

<< Toward Antibiotic Development

The identification of new antibiotics and potential microbe-specific targets remains a critical goal of much microbiological research (see the Perspective by Payne). Microorganisms must have menaquinone for respiration. *Escherichia coli* synthesizes menaquinone from chorismate using seven enzymes. There are no traces of orthologs of these enzymes in several pathogens, yet these bacteria and some archaea synthesize menaquinone. Hiratsuka *et al.* (p. 1670) traced an alternative pathway in the nonpathogenic organism *Streptomyces coelicolor* using a combination of bioinformatics and biochemistry to identify functions for uncharacterized genes. Because humans and certain intestinal commensals, notably lactobacilli, lack this alternative pathway, it represents an attractive target for the development of antibiotics. Antibiotics that block bacterial cell division are lacking. Haydon *et al.* (p. 1673) have synthesized a small molecule that binds to the bacterial cell division protein FtsZ and inhibits cell division. The molecule appears to bind to the bacterial protein at a site equivalent to the taxol binding site of tubulin. When injected into mice that had been given a lethal dose of *Staphylococcus aureus*, nontoxic doses of the molecule prevented the animals' death.

Tracking Electronic Phase Transitions

In solid-state systems, correlated electron effects can cause the electrons to behave collectively, forming large-scale ordered states. How these states form dynamically and influence, or are influenced by, other processes are of great current interest. Below a transition temperature, TbTe₃, forms a charge density wave where the electrons order spontaneously into regions of low and high charge density. Using a time- and angle-resolved photoemission technique, Schmitt *et al.* (p. 1649, published online 14 August) can track the transient melting of the charge density as it is excited by a laser pulse and show how it affects the underlying electronic state of the system. Such a technique will be invaluable in studying many-body correlated effects in modern condensed-matter physics.

Fine-Point Lithographic Printing

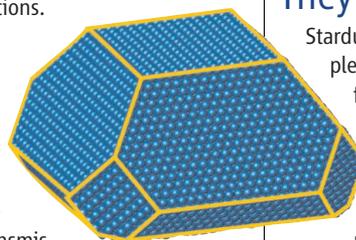
The advantages of two low-cost approaches for creating patterns with molecular inks on surfaces have been combined in a method that Huo *et al.* (p. 1658, published online 14 August) call polymer pen lithography. Like microcontact printing, an elastomeric stamp is inked with molecules such as 16-mercaptohexanoic acid and transferred to a gold surface. Like dip-pen lithography, ink is delivered on individual tips to create nanoscale dots, but on soft polymer tips without the use of individual cantilever control. The array can be leveled relative to the surface optically, and the size of the features formed can be con-

trolled from 90 nanometers to hundreds of micrometers by varying the force and time over which the stamp is in contact with the surface.

Nanoparticle Shape Shifting

Heterogeneous catalysts often consist of metal nanoparticles absorbed on oxide supports, and the size and shape of these nanoparticles are likely to be affected by conditions in the reactor such as temperature and oxidation state. However, such changes are not readily observed experimentally because many methods require vacuum conditions.

Nolte *et al.* (p. 1564) were able to examine the changes to rhodium nanoparticles on a MgO surface using high-resolution in situ x-ray diffraction, as well as transmission electron microscopy. At elevated temperatures (570 K), these pyramid-shaped nanoparticles became flatter upon exposure to oxygen, which causes the formation of a surface oxide. The nanoparticles returned to their original shape after exposure to CO, which causes reduction of the surface.



Exotic Superconducting Magnetism

Superconductivity and magnetic ordering are usually considered to be competing processes, the

two being mutually exclusive, or seen only in a small region of the phase diagram for inhomogeneous materials. CeCoIn₅ is an extremely clean material that can be prepared with high crystal quality. A so-called exotic superconductor, it exhibits many similar properties to the more complex high-temperature superconducting cuprates. Kenzelmann *et al.* (p. 1652, published online 21 August) use neutron scattering to probe the magnetic ordering in this material at low temperature and high magnetic field, and find evidence of magnetic ordering that is stabilized by, and coexistent with, superconducting behavior.

They Are Stardust...

Stardust recently returned our first direct samples of a comet. Comets are thought to have formed toward the outer part of the solar system. Early analysis provided some evidence for a few high temperature grains that may be from the inner solar system. Nakamura *et al.* (p. 1664) now find that the comet also contains material similar to chondrules, which are abundant in the most primitive meteorites, which are also thought to be from the inner solar system. Thus, mixing seems to have been widespread in the inner solar system and chondrules, or similar material, may have been distributed throughout it.

Political Baggage

Political attitudes have been thought to be shaped only by experiences and environment, but research is now beginning to show that some of

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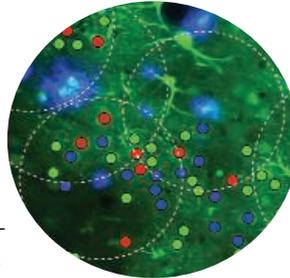
our responses to events may be “hard wired” **Oxley et al.** (p. 1667) found that individuals who had the strongest eye and skin responses to unexpected noises or threatening pictures (such as the picture of a spider crawling on a person’s eyeball) also tended to endorse political positions that were interpreted as protective of social groups.

Collateral Help

For some years, farmers in China have been using cotton plants engineered to express the insecticidal toxin Bt. **Wu et al.** (p. 1676; cover) have now analyzed data from 1997 to 2007 about the planting of Bt-cotton, as well as other crops, and have compared these observations with data about the occurrence of pests. The target pest, the cotton bollworm, has indeed declined over this same period. Furthermore, as might have been hoped, these reductions in pest populations locally carry collateral benefits for non-Bt-expressing crops that this pest would tend to attack.

Activity Around Plaques

Identifying the underlying cellular mechanisms of cortical dysfunction in amyloid-depositing mammalian brains should hopefully generate leads in the search for effective treatments for Alzheimer’s disease. **Busche et al.** (p. 1686) used in vivo two-photon calcium imaging of cortical networks to monitor Ca^{2+} signaling of individual layer 2/3 cortical neurons in a mouse model of Alzheimer’s disease. Fifty percent of cortical neurons in diseased mice exhibited impaired functional properties. A class of “hyperactive” neurons were identified, whose existence was not predicted from previous in situ or functional imaging data. The hyperactive neurons were located exclusively in peri-plaque regions and their presence correlated with impairment of cognitive behavior. This synaptically-driven hyperactivity of peri-plaque regions may underlie the increased incidence of epileptic seizures in Alzheimer’s disease patients.



Fish Lore

Amid increasing concerns about food security is the fear that our ocean fisheries are in imminent danger of collapse. **Costello et al.** (p. 1678; see the news story by **Stokstad**) contend that if fishermen have the exclusive and guaranteed right to harvest a given quantity of fish in a particular fishery at any time during the fishing season, they will have the incentive to manage the stock sustainably and collapse will be averted. The problem with rolling out this approach has been measuring the success of recently implemented schemes in the absence of data. By collating the available harvest data from all known fisheries, encouragingly, the authors conclude that rights-based fishing halves the chances of economic collapse.

Expensive Sons

Shags are large fish-eating seabirds that nest on rocky shores and are vulnerable to fish-borne anisakid nematode parasites. After ingestion, the worms migrate systemically, triggering physiologically costly inflammatory responses, and finally colonize the birds’ guts, where the parasites compete with their host for nutrients. **Reed et al.** (p. 1681, published online 7 August) found that parasitism impeded the ability of mothers to rear sons. Male chicks grow larger and more quickly than female chicks, and thus need more food. Female shags that had been treated with ivermectin to remove worms could forage at sea for longer and consequently were able to rear more sons than those that had not been treated. A similar effect of parasitism probably operates in many seasonally breeding birds.

May the Force Be with You

Apoptosis, or programmed cell death, not only removes unnecessary cells to shape embryonic development and maintain adult homeostasis, but also serves as a source of forces that contributing to tissue movements during embryogenesis. **Toyama et al.** (p. 1683; see the Perspective by **Davidson**) measured the mechanical forces provided by the ongoing process of cellular apoptosis and removal during *Drosophila*’s dorsal closure, a model system for wound healing and cell sheet morphogenesis during development. Suppressing apoptosis slowed dorsal closure, while enhancing apoptosis speeded-up dorsal closure relative to wild-type embryos. Thus it appears that organisms can co-opt apoptotic force for development, metamorphosis, and wound healing.

CREDIT: BUSCHE ET AL.