EDITORS' CHOICE

edited by Gilbert Chin

OCEANOGRAPHY

Pumping Carbon

The strength of the ocean's "biological pump," wherein organic carbon produced by photosynthesis in surface waters is exported to sediments and sequestered from recycling, helps regulate the concentration of CO_2 in the atmosphere. How has the biological pump responded to long-term changes in solar insolation? One way to estimate paleoproductivity is by measuring the organic content of marine sediments, which makes the assumption that organic carbon content is a good surrogate for productivity.

Perks *et al.* applied a sensitive analytical technique, combustion oxygen demand (COD), to estimate the amount of organic carbon in sediments from the western and eastern equatorial Pacific Ocean. Tropical surface water productivity in both sides of the Pacific has varied synchronously during the past 400,000 years, mainly in response to the 23,000-year precessional period of insolation, suggesting that productivity increases were caused by more vigorous equatorial upwelling driven by stronger trade winds. This pattern of basin-wide variation is difficult to reconcile with predictions of west-east asymmetry of paleoproduction. Future interpretations of paleoceanographic data sets from the equatorial Pacific may require more detailed consideration of equatorial circulation and biogeochemistry. — HJS

Paleoceanography **17**, 10.1029/2000PA000603 (2002).

CLIMATE SCIENCE

Storms on High

Space weather is caused by fluctuating magnetic fields and by energetic particles that originate from the Sun and penetrate far into Earth's atmosphere. Its effects—most notably the aurora borealis and aurora australis—are usually confined to the polar regions, but geomagnetic storms can erode the plasmasphere, a charged layer that rotates with our planet, and cause widespread disruption of power and communications systems. Foster *et al.* use ground-based global positioning system (GPS) data, radar, and satellite observations to study the geomagnetic storm on 31 March 2001, near the maximum of the 11-year solar cycle. From measurements of the electron content and ion density over the mid-latitude continental United States and from a comparison of the resulting patterns with satellite data of the plasmasphere, the authors provide a vivid picture of how disturbances in the plasmasphere are propagated in the underlying ionosphere and how plasmaspheric tails stretch toward the Sun. — JFU

Geophys. Res. Lett. **29**, 10.1029/2002GL015067 (2002).

DEVELOPMENT

Five into Three Is . . .

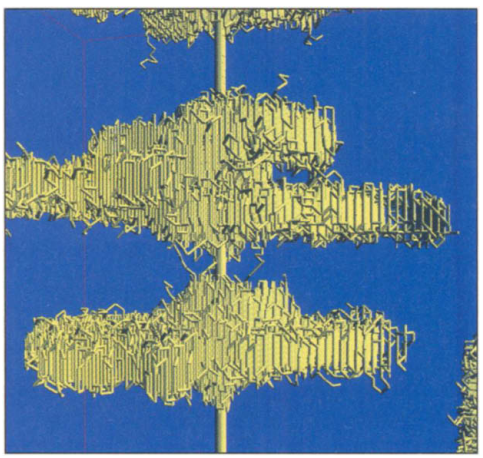
The identity of the digits of the avian hand has been hotly debated since the 1820s. Early in development, birds display four cartilaginous digits, with the distal digit (V) a rudimentary splint; however, mature birds possess only three ossified fingers. Studies of fossils and analyses of phylogenies suggest that the mature fingers are equivalent to digits I, II, and III of pentadactyl amniotes, but embryological evidence favors a homology of II, III, and IV. Two recent studies offer new results that bear on this question. Larsson and Wagner used molecular markers to identify digit condensations of chicken embryos, and Feduccia and Nowicki examined the digit anlagen of ostrich embryos. Both studies identify a single digit anlage that is in a proximal position relative to the three ossified digits. Hence, bird fingers develop from digit anlagen II, III, and IV. The findings have implications for the evolutionary relationship between birds and theropod dinosaurs, which display a I, II, III digit identity.— BAP & ShJS

J. Exp. Zool. **294**, 146 (2002); *Naturwissenschaften* 10.1007/s00114-002-0350-y (2002).

POLYMER SCIENCE

From Small Beginnings

Chainlike polymers are often processed under high-flow fields in order to extend and align the chains, which accelerates the growth rate of crystals. Under quiescent conditions, chain-folded crystals form, and these can grow as secondary crystals on an extended chain backbone, resembling kabobs stuck on a skewer. This shish-kebab morphology was postulated 45 years ago and has recently been observed with atomic force microscopy. Hu *et al.* have used simulations to study the nucleating influence of a single extended chain on the secondary crystallization. Even though the shish is made up of extended chains, the kabob thickness is only a fraction of the full chain length; the kabob grows outward through back-and-forth folding of the chain. At lower temperatures, the secondary nucleation rate increases, and two growing nuclei can merge and taper into a single kabob. The authors find that crystallization can be advanced by a shish that is only one chain wide. This suggests that alignment of the polymer chains may accelerate not only the growth rates of the polymer crystals in both extended and folded forms, but also the nucleation rates. — MSL



Narrow extended-chain crystal (shish) surrounded by secondary folded crystals (kabobs).

CREDIT: HU *ET AL.*, *MACROMOLECULES* 10.1021/MA0255581 (2002)

Macromolecules 10.1021/ma0255581 (2002).

BIOMEDICINE

Endostatin Goes to the Clinic

Solid tumors require a blood supply for growth, and many new cancer therapies are being formulated to disrupt that blood supply by targeting the tumor vasculature. One such therapeutic agent, endostatin, has attracted an extraordinary degree of public interest. Endostatin, a fragment of collagen, potently inhibits the growth of capillary endothelial cells in culture, and in preclinical studies with mice it has shown outstanding anticancer activity.

Eder *et al.* and Herbst *et al.* report the much-anticipated results of two phase I clinical trials of endostatin. The good news is that in both studies, which involved a total of 40 patients with advanced and otherwise incurable solid tumors, endostatin had no adverse side effects. One disappointing re-

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sult was the finding that only three patients showed signs of an anti-tumor response, and in all cases the response was minor. Phase I trials are not specifically designed to measure drug efficacy, however, and the authors suggest that optimization of endostatin delivery methods or use of endostatin in combination with other therapies or both may increase the response rate in future trials. — PAK

J. Clin. Oncol. **20**, 10.1200/JCO.2002.02.082; 10.1200/JCO.2002.11.061; 10.1200/JCO.2002.05.102 (2002).

GEOCHEMISTRY

Prismatic Filters of Seawater

Seawater can be exchanged between the mantle and the ocean through subduction zones. The Nankai trough, offshore of Japan, is where the Philippine Sea plate subducts beneath the Eurasian plate. A prism of sediments has developed in front of the volcanic arc by partial scraping of about 700 meters of sediment from the Philippine Sea plate.

Spivack *et al.* have assessed how efficiently seawater is transported by measuring the Cl chemistry at three drill holes that transect the accretionary prism of the Nankai trough subduction zone. The Cl abundance and isotopic composition of the fluids vary from the top to the bottom of each drill hole but are the same at the same depth across the trio. The vertical changes reflect Cl isotopic fractionation by low-temperature dehydration reactions near the surface and by high-temperature hydration reactions near the crust-mantle boundary. The lateral similarities indicate episodic and channel-like horizontal fluid flow. The mineral/fluid reactions and the horizontal flow indicate that most of the seawater is efficiently recycled back to the surface. Thus, the observations explain the Cl isotopic fractionation between the ocean and the mantle and fit well with models in which the entire ocean volume is recycled through accretionary prisms in 300 million years. — LR

A rig off Japan's Omae Zaki peninsula over the Nankai Trough.

Geophys. Res. Lett. **29**, 10.1029/2001GL014122 (2002).

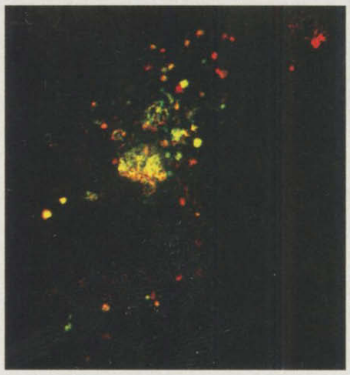
HIGHLIGHTED IN *SCIENCE'S* SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

Science's stke www.stke.org

Traffic at the Roundabout

The *Drosophila* nervous system has been used as a model system for studying the molecular signals underlying the developmental choices of axons at the midline. Growth cones that display the receptor Roundabout (Robo) are repelled from crossing the midline, whereas those featuring the receptor Frazzled are attracted across the midline. To prevent a return trip across the midline by axons that succeed in reaching the contralateral side, Robo is then up-regulated.

Keleman *et al.* show that *commissureless* (*comm*) regulates the exposure of Robo by altering its intracellular trafficking. When expressed alone in cultured cells, Robo is located primarily at the plasma membrane, whereas Comm is found in an internal late endosomal–lysosomal compartment. When expressed together, Comm associates with Robo as it emerges from the trans-Golgi network and carries it away in late endosomes, preventing Robo from entering the route to the plasma membrane. The authors suggest that either the timing of *comm* expression is specified intrinsically or retrograde signaling from the newly crossed growth cones serves to turn off *comm* and thus permit Robo to reach the surface once again. — NG



Colocalization of Robo (green) and Comm (red) in late endosomes.

Cell 110, 415 (2002).

CREDITS: (TOP) IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY; (BOTTOM) KELEMAN *ET AL.*, *CELL* **110**, 415 (2002)