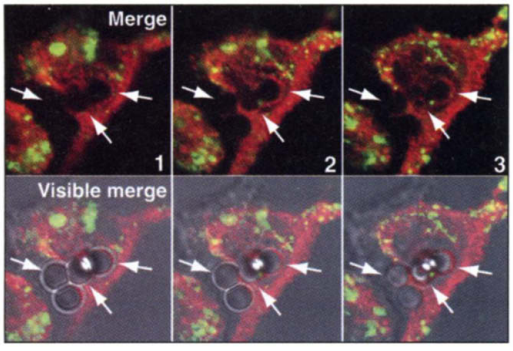
EDITORS' CHOICE

edited by Stella Hurtley

CELL BIOLOGY

Breaking and Entering

In fighting invading pathogens, the body's defenses include the engulfment of incoming pathogens by macrophages in the blood. This process is known as phagocytosis and involves the recruitment of intracellular membrane to the cell surface to produce a vacuole containing the unwelcome intruder. The resulting vacuole then fuses with the cell's degradative organelles, the lysosomes, and the invader is destroyed. Gagnon *et al.* examined the early stages of phagocytosis in macrophages and discovered that a major source of additional membrane for the formation of phagosomes is the endoplasmic reticulum (ER). The ER is the entry site of the secretory pathway and would not generally communicate directly with the plasma membrane. In other phagocytic cells, the neutrophils, ER is not used as a source of phagocytic membrane, and pathogen killing is more rapid. Certain pathogens may be able to exploit this process in macrophages to set up a protected niche within which they can multiply. — SMH



ER (red) wraps around latex beads (dark circles) before lysosomal membranes (green) are recruited.

Cell **110**, 119 (2002).

GEOLOGY

A Plateau Below

Volcanic flood basalt provinces have generally been thought to arise within 5 million years, which is a relatively short time scale for geology. The Keguelen Plateau in the South Indian Ocean, one of the largest oceanic plateaus, has been thought to have formed from a large outpouring of basaltic lava and would thus be one of the largest such provinces on Earth. Although it may have been emergent for a considerable part of its history, its remote location (mostly 1 km or more below sea level) has made its origin speculative. A recent oceanic drilling program leg aimed at understanding its origin and history has now provided dating results that imply that major volcanic eruptions commenced about 120 million years ago. Although large volumes of magma erupted near that time, significant volcanic eruptions continued subaerially for about 25 million years, which is much longer than would be expected for the melting of a single plume in the mantle. Parts of the plateau at least are underlain by continental crust that is likely to be fragments of India that were adjacent to the plateau as it began to form. Evidence for crustal contamination is seen in the earlier magmas but not in volcanism on the Plateau after about 20 million years ago. This suggests that a change occurred in the source region at depth in the mantle. — BH

J. Petrol. **43**, 1109 (2002).

APPLIED PHYSICS

Emission Under Stress

Amorphous and microcrystalline thin-film semiconductors have had a huge impact in the field of display technology. Now technologies with even lower power consumption and with higher resolution, such as cold emitter arrays, are being pursued. Thin-film amorphous carbon is one such candidate material for this application. Electron emission can occur at low voltages, but the mechanism remains unclear.

Pau *et al.* have studied electron emission yield from a series of amorphous carbon thin films grown by plasma deposition possessing various levels of internal stress. Films with higher amounts of stress and larger volumes of sp2 bonding have the lowest bias at which electrons are emitted. Just as application of pressure can alter the electronic properties of materials, the authors suggest that the internal stress distorts the electronic bands within the film, resulting in enhanced electron emission at low voltages. The result may prove useful for other thin-film technologies. — ISO

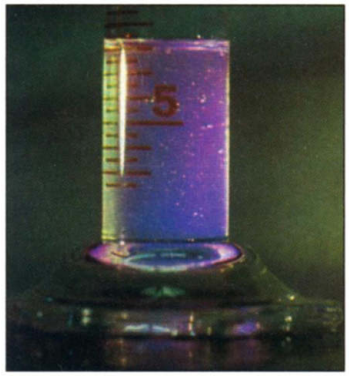
Appl. Phys. Lett. 10.1063/1.1497442 (2002).

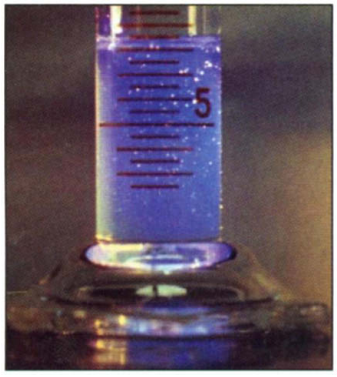
CONTINUED ON PAGE 481

CHEMISTRY

Colorful Cocktails

Working with a cocktail of methyl methacrylate (MMA), divinyl benzene, octane, and glycerol, Wormuth *et al.* created a set of brightly colored emulsions. When illuminated with white light, a "standard" emulsion can be prepared that transmits red light but appears to be blue when viewed at higher angles. The aesthetically pleasing colors are caused by a matching of the refractive index of the droplets with that of the continuous phase for a narrow range of wavelengths, so that the rest of the spectrum is scattered. For example, raising the temperature of the standard emulsion shifts the light absorbance minima to shorter wavelengths, so that the transmitted light is a green-blue color and the scattered light is violet. The colorful emissions are only observed for a limited range of compositions and temperature (for example, at higher concentrations methyl acrylic acid can be substituted for MMA), and often the net effect is an overall turbidity of the emulsion (which happens if ethylene glycol is substituted for the glycerol). Parallel studies by the same authors have also shown that these cocktails can be polymerized to form a porous latex material. — MSL





Standard emulsion at 25°C (left) and 60°C (above).

Langmuir 10.1021/la0157566 (2002).

CREDITS: (TOP) GAGNON *ET AL.*, *CELL* **110**, 119 (2002); (BOTTOM) WORMUTH *ET AL.*, *LANGMUIR* 10.1021/LA0157566 (2002)

PLANT BIOLOGY

A Pinch of Salt

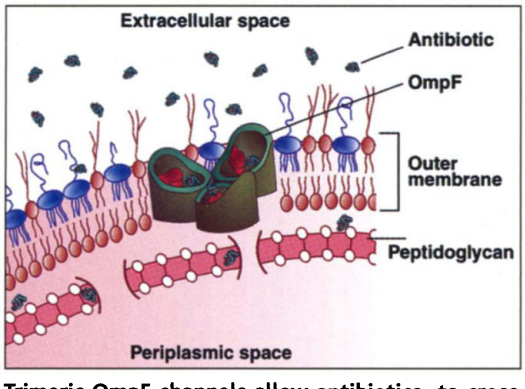
The unicellular green alga *Dunaliella salina* shows remarkable ability to tolerate salt, being able to grow in the presence of as much as 3.5 M NaCl. Among the adjustments the cells make in response to changing osmotic pressure are to adjust internal glycerol concentration and to transcribe certain salt-inducible genes. Azachi *et al.*, analyzing one of the salt-inducible mRNAs, find that a microsomal enzyme is added to the mix as the cells adjust to higher salinities. Osmotic shock alone is not as effective as salt at inducing synthesis of this enzyme. The enzyme, kcs, catalyzes the first rate-limiting step in fatty acid elongation. Cells grown in higher salt concentrations show a shift in membrane composition of microsomes from C16 toward C18 fatty acids as well as an increase in desaturation of the fatty acids. These modifications in membrane composition may serve to adjust to altered dynamics of vesicle transport and membrane fusion in the osmotically accommodated cytoplasmic environment. — PJH

Plant Physiol. **129**, 1320 (2002).

MICROBIOLOGY

Designed to Penetrate

One factor contributing to the innate resistance of bacteria to some antibiotics is membrane permeability. The general diffusion porin, OmpF, governs the influx of various molecules, including beta-lactam antibiotics, through the outer bacterial membrane. In the periplasmic space, these antibiotics inhibit bacterial cell wall synthesis. Nestorovich *et al.* put pure, intact, and functional *E. coli* OmpF in artificial lipid bilayers and showed that a current between the chambers made by the bilayer was interrupted when ampicillin was added. Earlier observations on OmpF by Simonet *et al.* showed that mutations in the third beta-sheet loop of OmpF, which penetrates the channel of the porin, result in resistance to ampicillin—the drug of choice for *E. coli* disease. Nestorovich's structural modeling studies show that the zwitterionic ampicillin "docks" at the midway constriction made by loop 3, because of the complementary electrostatic charges in the walls of the pore, thus blocking current flow. In some unknown way, the docking helps to speed up the transport of the antibiotic into the periplasmic space. Now the bilayer-OmpF system can be used in high-throughput screening devices to help predict the antibiotic potency of synthetic beta-lactam molecules. — CA



Trimeric OmpF channels allow antibiotics to cross the bacterial outer membrane.

CREDIT: NESTOROVICH *ET AL., PROC. NATL. ACAD. SCI. U.S.A.* **99**, 9789 (2002)

Proc. Natl. Acad. Sci. U.S.A. **99**, 9789 (2002); *Antimicrob. Agents Chemother.* **44**, 311 (2000).

IMMUNOLOGY

Open For Business

Commitment of $CD4^+$ T cells to the T helper cell 1 (T_H1) or T_H2 lineage is defined by the transcription of IFNγ and interleukin-4 (IL-4) cytokine genes, respectively. Potentially, this could be specified at the early stages of naïve T cell activation or during the subsequent elaboration of helper cell functions.

Fields *et al.* and Avini *et al.* used chromatin immunoprecipitation to obtain information about chromatin conformations at the IL-4 and IFNγ loci during T helper cell differentiation. Acetylation of histone tail domains (representing an open chromatin structure accessible to the transcription machinery) appeared at both loci in response to early signals from the T cell receptor. However, acetylation at each locus was maintained only in the presence of the correct cytokine stimulus. In the case of T_H2 signals, signal transducer and activator of transcription-6 (STAT-6) initiated cooperation of the transcription factors GATA-3 and NFAT in stabilizing the IL-4 locus. Fields *et al.* also observed that STAT-4–dependent T_H1 signals induced stabilization of the IFNγ locus via the transcriptional regulator T-bet. This two-tiered regulation of cytokine locus accessibility was mutually exclusive, because chromatin at the nonspecified locus was secured in a state not permissive for gene transcription. — SJS

J. Immunol. **169**, 647 (2002); *Nature Immunol.* **3**, 643 (2002).