HIGHLIGHTS OF THE RECENT LITERATURE

**PHYSICS**

**Refracting Electrons**

Scanning probe microscopy studies have directly revealed the wavelike properties of electrons on surfaces. “Electron waves” have been seen to scatter off impurities, to produce standing waves in confining potentials and even to produce the equivalent of an optical illusion in terms of a mirage when the electrons are confined to an elliptical coral. Carrying over the optical analogy, Repp et al. demonstrate the refraction of surface electron waves as they pass from one medium (NaCl) to another (Cu). The angles of the propagating electrons on either side of the interface are seen to obey Snell’s law, thus taking observations made in the classical world down to the level of the quantum world. The results may also suggest a route to engineer the properties of surface electrons. — ISO Phys. Rev. Lett. 92, 023003 (2004).

**IMMUNOLOGY**

**Inflammatory Fats**

Atherosclerosis is a complex disease with multiple associated risk factors. Increasingly apparent among these are the inflammatory events that arise from the interplay between plasma lipoproteins, the arterial wall, and the immune system. T cells and macrophages are thought to dominate in these inflammatory events, although other immune cells may also play a pro-inflammatory role.

To test whether natural killer T (NKT) cells might participate in atherogenesis, Turin et al. employed mice with a deficiency in apolipoprotein E (ApoE), a major plasma constituent involved in cholesterol transport. In these animals, an excess of cholesterol leads to the spontaneous development of atherosclerosis. Injection of ApoE-deficient mice with an artificial glycolipid known to activate NKT cells increased the severity of atherosclerotic lesions and amplified inflammatory cytokine production. This aggravation of disease required expression of CD1d, the protein responsible for presenting lipid antigens to NKT cells. Similarly, the spontaneous development of atherosclerosis in ApoE-deficient mice was less severe in the absence of CD1d. Thus, lipids that accumulate at atherogenic sites may contribute to inflammation through direct immune cell activation and could represent targets for therapeutic intervention in atherosclerosis. — SJ S J. Exp. Med. 199, 417 (2004).

**MICROBIOLOGY**

**Secret Hideout**

Uropathogenic forms of the bacterium *Escherichia coli* can divide and multiply within cells of the bladder in so-called pods (see Reports 4 July 2003 p. 105). Now Justice et al. have been able to observe the development of pods in real time using time-lapse videomicroscopy of infected mouse bladder explants. Four phases of development were observed—first bacteria were nonmotile and grew rapidly within the cytoplasm of the bladder cells. The colonies then developed into a biofilm-like community that filled the cytoplasm. Next the bacteria became motile and migrated from the host cell, finally forming a filamentous bacterial cell type. This developmental strategy appears to be important for the bacteria to evade clearance by leukocytes. — SMH Proc. Natl. Acad. Sci. U.S.A. 101, 1333 (2004).

**CHEMISTRY**

**Capturing Polymer Nanoparticles**

Across the spectrum of materials science, there is a desire to make particles with dimensions at or below the nanoscale. As scientists seek to engineer the properties of surface electrons, they may find that nanoparticles play a crucial role. — ISO Phys. Rev. Lett. 92, 023003 (2004).

**GEOCHEMISTRY**

**Exotic Extraterrestrial Carbon**

Graphite is a relatively rare mineral phase in meteorites. Some of the graphite found in some of the most primitive meteorites, the chondrites, originated from other stars. Semenenko et al. describe seven unusual graphite-bearing xenoliths found within the Krymka chondrite. The graphite grains are different from other meteoritic graphite in their shape, size, mineral associations, metal and sulfide associations, and carbon isotopic abundances. The graphite probably formed by the compression and heating of an exotic organic compound during multiple shock events due to impacts on the Krymka parent body. The identity of the exotic organic species is still unclear, but these findings provide clues to the evolution of carbon-bearing materials that are ubiquitous components in everything from dusty disks around stars, to giant gas planet atmospheres, to terrestrial life. — LR Geochim. Cosmochim. Acta 68, 455 (2004).
Experimental setup.

of choice. This route produces some nanometer-sized particles, but the majority are micrometer-sized. Meziani et al. modified the process so that the supercritical polymer solution is ejected into water rather than into air. The polymer they studied, poly(heptafluorodecylacrylate) (PHDFDA), is insoluble in water, and they studied, poly(heptafluorodecylacrylate) (PHDFDA) is insoluble in water, and so it precipitates out to form nanoscale particles. Unstabilized, the particles clumped together to form larger aggregates, but the addition of base and the surfactant sodium dodecyl sulfate stabilized the nanoparticles for at least several days. — MSL


NEUROSCIENCE

Making Plaques

A hallmark of Alzheimer’s disease (AD) is the progressive formation of brain plaques: deposits of insoluble fibrils of β-amyloid protein that are associated with cognitive impairment and neuronal loss. Two apolipoproteins, apoE and clusterin, bind to β-amyloid and promote its aggregation and fibril formation. The absence of either apolipoprotein results in fewer plaques in a transgenic mouse model of AD. Surprisingly, De Mattos et al. observed earlier and increased fibrillar β-amyloid deposits in the brain when the AD mice lacked both apolipoproteins. Before this deposition, more soluble β-amyloid was detected, and clearance of soluble β-amyloid was reduced in living mice. ApoE itself is cleared from the brain by binding to low-density lipoprotein receptor-related protein (LRP), indirectly implicating this neuronal receptor in β-amyloid clearance. But LRP also facilitates processing of the amyloid precursor protein to β-amyloid, thus enhancing its extracellular release. In AD mice expressing high levels of LRP in neurons, Zerbinatti et al. observed an increase in soluble β-amyloid in the brain and observed a parallel increase in cognitive deficits in these mice, supporting a role for the soluble form of β-amyloid in AD pathogenesis. — LDC


HIGHLIGHTED IN SCIENCE’S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

Nef and Transcription

The Nef protein encoded by human immunodeficiency virus (HIV) appears to function in pathogenesis through interactions in a signaling complex associated with the T cell receptor. Witte et al. identified an unexpected interaction partner of Nef: the protein Eed (embryonic ectodermal development factor). Eed is a member of the Polycomb group of proteins that regulate differentiation and proliferation of lymphocytes by inhibiting transcription. Expression of Nef caused a transient localization of Eed to the plasma membrane. This recruitment of Eed away from the nucleus might relieve its effects on transcriptional activity. Eed can also associate with the cytoplasmic domain of integrins, and stimulation of integrins causes Eed to move to the plasma membrane. Thus, the HIV Nef protein may function in part by co-opting a mechanism for control of transcriptional repression that is normally associated with integrin signaling. — LBR

Refracting Electrons
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