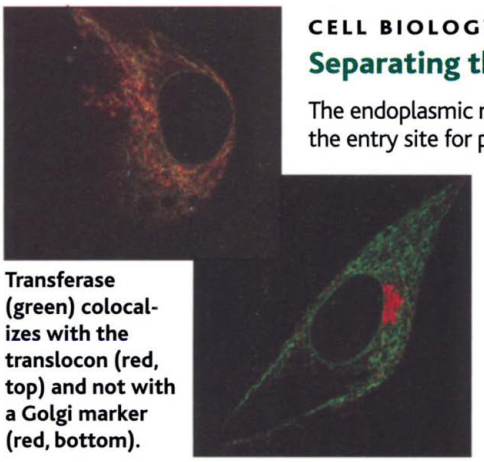
EDITORS' CHOICE

edited by Gilbert Chin



Transferase (green) colocalizes with the translocon (red, top) and not with a Golgi marker (red, bottom).

CELL BIOLOGY

Separating the Rough from the Smooth

The endoplasmic reticulum defines an intracellular compartment that is the entry site for proteins destined for the secretory pathway. Proteins cross into the endoplasmic reticulum via a protein complex known as the translocon and, on the lumenal side, encounter an associated oligosaccharyltransferase, which covalently attaches sugar residues. Nikonov *et al.* examined the mobility of this assemblage by fluorescently tagging the transferase. Translocon complexes that bound the nascent peptides emerging from actively translating ribosomes diffused sevenfold more slowly as compared to other endoplasmic reticulum proteins. A single messenger RNA molecule can be translated by multiple membrane-docked ribosomes at the same time, and this linkage may contribute to the slow diffusion of translocons and also help demarcate rough (ribosome-coated) and smooth (ribosome-free) endoplasmic reticulum domains. — SMH

J. Cell Biol. **158**, 497 (2002).

BIOMEDICINE

Steinbeck Redux

Mouse models have been powerful tools for studying the molecular events that underlie cancer development. But cancer may not arise in mice in precisely the same way that it does in humans, as illustrated by two studies.

Hamad *et al.* present evidence that *ras*, one of the best-characterized oncogenes, has distinct mechanisms of action in mouse and human cells. In mice, oncogenic Ras starts a normal cell on the path to cancer by activating Raf kinases, whereas in human cells it appears to activate Ral guanine nucleotide exchange factors. In broadly analogous work, Smogorzewska and de Lange show that, in humans, both the p53 and p16/Rb pathways function to alert cells to telomere dysfunction, whereas in mice only the p53 signaling pathway is used. The cell culture systems that display these interspecies differences are themselves imperfect models of human cancer, but the work serves as an important reminder that the most accurate information about cancer is likely to come from a combination of experimental approaches. — PAK

Genes Dev. **16**, 2045 (2002); *EMBO J.* **21**, 4338 (2002).

MATERIALS SCIENCE

Pressure-Packed Partnerships

If a solid is squeezed hard enough, it can be forced to undergo a phase transition, with accompanying changes in the arrangement of atoms. For example, crystalline silica can go from a fourfold-coordinated Si to a sixfold coordination, and the two new Si-O bonds that form cause the stishovite phase to remain stable when the pressure is removed.

Using molecular dynamics simulations, Trachenko and Dove look at the mechanics of high-pressure deformation of amorphous silica. At low pressures, the densification is reversible, and atoms in different regions of the sample undergo large local motions in response to changes in applied pressure. Above 3 gigapascals, however, an irreversible increase in the coordination of some of the Si atoms occurs, and this is enhanced with increasing temperature. They also observed a second process, where existing Si-O bonds are broken and new Si-O partnerships form, accompanied by a change in the local topology with an increase in the Si coordination and the formation of small rings of linked polyhedra. — MSL

J. Phys. Condens. Matter **14**, 7449 (2002).

ASTROPHYSICS

Stellar Anemia

The halo of the Milky Way contains a population of metal-poor stars that are among the first stars that formed; they provide information about the abundances of the first generation of heavy elements produced from supernovae before the universe was supplemented by successive generations of stars and galaxies. Aoki *et al.* used the high-dispersion spectrograph on the Subaru Telescope to obtain spectra of the carbon-rich, metal-poor star CS 29498-043. This star is low in Fe but enriched in Mg, Si, N, and Al relative to other classes of carbon-rich, metal-poor stars, and, along with two other recently observed stars, it may represent a new class. This unusual ratio of elements might reflect a distinctive nucleosynthetic process in which the C and Mg produced in the outer layers of a supernova escaped while the Fe from the inner core did not. — LR

Astrophys. J., in press (astro-ph/0208019).

ECOLOGY/EVOLUTION

Sociality and Sustainability

Exploitation by humans has led to the extinction of populations and entire species of animals. This is not just a recent phenomenon; unsustainable harvesting has been a part of human behavior for centuries, if not millennia. Accepting that total bans on the exploitation of wild populations are rare, ecologists and environmental managers have recently devoted a lot of attention to quantifying levels of harvest that are sustainable for the long term. These estimates often suffer from a lack of data on population trends, behavior, and life history of the target species, which can limit the development of credible simulations and models.

Stephens *et al.* have analyzed a system for which the behavioral and population data are rich, enabling them to model harvesting with greater confidence. The alpine marmot, a social mammal with fluctuating populations, is protected in some areas of Europe but widely hunted in others, often to extinction. Of several widely used models of sustainable harvesting, Stephens *et al.* found that "threshold harvesting," which assumes a certain

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CREDITS: (LEFT) NIKONOV *ET AL.*, *J. CELL BIOL.* **158**, 497 (2002); (RIGHT) NATIONAL ASTRONOMICAL OBSERVATORY OF JAPAN

safe threshold population density that can withstand harvesting, is the most appropriate for this system. The threshold in the case of the marmot, because of its sociality, is quite high: the annual removal of only 5% of the adult population would lead to extinction. Many exploited species (such as whales, ungulates, and primates) are social, and perhaps indices of unsustainabilty should be reduced for such species. — AMS

J. Appl. Ecol. **39**, 629 (2002).

CHEMISTRY

Complexes Dissociate, and Then Some

The accurate determination of protein-ligand dissociation constants (K_d) normally requires working with purified components, but in some cases, even estimates of K_d can be valuable. Powell *et al.* have used a mass spectrometric method for determining protein stability, called SUPREX (stability of unpurified proteins from rates of H/D exchange), to estimate K_d within a factor of 2 to 3. In their method, the amount of D incorporation into a protein after a given amount of time is determined from the increase in molecular weight, and this incorporation is determined in solution for different concentrations of denaturants. These changes can be related to the free energy of folding of the protein; differences in the free energy with and without ligands allow K_d to be determined, such as for unpurified Trp repressor in a bacterial lysate. — PDS

J. Am. Chem. Soc. 10.1021/ja026574g (2002).

GEOLOGY

Stress Makes Dating Difficult

Fission track dating has become central to many tectonic studies, particularly for measuring rates at which rocks have been eroded and exposed in active mountain ranges such as the Himalayas and those of western North America. In theory, the abundance of fission tracks (trails of crystal damage left by alpha particles expelled from uranium atoms over time) in minerals such as zircon or apatite can be related to the time since the mineral cooled below its closure temperature—the point above which tracks become thermally healed, or annealed. That cooling age allows calculation of the rate at which rocks have been tectonically brought to the surface from deep in the crust, assuming there is a well-behaved temperature-depth relationship and that temperature is the dominant variable.

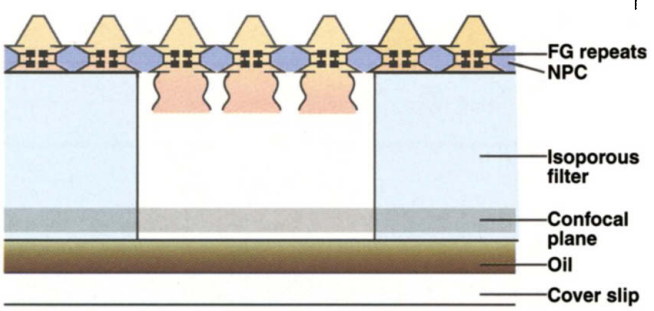
Wendt *et al.* report experiments that cast doubt on the latter assumption. Subjecting apatite grains to a variety of temperature, pressure, and loading conditions, they found that the annealing behavior of fission tracks in the material is extremely sensitive to pressure and differential stress, with variations in parameters such as closure age exceeding 100% in some cases. Thus, apatite fission track dating may be unreliable where pressure or differential stress has played a significant role in the geologic story, which includes most tectonically interesting settings. — SW

Earth Planet. Sci. Lett. **201**, 593 (2002).

BIOPHYSICS

Exposing the Innards

The quantitative analysis of how molecules cross biological membranes has relied on in vitro preparations in which the solute compositions on both sides of the membrane are accessible to the experimenter; for instance, both right-side-out and inside-out erythrocyte ghosts have been used to measure anion flux. Making such measurements across internal membranes has been especially daunting, but Siebrasse and Peters describe a method for monitoring passage through nuclear pore complexes (NPCs), large channels about 10 nm in diameter that allow movement of macromolecules between the cytoplasm and the nucleus. They show that NTF2, a protein that binds to the FG repeats of the nucleoporin components of the NPC, is transported about 50 times faster than an inert comparably sized protein, with a turnover rate of 100 molecules s^{-1} NPC^{-1}. Also in this system, Siebrasse *et al.* have been able to reconstitute nuclear transport that is dependent on both an export receptor and the GTP-binding protein Ran. — GJC



Optical measurement of nuclear pore flux.

SOURCE: SIEBRASSE & PETERS, *EMBO REP.* 10.1093/EMBO-REPORTS/KVF171 (2002); ILLUSTRATION: DEBRA J. MORGENEGG/*SCIENCE*

EMBO Rep. 10.1093/embo-reports/kvf171 (2002); *J. Cell. Biol.*, in press.