EDITORS' CHOICE

edited by Gilbert Chin

GEOPHYSICS

Subducting Slabs Stay Shallow

Subduction of crust occurs at plate boundaries and is driven by the pull of the subducting slab into the convective mantle. The gravitational pull, combined with plate collision, creates a subduction zone typically at angles of 30° to 60° relative to horizontal.

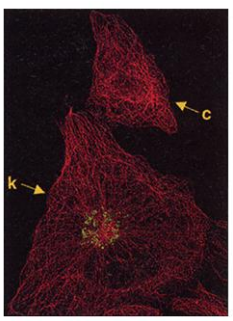
In some regions, such as the west coasts of North and South America, the sinking slab levels off at a shallow depth near the crust-mantle boundary and extends horizontally for tens to hundreds of kilometers. Slab pull cannot explain this flat geometry, but van Hunen *et al.* suggest that a continent overriding a young oceanic crust can. They developed numerical models of a thick continent overriding a passive oceanic crust and, after considering the effects of several parameters, found that mantle strength and viscous heating were particularly important in creating a flat slab. Their models provide a good fit with observations of shallow, flat slabs and define an allowable range of plate velocities, rheological properties, and boundary conditions. — LR

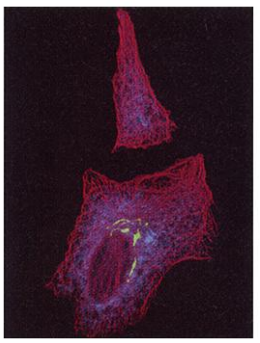
Earth Planet. Sci. Lett. **182**, 157 (2000).

CELL BIOLOGY

Golgi Indissoluble

The contributions of the Golgi apparatus to protein maturation and membrane trafficking make it an essential component of eukaryotic cells. Using a microsurgical technique, Pelletier *et al.* have examined the effects of removing the Golgi by dividing cells into cytoplasts [containing endoplasmic reticulum (ER) but lacking the nucleus-proximal Golgi] and karyoplasts (containing nucleus, Golgi, and ER).





Karyoplast and cytoplast (left) stained for Golgi (green), microtubules (red), and ER (blue, above).

Newly synthesized proteins in the Golgi-free cytoplasts did not arrive at the cell surface, and no apparent regeneration of the Golgi apparatus from the ER was detected. When a portion of Golgi membranes were captured in the cytoplasts, intracellular transport to the plasma membrane did occur. Thus, a distinctive set of Golgi membranes, which cannot be replenished by the ER, appears to be a requirement for moving protein cargoes to the cell surface. In related work, Seemann *et al.* show that Golgi-resident enzymes can recycle quantitatively to the ER, but that the cell retains matrix proteins that provide the scaffold for reconstructing a functional Golgi apparatus. — SMH

Nature Cell Biol. **2**, 840 (2000); *Nature* **407**, 1022 (2000).

IMMUNOLOGY

Prime Killers

Cells infected with viruses and intracellular bacteria trigger their own destruction by presenting antigenic fragments of the pathogen to cytotoxic T cells (CTL). Preceding this is a crucial priming phase in which naive T cells develop their killer phenotype through stimulation by "professional" bone marrow–derived antigen presenting cells (APC) that have acquired antigenic polypeptides from the pathogen.

In exploring the role of APC in CTL priming, Lenz *et al.* and Sigal and Rock observed that one particular epitope from mouse LCMV virus induced CTL, even when the appropriate bone marrow–derived APC were almost completely absent. For Lenz *et al.* this finding indicates that cells other than professional APC could participate in the priming of some anti-viral CTL. Sigal and Rock, on the other hand, argue that because of the vigorous replication of this virus, more antigen could be presented by a small number of remaining APC. They also observed that APC could prime a limited CTL response to another epitope of LCMV in the absence of the molecular transporter TAP, which is normally required for antigen processing, suggesting that this relatively inefficient pathway of CTL priming may operate when there is a high viral load. — SJS

J. Exp. Med. **192**, 1135 (2000); *J. Exp. Med.* **192**, 1143 (2000).

APPLIED PHYSICS

Speed Is of the Essence

As the dimensions of electronic devices shrink to the extent where single electrons determine operational behavior, there is an increased need to understand the dynamics of charge motion through a semiconductor device, including the tunneling of electrons into quantum dots. Recent work has shown that coupling the quantum dot to a single electron transistor (SET) could shed some light on the electron tunneling process. As an electron is added to the dot, the potential on the island is changed, which in turn results in an oscillation of the current in the SET. However, the sensitivity of the SET to the proximity of an electron on the dot is such that the bandwidth is limited to about 1 megahertz (MHz). Lu *et al.* now show that this sensitivity can be increased by more than an order of magnitude with a superconducting SET. They estimate that the greater sensitivity of this technique should allow them to increase the bandwidth to around 100 MHz, or within the realms of individual tunneling events. — ISO

Appl. Phys. Lett. **77**, 2746 (2000).

CLIMATOLOGY

Taking an Ice Core's Temperatures

Most of our understanding of high-latitude surface air temperature variations during the past 450,000 years comes from the isotopic compositions of oxygen ($\delta^{18}O$) and hydrogen (δD) in polar ice cores. The credibility of these proxies is supported not only by theoretical considerations but also by observations that the $\delta^{18}O$ of modern snow in Greenland reflects local surface temperature. However, it is also well known that factors other than temperature affect the isotopic composition of snow. Borehole measurements of ice sheet temperatures have shown that the true temperature difference between the last glacial maximum and the present is nearly twice what was inferred from the isotopic composition of ice and modern isotope-temperature calibrations.

Hendricks *et al.* have looked at the processes involved in the isotopic fractionation of atmospheric moisture with a one-dimensional meridional model of

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SOURCE: (BOTH IMAGES) PELLETIER *ET AL.*, *NATURE CELL BIOL.* 2, 840 (2000).

water vapor transport. They discuss the importance of several factors on the isotopic composition of snow, including evaporative recharge of moist air masses, transport by eddy diffusion, the equator-to-pole temperature gradient, and distance from the ocean. Understanding the significance of these parameters may allow the isotopic record to be reconciled with results from physical studies. — HJS

Global Biogeochem. Cycles **14**, 851 (2000).

ECOLOGY/EVOLUTION

Sexual Selection and Speciation

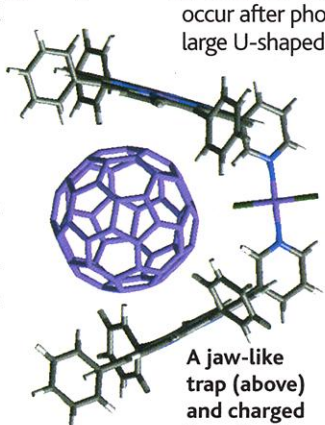
One of the tantalizing and enduring questions in evolutionary biology is the process of sympatric speciation: how do populations living in the same place diverge sufficiently to form distinct species? In a study of a highly polymorphic cichlid, *Amphilophus citrinellum*, in Nicaraguan lakes, Wilson *et al.* look at the dynamics of species formation, especially the emergence of non-geographical isolating factors. *A. citrinellum* displays a variety of color morphs and jaw morphs, and exhibits assortative mating. Wilson *et al.* hypothesize that this should lead to decreased gene flow between populations of different morphs; analysis of DNA microsatellite loci and mitochondrial control region DNA reveals genetic differentiation between color morphs but not between jaw morphs. This result implies that sexual selection (by color) in these fishes is the initial force driving early differentiation, and that ecological specialization (as indicated by jaw morphology and hence feeding) comes later. — AMS

Proc. R. Soc. London B **267**, 2133 (2000).

CHEMISTRY

Porphyrin Mandibles

The ability to craft molecular shape has allowed chemists (with some help from porphyrin groups) to manipulate attractive interactions between molecules and repulsive interactions within a molecule. Sun *et al.* have created a small, jaw-like trap for fullerenes in which two substituted porphyrins are linked by a Pd center. The biting, while tight, is noncovalent and labile—bound C_{60} can be displaced by C_{70}. Bell *et al.* have studied conformational changes that occur after photoinduced charge transfer in large U-shaped molecules bearing porphyrin and methyl viologen end groups. Initially, in one isomer of the molecule, the porphyrin group, which is neutral, lies near the methyl viologen group, which has a double positive charge. Transfer of an electron appears to occur through space and creates two end groups, each with a single positive charge, that strongly repel and open the molecular jaws. The long lifetimes of the charge transfer complex (hundreds of nanoseconds) suggest the electron is forced to return the long way, through the molecule. — PDS



A jaw-like trap (above) and charged jaws (top)

J. Am. Chem. Soc. **122**, 10704; 10661 (2000).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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Isomer-Specific Dephosphorylation

The protein Pin1 is an isomerase that catalyzes interconversion of cis and trans forms of proline in polypeptides and is thought to function in signaling pathways that control cell division. Zhou *et al.* propose a mechanism by which Pin1 might influence signaling through such pathways. They report that the proline-directed phosphatase known as protein phosphatase 2A (PP2A) is stereospecific and dephosphorylates only *trans* phosphoSer- or phosphoThr-Pro peptides; Pin1 may function to facilitate dephosphorylation of potential PP2A substrates by promoting cis-trans isomerization. Consistent with this possibility, genetic evidence indicates that overexpression of Pin1 can partially overcome defects caused by conditional mutations in PP2A, and defects from loss of Pin1 function are reduced in cells overexpresssing PP2A. — LBR

Mol. Cell **6**, 873 (2000).

CREDITS: (LEFT) SUN *ET AL.*, *J. AM. CHEM. SOC.* **122**, 10704 (2000); BELL *ET AL.*, *J. AM. CHEM. SOC.* **122**, 10661 (2000).