EDITORS' CHOICE

edited by Phil Szuromi

EVOLUTION

Disappearing in Stages

The extinction at the end of the Triassic is one of the five largest in the geologic record. It marked the demise of conodonts, a common but enigmatic index fossil seen through the Paleozoic, as well as other marine fauna; on land, the dinosaurs emerged to dominate Mesozoic ecosystems in its aftermath. The best-dated large extinctions, those at the end of the Permian (the largest such event in the geologic record) and at the end of the Cretaceous, seemed to have occurred extremely rapidly (within no more than a few hundred thousand years) and apparently in response to catastrophic environmental changes. The end-Triassic extinction has been less well resolved, in part because it is mostly recorded in continental rock sections.

Carter *et al.* now provide dates for the extinction in a marine section in the Queen Charlotte Islands off western Canada. The ages from uranium-lead dating imply that the extinction of conodonts and other marine organisms occurred just a little less than 200 million years ago. In contrast, the accepted dates on the extinction of terrestrial faunas are up to about 1 million years older (and most time scales have placed the end of the Triassic several million years earlier still), which implies that the extinction proceeded in stages. This time period in the geological record also corresponds with voluminous basaltic magmatism, which also occurred during the end-Permian and end-Cretaceous extinctions. — BH

Geology **28**, 39 (2000).

CELL BIOLOGY

Peroxisome Biogenesis

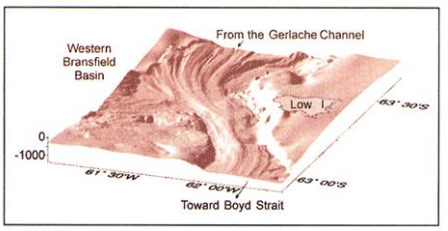
Peroxisomes are a class of vesicular organelles involved in lipid and drug metabolism. The number of peroxisomes in a cell can be increased when cells are exposed to certain chemicals, for example, oleic acid. Peroxisome biogenesis disorders, such as Zellweger syndrome, neonatal adrenoleukodystrophy, and infantile Refsum syndrome, are lethal genetic disorders that cause severe mental retardation. How peroxisomes form has not been well understood—fusion of small vesicles is one possibility, but the existence and characteristics of these precursor vesicles have not been established.

Titorenko *et al.* have now examined the formation of peroxisomes in the yeast *Yarrowia lipolytica* in detail and describe six vesicular intermediates in the production process that are linked by vesicular fusion and vesicular maturation through protein import. They go on to describe the fusion of the first two intermediates in the pathway in a cell-free reaction that requires cytosol and energy in the form of adenosine triphosphate (ATP). Furthermore, they provide evidence for a role for two members of the AAA family of membrane-associated adenosine triphosphatases in the fusion reaction itself. Why peroxisome biogenesis requires so many distinct intermediates is unclear, and the source of the precursor vesicles remains obscure. However, the molecular dissection of the assembly process will enhance our understanding of the basic cell biology of these organelles and may help in defining and circumventing the defects in peroxisomal biogenesis disorders. — SMH

J. Cell Biol. **148**, 29 (2000).

GEOLOGY

Old Ice Streams



Basin bundles.

The size and behavior of past Antarctic ice sheets are essential elements in the quest to understand how and why climate changed in the past and what the consequences may be in the future. Modern observations have shown that Antarctic ice flow is slow and diffuse over most of the interior of the ice sheet but focuses into relatively rapid streams near the edges of the sheet. Canals *et al.* have found a set of parallel to subparallel ridges and grooves up to 100 kilometers (km) in length at a water depth of 1000 m in the Western Bransfield Basin off Antarctica. They identify this formation, called a "bundle" structure, as material deposited by a giant ice stream during the last glacial maximum. This finding illustrates the importance of rapid ice flow during past glacial maxima that are related to present ice sheet movements. The minimum ice thickness necessary to have formed this bundle is 1000 m. This single stream, which was probably about 340-km long, would have transported approximately 8000 km^3 of ice to the ocean—enough to raise sea level slightly more than 2 cm. — HJS

Geology **28**, 31 (2000).

SOURCE: CANALS *ET AL.*, *GEOLOGY* **28**, 31 (2000).

GEOPHYSICS

Gamma-Ray Cloud Burst

Emissions of gamma rays are normally associated with high-energy astrophysics, not thunderstorms, but theoretical work going as far back as 1925 has predicted gamma-ray emissions to occur in strong thunderstorm electric fields. However, only recently, thanks to advances in electronics and thunderstorm ballooning techniques, has it become possible to measure gamma-ray emissions directly in thunderstorms. Eack *et al.* now report balloon measurements that reveal a greater than threefold increase in the gamma-ray flux in the anvil (or "thunderhead") of a summer thunderstorm. The enhanced gamma-ray emissions are most likely the result of a runaway effect, in which a "seed" electron with an energy of about 1 million electron volts produced by a cosmic ray initiates an avalanche of energetic electrons. The measurements indicate that gamma ray production in thunderstorms is not confined to isolated regions near the main charge centers of large thunderstorm complexes (where previous measurements were obtained) and may thus be more widespread than previously believed. — JU

Geophys. Res. Lett. **27**, 185 (2000).

NEUROSCIENCE

Picking Out the Prime Suspect

An ancient cellular mechanism drives the rhythms of the body, and to ensure that this biological clock is in tune with the 24-hour cycles of the Earth, it can be reset by light or by temperature. How temperature resets the clock in mammals is not known, but now Provencio *et al.* have provided a strong candidate for the pigment that captures light

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to reset the mammalian clock. There have been several suspects along the way. The most obvious pigments in the eye, the opsins in the rods and cones of the retina (which form visual images), are surprisingly unimportant for mediating light effects on circadian rhythms: Light easily resets the clocks of mice with no rods or cones and of people who are completely blind. Another pair of suspects has been the cryptochromes, flavin-based pigments that absorb blue light and are present in retinal ganglion and inner nuclear cells, but recent evidence has knocked cryptochromes almost entirely out of the line-up. The phenotype of mice missing both cryptochrome 1 and 2 suggests that cryptochromes are not required for entrainment of the circadian rhythm, and their interaction with other clock components does not require light, as would be expected if they were light receptors.

The new prime suspect is melanopsin, an opsin found only in the cells of the mammalian inner retina. Melanopsin is much more like invertebrate opsins than mammalian ones, including the substitution of an aromatic residue for a Schiff's base counterion, which in the usual mammalian opsins allows local regeneration of the chromophore. The melanopsin in retinal ganglion and amacrine cells far away from the chromophore-regenerating retinal pigment epithelium would require such local regeneration for function. To add to the argument, these melanopsin-containing cells have the same frequency and distribution as the retinal cells that project directly to the suprachiasmatic nucleus, the site of the clock. Finally, the peak of the circadian light response is at a wavelength expected from an opsin-based photopigment (like melanopsin), rather than a flavin-based photopigment. At this point, the evidence remains circumstantial and several other pigments in the retina must remain in town for questioning. Nonetheless, melanopsin is emerging as a likely culprit as a receptor for the light that keeps mammalian bodies in tune and in time. — KK

J. Neurosci. **20**, 600 (2000).

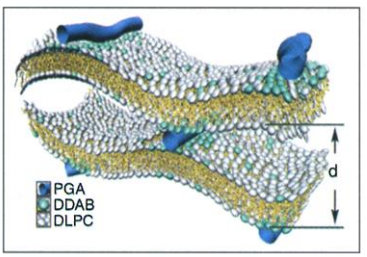
CREDIT: SUBRAMANIAN *ET AL., J. AM. CHEM. SOC.* **122**, 26 (2000).

CHEMISTRY

In a Pinch

Complexes of cationic lipids and DNA have been used for gene delivery. For certain concentration ranges, complexes of neutral and cationic lipids with DNA form lamellar structures in which intercalated DNA forms well-ordered two-dimensional arrays.

Analogous complexes have recently attracted interest for protein or drug delivery. Subramanian *et al.* have now examined the structure of complexes of mixtures of neutral and cationic lipids with a high-molecular-weight peptide (polyglutamic acid) using small-angle x-ray and neutron scattering. Near the isoelectric point of these complexes, dilution with neutral lipids increased the membrane spacing from 4 to 6 nanometers. In their model for these complexes, the interaction of the polypeptide and the lipid layers pinches off pockets of water locally. The authors suggest that these pinched regions could be used, for example, in drug delivery. — PDS



Pinching off a pocket.

J. Am. Chem. Soc. **122**, 26 (2000).

Science's stke

Restoring Retinoid Signals in Cancer Cells

Retinoids have multiple biological effects, including inhibition of proliferation of certain cancer cells. The retinoids often act through heterodimers of two nuclear receptors, the retinoic acid receptors (RARs) and the retinoid X receptors (RXRs). In normal cells, the expression of RARb is enhanced through transcriptional activation in response to retinoids, but many cancer cell lines lose their ability to response even though the RAR and RXR proteins are still expressed. Lin *et al.* now show that such retinoid-insensitive cells may be missing another nuclear receptor, the orphan receptor COUP-TF. In cancer cell lines lacking COUP-TF, expression of COUP-TF restored retinoid-induced expression of RARb as well as the apoptotic and growth inhibitory effects of retinoic acid in these cells. COUP-TF appears to enhance the interaction of RAR with the transcriptional coactivator CBP through DNA binding. This mechanism of action of COUP-TF is distinct from its effects on other genes, where it has its own transactivation activity through recruitment of a different coactivator. — LBR

Mol. Cell. Biol. **20**, 957 (2000).