EDITORS' CHOICE

edited by Gilbert Chin

GEOCHEMISTRY

Fixing a Precise Date

Some of Earth's oldest rocks, in what is known as the Itsaq Gneiss Complex, are exposed in southern Greenland. These rocks are thought to harbor the primary evidence for Earth's earliest life, and their age bears on questions about the rate and origin of continental crust and the early evolution of Earth's mantle. Their exact age, however, is controversial; estimates have ranged from more than 3.85 billion years ago (Ga) to about 3.6 Ga. The obstacle is not the method—uranium-lead dating of zircons within these rocks—but that many of the zircons show intricate zoning and can yield multiple ages, and they can have older cores and younger rims. Also, the crosscutting relations of many of the rocks are complex. Nutman *et al.* present additional results for zircon age and field mapping, and summarize previous data on the age of these rocks. They conclude that some of the rocks, including those containing evidence for early life, date to about 3.85 Ga. — BH

Geochim. Cosmochim. Acta **64**, 3035 (2000).

NEUROSCIENCE

Midline Signals

Despite the overt differences between the crystalline, multifaceted eye of *Drosophila* and the monofocal, multilayered complexity of the vertebrate eye, the early steps in formation of these two different eye types show remarkable similarities.

Masai *et al.* find that zebrafish eyes display a molecular correlate of the morphogenetic furrow that sweeps across and imposes pattern on the developing fruitfly retina. In the *Drosophila* retina, neurogenesis is initiated through induction of the gene *atonal*, which encodes a transcription factor. Homologs of the *atonal* gene are found in various vertebrates and include the *ath5* gene expressed in zebrafish retina. Analysis of the expression of *ath5* in zebrafish mutants suggests that axial tissues, perhaps through the action of the gene *one-eyed pinhead* in medial tissues and more proximately through signals from the optic stalk, are responsible for inducing normal expression of *ath5*. If initial induction of *ath5* expression at the point of conjunction with the optic stalk does not occur, cells more peripheral in the retina fail to differentiate. The results imply the existence of a wave of neurogenesis that spreads across the zebrafish retina, reliant on *ath5* expression and propagated by local signals once it is initiated. — PJH

Neuron **27**, 251 (2000).

CHEMISTRY

Not Too Close for Comfort

Gold can exist as a negative ion in certain compounds, and in this and other properties it resembles the halogens, especially iodine. Mudring and Jansen have found another parallel between halogens and gold; under the influence of bases, gold can disproportionate into Au^+ and Au^-. They have characterized two materials resulting from such a reaction, $Rb_7Au_5O_2$ and $Cs_7Au_5O_2$. In the crystals, positively and negatively charged gold ions exist side by side; yet the Au^+ and Au^- ions are stable and do not react with each other. — JU

Angew. Chem. Int. Ed. **39**, 3066 (2000).

APPLIED PHYSICS

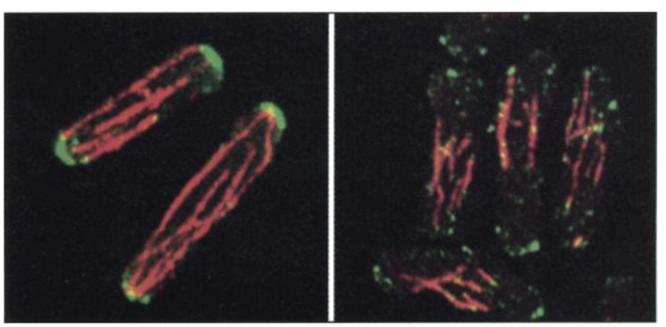
Nanoscale Wiring

Several potential building blocks for molecular electronics already have been identified, but the problem of wiring circuitry together on such a small scale still remains. Smith *et al.* have used electric-field–enhanced assembly to position individual gold nanowires from a colloidal suspension between conducting contacts. The nanowires, which range from a few tens to a couple of hundred of nanometers in diameter and are several micrometers in length, are polarized under the influence of an alternating electric field applied to one of the electrodes. The local high electric field developed at the edge of the electrodes provides the driving force for the nanowire alignment. Once a nanowire has bridged the electrodes, the field is reduced, which then prevents additional nanowires from aligning nearby. — ISO

Appl. Phys. Lett. **77**, 1399 (2000).

CELL BIOLOGY

AnTIPodean Guide



In wild-type cells (left), tea1p (green) is associated with microtubules (red) and found at the ends of cells, but goes awry in the absence of tip1p (right).

SOURCE: BRUNNER AND NURSE, *CELL* **102**, 695 (2000).

The fission yeast *Schizosaccharomyces pombe* is a cylindrical cell that splits along its equator during cell division. In order to retain a rod-like shape, the daughter cells must grow only at the old end and at the freshly-created end, in a process that requires intact microtubules.

Brunner and Nurse have examined the microtubule guidance system required for growth. They identify a protein that needs to be located at the ends of the microtubules in order for the yeast to grow normally and find that this protein, tip1p, is related to the mammalian protein CLIP170, which plays a role in generating polarity in epithelial cells. Cells lacking tip1p displayed a bent morphology, which correlated with a disorganized microtubule network that had failed to reach to the end of the cell and with the improper localization of tea1p, a protein known to be required for polarized cell growth. How tip1p at one end of the cell "knows" when it is exactly opposite its counterpart remains a mystery, but identifying further mechanisms in controlling polarized cell growth may offer insights into positional development in complex organisms. — SMH

Cell **102**, 695 (2000).

IMMUNOLOGY

Line of Defense

The epithelial monolayer of the small intestine needs to be protected well against bacterial colonization and invasion. Specialized Paneth cells, located at the base of the small intestinal crypts of Lieberkühn, contain granules of preformed microbicidal polypeptides known as α-defensins or cryptdins. The Paneth-cell defensins are known to be secreted in response to cholinergic stimulation, but Ayabe *et al.* discovered

CONTINUED ON PAGE 1843

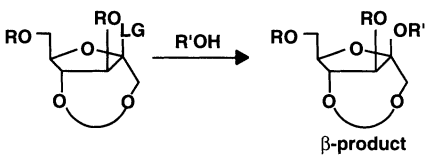
that bacteria could stimulate Paneth cells directly to secrete these weapons. When they isolated crypt cells from mouse gut and incubated them with *Salmonella typhimurium, Escherichia coli,* or *Staphylococcus aureus*, up to 90% of the bacteria were killed, but only a third as many if cryptdin-negative mutants were used. They found that a wide variety of bacterial antigens stimulated Paneth cells to degranulate, and they concluded that common pattern recognition events triggered the exocytosis. — CA

Nature Immunol. **1**, 113 (2000).

CHEMISTRY

A Sweet Result

Sucrose is readily made by sugar cane and the sugar beet, but to organic chemists it presents a formidable challenge in the control of stereochemistry. Sucrose contains a trehalose linkage, and thus sterochemistry must be controlled at both C-1 carbon atoms that link the sugar rings (the



R, protecting group; LG, leaving group; R'OH, protected glucose acceptor.

anomeric carbons). Early efforts focused only on the α linkage to glucose; because the resulting linkage to the fructosyl acceptor was a mixture of α and β, yields were low (about 6%). Oscarson and Sehgelmeble now describe a method for synthesizing β-fructofuranosides. They lock the anomeric CH_2OH group on the five-membered ring to the α side through an internal 1,4 acetyl bridge and form a thioglycoside fructose donor. This donor could then be coupled to a glucose acceptor to form sucrose in 80% overall yield. — PDS

J. Am. Chem. Soc., in press.

MOLECULAR BIOLOGY

Januslike RNA

The use of multiple protein components, which combine with relatively weak interactions, to achieve a varied and reversible regulation of gene expression is no longer a surprising concept. Lease and Belfort, however, suggest that similar mechanisms involving RNA may exist.

DsrA is a small 87-nucleotide RNA that is predicted to adopt a structure containing three stem-loop motifs; it exerts modulatory effects on the transcriptional regulators H-NS (inhibitory) and RpoS (stimulatory). Structural analysis of the interactions between DsrA and the messenger RNAs (mRNAs) for these two proteins indicate that sequences in the first stem-loop bind to and appear to stabilize the RpoS mRNA, and that sequences in the second stem-loop grab the 5′ and 3′ ends of the H-NS mRNA in a coaxial stack, effectively sequestering it. The capacity of a single molecule to recognize unrelated targets in specific and noncovalent fashion leads immediately to the search for regulators; might these be RNA molecules, too? — GJC

Proc. Natl. Acad. Sci. U.S.A. **97**, 9919 (2000).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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Reduced in order to Divide

In response to extracellular signaling molecules, progenitor cells either continue dividing without differentiating, in a process termed self-renewal, or divide a limited number of times and then differentiate. Smith *et al.* find that the redox state of progenitor glial cells correlates with their self-renewal capacity.

A fluorescent dye sensitive to redox state, dihydrotetramethylrosamine (Ros), was used to label and sort oligodendrocyte-type-2 astrocyte cells into one group possessing a relatively reduced intracellular state (Ros-low) and a second with an oxidized intracellular environment (Ros-high). The Ros-low cells exhibited a high proportion of self-renewing or dividing cells, and yielded four times as many cells per clone as those in the Ros-high group. Pharmacological alteration of intracellular redox state to a more reducing potential promoted self-renewal and blocked the ability of extracellular factors to promote differentiation, while adding oxidizing agents to the medium had the opposite effect. Modulation of the intracellular redox state by multiple signaling process may serve to integrate inputs from a collection of pathways that influence differentiation and self-renewal. — NG

Proc. Natl. Acad. Sci. U.S.A. **97**, 10032 (2000).

CREDIT: OSCARSON AND SEHGELMEBLE, *J. AM. CHEM. SOC.*, IN PRESS.