromosomal localization was maintained—chromosome regions in the "top" of the nucleus stayed at the top, and those at the "bottom" stayed at the bottom. Similarly, Walter *et al*. used "chromosome painting" to observe that in HeLa cells, the global distribution of chromosomes and chromosomal territories was retained throughout interphase even though during mitosis itself some rearrangements of specific chromosome territories were seen. Transmission of chromosomal position from mother to daughter might be mediated by controlling the timing of particular chromosomal partitioning during mitosis and could be important in maintaining gene expression patterns. — SMH



Half of the double-fluorescently labeled chromosomes (red and green = yellow) were bleached (leaving red) and did not redistribute across the central plane of the nucleus through mitosis (left to right).

Cell 10.1016/s0092867403001892 (2003); *J. Cell Biol*. **160**, 685 (2003).

GEOPHYSICS

Deep Reactions

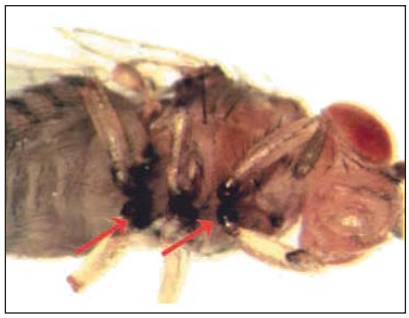
Contaminants in ice cores can offer valuable evidence of past environmental change if they are not affected by processes occurring in the ice itself during their long periods of residence. Sometimes, though, the ice record can become overprinted by in situ formation of material, such as when excess CO_2 is formed by reaction between the carbonate and acids contained in the ice. A new twist to this simple idea is reported by Colussi and Hoffmann, who show that CO in ice from Greenland is made by the action of ultraviolet Cherenkov radiation on organic matter. Cherenkov radiation is produced in glacial ice by the interaction of muons with the ice. Because muons can retain the energy required to form Cherenkov radiation for hundreds of meters, they can photolytically decarbonylate trapped chromophoric organic matter over great depths and long time intervals. Rates of CO production were calculated that are in substantial agreement with CO measurements in ice cores from Greenland that are younger than about 350 years. Thus, cosmic rays could perhaps generate other chemical signals measured in ice cores. — HJS

Geophys. Res. Lett. **30**, 1195 (2003).

DEVELOPMENT

Necrotic Flies

Serpins, like antithrombin and antitrypsin, inhibit serine proteases, and when they are lacking or mutated contribute to a range of disorders including hepatitis, emphysema, and thrombosis. Serpins undergo a conformational change that allows interaction with target proteases, and mutations that affect this mechanism lead to the formation of inactive serpin polymers. Green *et al*. studied *Drosophila* strains with mutations in the *necrotic* (*nec*) gene, which encodes a serpin homologous to antitrypsin. Amino acid substitutions equivalent to those found in human pathological variants were observed, and overexpression of the *nec* mutants induced early mortality. *Drosophila* may thus provide a model system to test therapeutics for human disease.



Mutant fly lacking nec displays necrotic patches (arrows).

In an independent study, Rapa *et al*. identified a human antithrombin variant associated with early-onset thrombosis. Although inactive, the mutant displayed higher affinity for heparin, which normally catalyzes the conformational change that activates antithrombin. Thus, the mutant could sequester heparin and block normal serpin activation. — LDC

Development **130**, 1573 (2003); *J. Biol. Chem*. 10.1074/jbc.M300062200 (2003).

MICROBIOLOGY

Patchwork Plasmid Poison

Gram-positive bacteria, such as *Enterococcus faecium*, are sources of hospital-acquired infection and are dangerous vehicles for antibiotic resistance plasmids. Little is known about the mechanisms by which such plasmids are maintained in Gram-positive bacteria. Grady and Hayes have discovered in the genetic patchwork that constitutes the multidrug-resistance plasmid pRUM a novel gene cassette encoding a protein toxin and cognate antitoxin: Axe-Txe. Toxin-antitoxin systems in Gram-negative bacteria ensure plasmid persistence in a population by inhibiting cells that do not possess the plasmid that encodes the antidote. Experimentally, Txe crosses the species boundary to inhibit the growth of Gram-negative *Escherichia coli*—this effect is reversed if expression of Axe is induced. Other homologs of Axe-Txe are widespread among bacteria, and *E. coli* itself possesses the YefM-YoeB pair. Bacteria producing Txe have a distinct filamentous phenotype, and it seems that Txe acts to inhibit cell division, although the cellular target is not yet known. — CA

Mol. Microbiol. **47**, 1419 (2003).

BIOMEDICINE

Meeting O_2 demand

Neuroglobin (Ngb) is a recently discovered O_2-binding protein whose preferential expression in the vertebrate brain has sparked interest in its physiological function. Two new studies support the hypothesis that Ngb plays a key role in sensing or responding to O_2 levels. Studying a rat model of focal cerebral ischemia (stroke), Sun *et al*. found that antisense-

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CREDITS: (RIGHT PHOTO) GREEN *ET AL*., *DEVELOPMENT* **130**, 1573 (2003); (LEFT) GERLICH *ET AL*., *CELL* 10.1016/S0092874030001892 (2003)

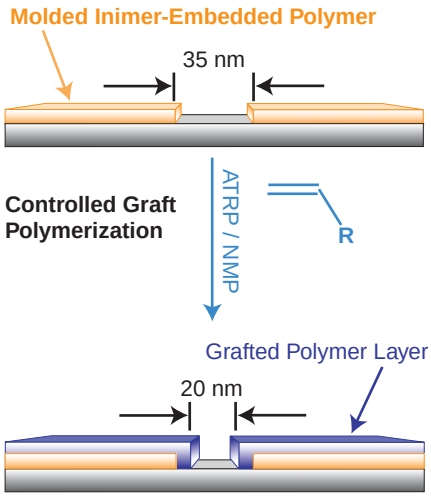
mediated reduction of Ngb levels before the ischemic insult exacerbated the histopathological and behavioral features of stroke. Thus, Ngb may act as an endogenous neuroprotective factor. Schmidt *et al.* studied Ngb in the retina, a tissue that has an exceptionally high O_2 demand. Intriguingly, the level of Ngb in mouse retina was 100 times higher than that in the brain, and within the retina itself the distribution of Ngb correlated with relative O_2 consumption. Whether Nbg enhances O_2 delivery or acts by other mechanisms remains to be determined. — PAK

Proc. Natl. Acad. Sci. U.S.A. **100**, 3497 (2003); *J. Biol. Chem.* **278**, 1932 (2003).

CHEMISTRY

Tunable Tiny Features

Patterning at the nanometer scale is an area of intense investigation, because current fabrication methods have their limitations at this length scale. For top-down approaches like lithography or molding, the problem is making reproducible features smaller than 50 nm, whereas for bottom-up approaches like self-assembly, the challenge is patterning large areas with exact positioning. By combining a molding step with a subsequent polymerization, von Werne *et al.* overcame some of these limitations.



Experimental setup for surface tuning and nanoscopic patterning.

The key to their method is the inclusion in the curable photopolymer used to make the initial pattern of an "inimer," namely, a molecule with both an initiator and a monomer fragment for subsequent polymerization steps. Some of the inimers remain on the surface of the molded pattern, and then a second polymer can be directly synthesized onto the mold via living free-radical polymerization. Feature sizes between parts of the pattern could be reduced from a spacing of 100 nm to 20 nm. Also, because several different polymers could be grafted onto the same initial molded pattern, it was possible to change the surface chemistry using the same basic processing steps. — MSL

J. Am. Chem. Soc. 10.1021/ja028866n (2003).

ASTRONOMY

Shivering Cloud

Although it is uncertain how or why molecular clouds form in space, many clouds are thought to be important nurseries of star formation through collapse or mergers. A particular group of clouds, the Bok globules, are small, cold molecular clouds that appear to be stable against collapse and do not contribute appreciably to star formation. Lada *et al.* wanted to know why one particularly well-studied Bok globule, Barnard 68, was so stable, so dark, and so averse to stellar production.

Bok globule Barnard 68.

They determined the dynamical state of Barnard 68 using high-resolution molecular-line observations from the 30-meter Institute de Radio Astronomie Millimetrique (IRAM) telescope in Spain. Although turbulence is the common stabilizing force against gravity in most clouds, the spectra confirm that Barnard 68 is stabilized by thermal pressure. More intriguing is the unusual pattern in the emission lines from $C^{18}O$, N^2H^+, and $C^{32}S$ that suggests that the outer layers of the cloud are pulsating and that gas in the interior is rotating more slowly than gas in the exterior, which appears to create an odd differential rotation. The oscillations of the outer layers may be caused by the passage of a supernova shock wave, like a bell set to ringing by the ping of a hammer. Nonetheless, although a supernova may have sent a shiver through Barnard 68, it remains cold to star formation and dynamically stable. — LR

Astrophys. J., in press; available at arXiv: astro-ph/0211507 (2003).

CREDITS: (RIGHT PHOTO) COURTESY OF THE EUROPEAN SOUTHERN OBSERVATORY; (LEFT ILLUSTRATION) ADAPTED FROM VON WERNE *ET AL., J. AM. CHEM. SOC.* 10.1021/JA028866N (2003)