Silicon Does the Wave

Flexible materials with good electronics properties are of interest for a number of applications, including sensors and paperlike displays. Typically, the materials used are organic, because conventional semiconductor substrates, such as silicon wafers, are too thick and brittle to bend readily. **Khang et al.** (p. 208, published online 15 December 2005) have deposited single-crystal ribbons of silicon onto prestretched rubber made of poly(dimethyl siloxane). When the stress is released, the silicon takes on a wavy form, which is then amenable to either stretching or compression. This material was used to build a number of basic electronic components such as transistors and diodes.

Plasmons in Optoelectronics

Future electronic technology is expected to combine the size and speed of nanoscale electronic and optical circuitry. However, the length scale of electronic devices responsible for switching and amplifying signals is now below that of the wavelength of light, and the even larger waveguides, for carrying and transferring that signal. **Ozbay** (p. 189) discusses the possibilities and challenges of using surface plasmons, which are collective excitations of electrons caused by light absorption on the surface, to integrate electronics and photonics on chips.

Titan's Clouds

By modeling the circulation patterns of the thick hazy atmosphere of Titan, Saturn's largest moon, **Rannou et al.** (p. 201; see the Perspective by **Lellouch**) explain the formation of different types of clouds that have been observed by telescopes and spacecraft. The general circulation model, which includes cloud microphysics, mimics the distribution of methane and ethane clouds seen in Titan's nitrogen-rich atmosphere and produces both a permanent south polar cloud and sporadic clouds at more temperate latitudes.

Magnetic Logic Gates

A computer architecture based on quantum cellular automata (QCA) can be built from a series of identical, simple, and bistable units that are coupled together either electrostatically (EQCA) or magnetically (MQCA). Whereas EQCA operates only at cryogenic temperatures, the higher coupling energies in MQCA should allow opera-

tion at higher temperatures. **Imre et al.** (p. 205; see the Perspective by **Cowburn**) fabricated and demonstrate room-temperature operation of a three-input majority logic gate (the basic building block for MQCA logic) from a system of coupled nanomagnets. They calculate that a chip with 1010 such gates operating at 100 megahertz would dissipate less than 0.1 watt of heat.

Combating Creep

Ceramics can deform at grain boundaries, and for demanding operation at high temperatures, impurities are deliberately added to prevent deformation. **Buban et al.** (p. 212) have used Z-contrast transmission electron microscopy to locate the positions of yttrium (Y) atoms in a grain boundary in a bicrystal of alumina. The Y ions form more and stronger bonds with their neighbors than occurs with aluminum in the undoped bicrystal. These stronger bonds appear to inhibit grain boundary sliding and thus account for the significant drop in the creep rate upon yttrium doping.
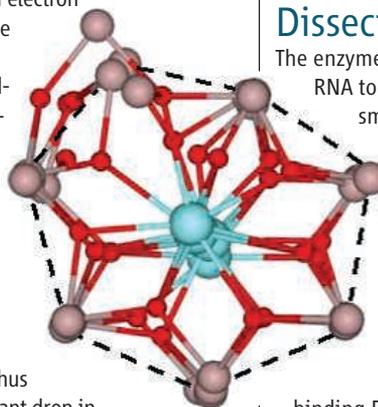
Imaging Reactions

For many rapid chemical reactions, ultrashort laser pulses have revealed precisely in what order, and at what rate, individual bonds are made and broken. However, molecules in gas or solution phase are in constant, random motion. Thus, the

data often emerge averaged over every orientation, and offer little insight into the spatial characteristics of the reaction. **Geßner et al.** (p. 219, published online 15 December 2005) address this limitation in a study of photoinduced dissociation of the NO dimer. They simultaneously measure electron energy, through ionization as well as the angular distributions of ejected electrons and ionic products. With femtosecond time resolution, they uncovered the geometrical evolution of the dimer's electronic charge distribution, and then the reorientation of the nuclei that liberated the NO fragments.

Dissecting Dicer

The enzyme Dicer cleaves double-stranded (ds) RNA to produce ~22 nucleotide (nt) long small interfering (si) RNAs, the effector molecules that underpin RNA interference (RNAi). **MacRae et al.** (p. 195) have determined the structure of full-length Dicer from the eukaryote *Giardia intestinalis*. *Giardia* Dicer is a much abbreviated version of human Dicer, consisting of little more than the dual RNase III domains and an RNA-binding PAZ domain. Nonetheless, it cleaves dsRNA into the expected 25-nt siRNA fragments. The authors liken the *Giardia* Dicer structure to a hatchet; the RNaseIII domains are spaced to generate the characteristic siRNA 3' overhang—forming the "blade"—that is connected through the long α-helical "handle" to the RNA-binding PAZ domain at the base. The distance from the active sites of the RNaseIII

domains to the RNA-binding pocket of the PAZ domain, 65 angstroms, approximates to 25 base pairs of A-form dsRNA.

Keeping an Eye on the Clock

As part of the cycle of intrinsic circadian clock, two proteins, PER and TIM, are thought to slowly associate in the cytoplasm of cells. This process takes 4 to 6 hours, after which the dimers enter the nucleus of the cell and interact with other clock components and close one of the clock's feedback loops. **Meyer et al.** (p. 226; see the Perspective by **Dunlap**) labeled both PER and TIM in single living *Drosophila* cells with tags that emit a fluorescent signal when the proteins are in close proximity. The proteins did indeed associate with the expected time course, but, surprisingly, PER and TIM dissociated before moving to the nucleus. The extent of nuclear localization was independent of the concentrations of PER and TIM in the cytoplasm. Thus, fundamental assumptions about how the circadian clock keeps time need to be revisited.

An Exciting Inhibitory Neuron

Discovered 30 years ago, axo-axonic or Chandelier cells are the most specific inhibitory neurotransmitter γ-aminobutyric acid (GABA)ergic cell type known and are regularly used in textbooks to illustrate the strategic placement of inhibition on the axon. **Szabadics et al.** (p. 233) show that instead of inhibiting postsynaptic cells, axo-axonic cells can actually excite postsynaptic cells, which leads to an unprecedented phenomenon in the cortex: A single GABAergic cell that can reliably activate the cortical network.

Defective Dengue

Dengue virus infects an estimated 50 million people throughout the tropics and causes explosive outbreaks triggered by variant strains. There are several strains of virus involved and, paradoxically, a defective strain is now in circulation. **Aaskov et al.** (p. 236) propose that this defective form persists through complementation—defective viruses exploit the proteins from functional viruses that infect the same cell. When enough hosts have multiple infections with different strains, defective viral strains can persist and influence the epidemiology of the disease. For example, in Myanmar, the variant's spread accompanied a decline in another related strain.

Monitoring Magnetosomes

Magnetosomes are the small magnetite-containing membranes found in certain bacteria. **Komeili et al.** (p. 242, published online 22 December 2005) now present evidence that magnetosomes represent invaginations from the bacterial plasma membrane, rather than, as previously assumed, individual magnetite-containing vesicles. Furthermore, magnetosomes are aligned within the cell through the agency of an actin-like filamentous protein. Magnetosome assembly and intracellular organization may represent a stepping stone in intracellular complexity between organelle-less bacteria and organelle-rich eukaryotes.
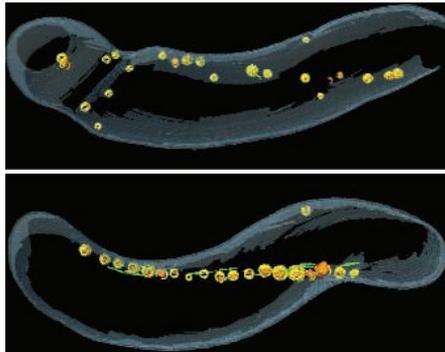
Protein Network Topologies During Viral Infection

Virus infection triggers dramatic changes in the host and in the infecting virus. **Uetz et al.** (p. 239, published online 8 December 2005; see the Perspective by **Baker and Chant**) used yeast-two-hybrid analysis of a subset of the viral proteins and found that two herpesviruses, Kaposi sarcoma–associated herpesvirus and varicella-zoster virus, shared protein interaction network topologies. The observed topologies were distinct from the cellular networks that have been studied so far. Viral networks resemble single, highly coupled modules, whereas cellular networks are organized in separate functional submodules. The authors used simulations to show that infection may result in a change to the viral protein interaction network that renders its topology more similar to that of the host cell.