EDITORS' CHOICE

edited by Gilbert Chin

CHEMISTRY

Coloring Chiral Excess

In nematic liquid crystals, weak interactions between the rod-like molecules cause them to align locally along one "average" direction. Adding a small amount of a chiral nematic (cholesteric) can cause the entire mixture to behave like the cholesteric liquid crystals used in displays, for which the average alignment direction rotates as one traverses the sample. However, most chiral materials have only a weak helical twisting power.

van Delden and Feringa have coupled a chiral amine or alcohol to an achiral liquid crystalline group and show that the helical twisting power can be increased. When the coupled material then is blended with a nematic, the helical pitch approaches visible wavelengths, and a color signal is obtained. In mixtures containing 15 to 20 weight % of the coupled molecule, the color shifted from violet to red as the enantiomeric excess decreased from 100 to 50%. This technique offers promise for the rapid screening of chiral catalysts generated by combinatorial chemistry. — MSL

Angew. Chem. Int. Ed. **40**, 3198 (2001).

GEOPHYSICS

Earth's Liquid Center

Originally, Earth's core was entirely liquid, but cooling has allowed iron to crystallize, producing a solid inner core and a molten outer core. Vigorous convection within the still-liquid outer core, which is thought to produce Earth's magnetic field, is driven in part by the latent heat of crystallization of the inner core, and the geometry of the convection is affected by the presence of the inner core.

When did the inner core begin to form? Precambrian paleomagnetic records do not yet provide a clear signal of the onset of Earth's magnetic field. Hence, Labrosse *et al.* have modeled the thermal evolution of the core in order to predict the age of the inner core from estimates of Earth's heat flow, in much the same way as Lord Kelvin attempted nearly 150 years ago to calculate the age of Earth. This analysis suggests that the inner core formed about 1 billion years ago, with an upper age limit of 2.5 billion years (under the assumption that the core contains some radioactive elements). Thus, the inner core seems not to have been present for most of Earth's 4.5-billion-year history. — BH

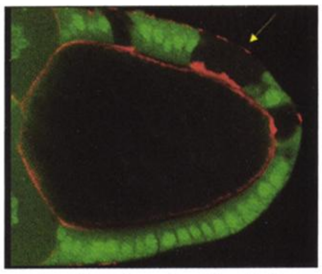
Earth Planet. Sci. Lett. **190**, 111 (2001).

CELL BIOLOGY

Space, the Final Frontier

Inside cells, the actin cytoskeleton regulates spatial arrangements and transmits the forces propelling cellular rearrangements in morphogenesis. Actin either exists as soluble monomers or forms polarized filaments, and this transition is controlled by a variety of actin-binding proteins.

Baum and Perrimon describe how a group of proteins is involved in controlling the polarized distribution of actin filaments in the *Drosophila* follicular epithelium. This epithelium forms a single layer of cells that undergoes multiple morphological changes as the embryo develops, and within which islands of mutant cells were generated with the directed mosaic technique. *Drosophila* profilin and cofilin are important in cortical actin production and stabilization, respectively, whereas a homolog of the adenylyl cyclase–associated protein (CAP) limits actin filament formation at apical regions of the cell. The function of CAP is linked to the actin filament promoter Enabled and to the Abelson tyrosine kinase. Together, these proteins appear to act as master regulators of the apical actin cytoskeleton. — SMH



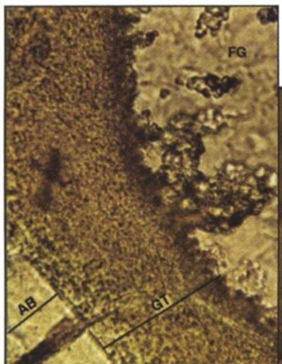
Actin distribution (red) is enhanced at the apical surface of CAP-deficient cells (those lacking green fluorescence).

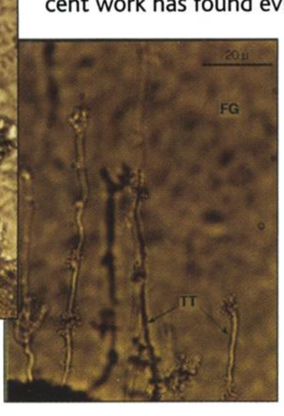
Nature Cell Biol. **3**, 883 (2001).

GEOMICROBIOLOGY

An Ocean (and Bacteria) Run Through It

Soon after new oceanic crust forms at mid-ocean ridges, it begins to be corroded by seawater. This alteration of the crust is important because it affects the chemistry of the oceans, and it also can affect the chemistry of Earth's mantle and even the formation of volcanoes when the hydrated crust is subducted. It has long been thought that alteration is primarily an inorganic reaction between seawater and fresh basalt glass, but recent work has found evidence for bacterial alteration.





Granular (GT) and tubular (TT) textures in bioaltered basaltic glass.

Furnes *et al.* have surveyed and attempted to quantify the relative proportions of inorganic and biological alteration by examining drill cores from oceanic crust of various ages and tectonic settings. Their survey shows that microbes may be responsible for 20 to 90% of the alteration in the upper 300 meters of the crust and may account for as much as 10% of the alteration even at 500 meters. Microbial activity can alter both young and old crust, and it can generate microchannels and pits that may facilitate the inorganic reactions. — BH

Geochem. Geophys. Geosys. **2**, 2000GC000150 (2001).

NEUROSCIENCE

Seeing Things Differently

The visual system is traditionally regarded as being organized in a strongly hierarchical way. Early processing stages, such as area V1 (the primary visual cortex), perform their highly specialized task and then send this information to higher-order centers for analysis. Several findings have questioned this view. For instance, V1 neuronal responses are enhanced by attention when a monkey mentally traces a curve on a screen, but receptive fields on

CONTINUED ON PAGE 2353

SOURCE: (LEFT) FURNES *ET AL.*, *GEOCHEM. GEOPHYS. GEOSYS.* 2, 2000GC000150 (2001); (RIGHT) BAUM & PERRIMON *NATURE CELL BIOL.* 3, 883 (2001)

distracter curves are not enhanced. Interestingly, this attentional modulation, thought to come from higher order centers, occurs very late: several hundred milliseconds after the stimulus appears.

Now, Roelfsema and Spekreijse have varied the difficulty of separating the target and distracter curves, so that the monkey frequently makes errors distinguishing them. Responses of V1 neurons were enhanced if they fell on the curve that the monkey actually attended to even if it was not the correct choice (not the one that they were supposed to be attending to). These results strengthen the argument that V1 responses do not represent sensory input alone but can be modulated by top-down feedback, which can be a matter of interpretation. — PRS

Neuron **31**, 853 (2001).

PSYCHOLOGY

Human Versus Computer

One topic occupying countless hours of coffee klatch is predicting how one person will behave toward another. Often arising in situations where choices must be made, the attempt to construct the possible outcomes of another individual's actions relies on considering not only the short-term consequences but also the long-term reverberations. Some of the factors taken into account are the payoff matrix (for example, relating actions to rewards in a two-player game) and the reputations of the players.

McCabe *et al.* have taken a step in uncovering the neural basis of making cooperative choices by conducting a brain imaging analysis of participants in a trust and reciprocity game. By giving up immediate profit, the first player could obtain a larger reward if the "opponent" then cooperated by not grabbing the lion's share. Prefrontal regions of the brain (the "command and control" center) were more active in trials where the opponent was a second and potentially cooperative human as compared with a computer that pursued a fixed strategy of known probabilistic choice. What, precisely, this activation represents will be examined in future studies. — GJC

Proc. Natl. Acad. Sci. U.S.A. **98**, 11832 (2001).

APPLIED PHYSICS

Small and Manipulative

The familiar picture one associates with electromagnets is their use at a scrap yard for lifting compacted vehicles. The ability to move much smaller magnetic particles with a magnetic field may find a host of applications. For instance, the mechanical properties of cell walls have been probed by gently tugging on an implanted magnetic particle.

By scaling the system down, Barbic *et al.* manipulated magnetic particles of a few micrometers (μm) in size. Their magnetic manipulator consists of a soft ferromagnetic core 50 μm in diameter, sharpened to a point and wound by a 25 μm-diameter copper wire. The authors estimate that the tip can exert a force of 0.5 piconewtons for a 10-milliampere current passed through the coil wires, and they suggest that the negligible heating of the sample offers an advantage over optical trapping techniques. — ISO

The magnetic manipulator.

Appl. Phys. Lett. **79**, 1897 (2001).

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Real T Cells Aren't Cultured

Much of our understanding of the signaling events initiated when T cells respond to antigen comes from studies of transformed T cell lines in culture. But several recent pieces of evidence indicate that freshly isolated T cells from mice may respond differently.

Zell *et al.* have used flow cytometry and antibodies to measure responses of naive $CD4^+$ T cells (from lymph nodes or spleens) harvested from animals exposed to antigen. Responses differed from those in cultured cells: (i) The untransformed T cells responded more rapidly and more efficiently; (ii) phosphorylation of c-Jun or the p38 mitogen-activated protein kinase did not require activation of the costimulatory receptor CD28; and (iii) the immunosuppressive drug cyclosporin A did not inhibit phosphorylation of the mitogen-activated protein kinases. Thus, it appears that the microenvironment in which T cells reside in the animal results in signaling processes substantially different than those observed in cultured cell lines. — LBR

Proc. Natl. Acad. Sci. U.S.A. **98**, 10805 (2001).

CREDITS: BARBIC *ET AL.*, *APPL. PHYS. LETT.* 79, 1897 (2001)