EDITORS' CHOICE

edited by Gilbert Chin

PALEONTOLOGY

Large Early Life Forms

The Ediacaran fauna represent the first complex multicellular fossils—some are a meter or more in length—preceding the Cambrian, when a wide variety of forms including shelly fossils evolved. The oldest Ediacaran fossils have been considered to be about 565 million years old, although there have been some hints of earlier complex fossils, particularly phosphotized animal embryos from China.

***Charnia wardi* (left) from near Portugal Cove South, Newfoundland (above).**

Narbonne and Gehling have discovered several Ediacaran fossils from Newfoundland that are considerably older, about 580 million years old, and that are found 1500 m stratigraphically below the younger type Ediacaran fossils. These older fossils were preserved in volcanic ash and are almost 2 m long. Furthermore, they lie close to, but above, a prominent glacial deposit that is associated with several major glaciations that affected Earth in the late Precambrian ("snowball Earth" glaciations), providing a potential link between the bottleneck of these glacial events and the appearance of more complex life on Earth. — BH

Geology **31**, 27 (2003).

BIOTECHNOLOGY

Tinkering with Nature

Experimental efforts to direct the evolution of enzymes are of special interest both for their technological potential—for instance, protection against chemical agents or improved bioremediation—and for what they might tell us about our evolutionary history. Griffiths and Tawfik have devised an in vitro system with intriguing parallels to some conceptions of prebiotic conditions. In addition to the usual linking of nucleotide fragment (containing the genetic information undergoing mutation) and enzyme product (generating the phenotype subject to selection), they use antibody-coated microbeads that capture the readout of the enzyme. More importantly, they encapsulate each microbead in a 5-fl droplet of water emulsified in mineral oil. Compartmentalization of gene, enzyme, and product mimics surfacial and local environmental factors thought to be critical in concentrating biochemicals and in overcoming diffusion during prebiotic stages of evolution. Alas, the end result here is a reminder that natural evolution has worked well indeed, as heroic efforts to improve the catalytic efficiency (k_{cat}/K_m) of phosphotriesterase, which can inactivate soman and sarin, yield only a factor of two. — GJC

EMBO J. **22**, 24 (2003).

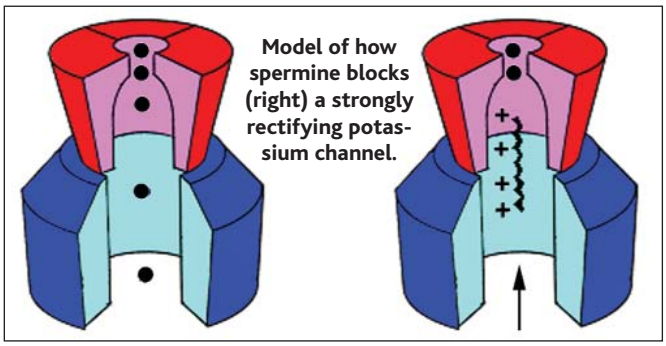
BIOCHEMISTRY

Cue to Exeunt

Many biological channels conduct ions with similar activities in both directions; however, a subset known as inward rectifier (IRK) channels conducts K^+ ions into the cell more readily. This subset of channels helps to maintain the normal resting potential and also influences heart rate and neurotransmitter action (via G proteins). Rectification occurs because at voltages where K^+ would normally flow outward, the channel is blocked by intracellular cations (Mg^{2+} or polyamines).

But why does this occur only in IRK channels? The answer comes from the 1.8 Å structure of the intracellular region of the G protein–gated IRK channel (GIRK1), solved by Nishida and MacKinnon. The tetrameric assembly contains a pore about 30 Å in length and 7 to 15 Å in diameter. Docking this cytoplasmic pore onto the narrower transmembrane piping of the MthK channel gives an ion conduction pathway roughly 60 Å in length. The pattern of negatively charged and hydrophobic amino acids lining the inner wall of the pore would attract complementary polyamines. The authors propose that the strong voltage dependence of inward rectification arises because, as a polyamine moves into the cytoplasmic pore, it herds and forcibly queues K^+ ions toward the transmembrane exit. — VV

Cell **111**, 957 (2002).



Model of how spermine blocks (right) a strongly rectifying potassium channel.

ASTROPHYSICS

Galaxy Evolution: A Dim Future

Galaxies, the major building blocks of the luminous universe, have evolved with time. However, it has been difficult to follow this evolution by characterizing faraway galaxies, because the morphologies of these distant objects are obscured.

Using the 10-m Keck telescope and adaptive optics, Glassman *et al.* have succeeding in resolving the disk and the bulge of 10 galaxies at a redshift of 0.5 at infrared wavelengths. The disks are larger and have a higher surface brightness than today's more evolved galaxies (at a redshift of 0). Thus, these less evolved, higher-redshift galaxies (immature galaxies) possess a younger stellar population with more active star formation, and these disks will probably fade and come to resemble today's more evolved galaxies. The bulges show no differences compared to today's galaxies, which is consistent with the model of bulges forming from a uniformly older stellar population and not changing over time. More observations of

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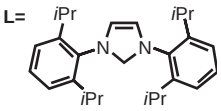
CREDITS: (BOTTOM) NISHIDA AND MACKINNON, *CELL* **111**, 957 (2002); (TOP) GUY M. NARBONNE

more galaxies, with improvements such as large telescopes and adaptive optics, will help confirm whether young and active galaxies can look forward to a dim future of fading disks and static halos, or if alternative scenarios such as starbursts or exotic galaxies might liven up the luminous cosmos. — LR

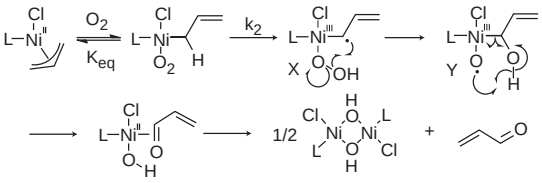
Astrophys. J. **581**, 865 (2002).

CHEMISTRY

A Ni(II) Knife for Oxygen



Aerobic oxidation of organic compounds can be catalyzed by a number of Pd(II) complexes, but few examples are known for the corresponding Ni(II) system in the absence of large biomimetic ligands. Dible and Sigman show that a Ni(II) complex containing allyl chloride and N-heterocyclic carbene ligands reacts stoichiometrically with oxygen to yield aldehydes and ketones (derived from the allyl moiety) as well as a nickel dimer bridged by hydroxyl groups. The authors propose a mechanism in which O_2 binds reversibly to the Ni(II) complex and decomposes it to one bound to a hydroxyl and an oxidized allyl species that is side-on bonded through its carbonyl group. Dimerization then liberates the oxidized organic species. Further study may lead to systems that perform this chemistry catalytically. — PDS



Scheme for oxygen scission and nickel dimer formation.

J. Am. Chem. Soc. 10.1021/ja0286876 (2002).

DEVELOPMENTAL BIOLOGY

Coarse and Fine Tuning

Deletion of two myogenic transcription factors, Myf5 and MyoD, is sufficient to abrogate the skeletal muscle lineage in mice. The absence of muscle leads to degeneration of neuronal components. Spinal and brainstem motor neurons and proprioceptive sensory neurons begin to develop but are then eliminated by apoptosis.

Competing theories about brain cortical development disgaree over the developmental causation of cortical specializations. What defines, for example, the olfactory cortex or, of more interest in these experiments, the specialized region known as the motor cortex? Regions of the cortex might be specified by preexisting intrinsic programs, or they might be specified in reaction to signals coming from outside sources, such as the thalamus. Kablar and Rudnicki find that, in mice lacking skeletal muscle, the large-scale organization of the neocortex is normal, favoring early intrinsic patterning mechanisms. However, the cortical neuronal cell populations that would subserve motor activity show a spectrum of deficits, suggesting that fine elaboration of neuronal structures depends on extrinsic signals. — PJH

Int. J. Dev. Neurosci. **20**, 573 (2002).

ECOLOGY/EVOLUTION

Biodiversity from Space

Mapping and quantifying biodiversity is key to effective conservation planning, yet gathering the necessary data can be costly and time-consuming. Conservationists and land managers therefore place a premium on methods, such as remote sensing, that yield tolerable estimates of biodiversity in the absence of exhaustive ground surveys. Bawa *et al.* have tested a method of estimating tree diversity from space. Their study, conducted in the Biligiri Rangaswamy hills in the Western Ghats, India, shows a strong and positive correlation between species richness and an index of green biomass—the Normalized Difference Vegetation Index (NDVI)—which can be assessed accurately using satellite imagery. This technique shows promise for estimating broad patterns of tree species diversity at the landscape scale in tropical forests, which may be crucial to identifying areas most in need of protection and where rapid destruction is underway. — AMS

Conserv. Ecol. **6**, www.consecol.org/vol6/iss2/art7 (2002).