EDITORS' CHOICE

edited by Gilbert Chin

PHYSICS

Oh Holey Light

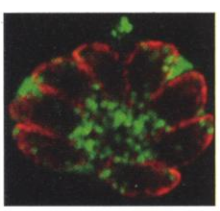
Shining light through an aperture that is smaller than the wavelength of the light generally is a rather inefficient process. However, recent experiments with metal sheets decorated with a periodic array of submicrometer perforations have displayed enhanced light transmittance in certain spectral regions. Analysis of those early results suggested that the light got a helping hand through the holes by tunneling through surface plasmons, which are electronic excitations induced by and coupled with the interaction between the incident light and the electrons near the metallic surface.

Two studies now verify that initial hunch and reveal further insights into the physical processes involved. The calculations of Martín-Moreno *et al.* show that light is transmitted via surface plasmon molecules (pairs of coupled plasmons on either side of the metal sheet) through thin films and that this mechanism evolves into tunneling between two isolated plasmons as the thickness of the sheet is increased. Approaching the problem from a different direction, Salomon *et al.* show that electromagnetic coupling between the perforations results in the same enhancement of transmission. — ISO

Phys. Rev. Lett. **86**, 1114 (2001); *Phys. Rev. Lett.* **86**, 1110 (2001).

MICROBIOLOGY

May I Help You?



In MIC6-deficient mutants, MIC4 (green) accumulates in dense granules and in the vacuolar space surrounding the parasite rosette.

The intracellular parasite *Toxoplasma gondii* contains a structure known as the microneme (a secretory organelle) at its apical end. The microneme is needed for parasite invasion and is thought to provide components required for binding to host cells and for the formation of the parasitophorous vacuole, in which the parasite grows and replicates.

Reiss *et al.* have discovered that the biogenesis of micronemal proteins involves helpers that mediate the transport and targeting of newly synthesized protein to the growing organelle. The transmembrane protein MIC6 acts as an escort for two soluble micronemal proteins, MIC1 and MIC4, by forming a tripartite complex within the endoplasmic reticulum, followed by transit to the microneme. Both MIC1 and MIC4 are adhesins that likely participate in binding to host membranes. Taken together their findings suggest that the three-component complex may act as a bridge between the invading parasite and the host cell. — SMH

J. Cell Biol. **152**, 563 (2001).

ASTROPHYSICS

Reaching for the Stars

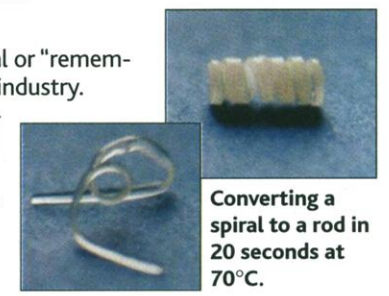
If you could look at the Milky Way Galaxy (a spiral galaxy) edge-on, you would see a thin disk of luminous stars. The halo would be harder to see because its mass is mostly dark matter, with a few clumps of stars here and there. Although we don't know what dark matter is or how much there is in the Galaxy, we can detect its influence by measuring the spatial distribution and relative velocities of stars. A standard hierarchical galaxy formation model would suggest a lumpiness to halo star distribution; in a pair of papers, Ibata *et al.* suggest using a newly modeled and observed stream of stars to refine galaxy formation models.

The stream of stars comes from the Sagittarius dwarf galaxy, which is the closest galaxy to the Milky Way. A tail of stars is torn away from the dwarf galaxy as it passes close to the galactic center and is pulled into a great circle path within the Milky Way halo. Ibata *et al.* numerically simulated multiple galaxy interactions in order to model a stream of stars along a great circle path. Over time, stars move off the path (in part due to interactions with dark matter within the halo), and the simulations show that the amount of movement is dependent on the mass distribution model of the halo. Their results indicate that the halo has a more nearly spherical distribution of dark matter than previous models would suggest. — LR

Astrophys. J., in press (astro-ph/0004011); *Astrophys. J.* **547**, L133 (2001).

POLYMER SCIENCE

Getting Back into Shape



Converting a spiral to a rod in 20 seconds at 70°C.

Shape-memory metal alloys, which can be restored to an original or "remembered" shape after deformation, have found uses in the medical industry. Lendlein *et al.* have now extended shape memory to polymers—in this case, a family of oligo(ε-caprolactone) dimethacrylate/*n*-butyl acrylate networks. The memory effect is obtained by connecting a crystallizable segment [the oligo(ε-caprolactone)] that can form a temporary physical network to a component (the *n*-butyl acrylate) that can soften the network and improve the strain recovery. These materials possess application advantages over their metal counterparts in that they can be programmed at 70°C and can tolerate significantly larger deformations. The polymers can be tailored to specific shape transition temperatures and deformation characteristics by changing the proportions of the network components. The biocompatibility of the two components should allow these materials to find use in the biomedical sector. — MSL

Proc. Natl. Acad. Sci. U.S.A. **98**, 842 (2001).

NEUROSCIENCE

Emotion, Cognition, and Behavior

One of the functions of the limbic system is the coordination of emotion and cognition. Anatomical and physiological studies have shown that three structures of the limbic system—the prefrontal cortex, the amygdala, and the nucleus accumbens—are connected and speak to one another.

Jackson and Moghaddam have analyzed the interaction of these areas in detail. Electrical stimulation of the basolateral nucleus of the amygdala in-

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SOURCE: (TOP) REISS *ET AL.*, *J. CELL BIOL.* **152**, 563 (2001); (BOTTOM) LENDLEIN *ET AL.*, *PROC. NATL. ACAD. SCI. U.S.A.* **98**, 842 (2001).

creased glutamate release in the prefrontal cortex and in the nucleus accumbens. In contrast, dopamine efflux was upregulated only in the prefrontal cortex and not in the nucleus accumbens. If, however, glutamatergic neurotransmission in the prefrontal cortex was blocked, there was a subsequent increase in dopamine release in the nucleus accumbens. Dopaminergic neurotransmission in the nucleus accumbens is known to contribute to goal-directed behavior, and these results suggest that the prefrontal cortex modulates the consequences of amygdala activity by suppressing dopamine release in the nucleus accumbens. — PRS

J. Neurosci. **21**, 676 (2001).

CLIMATOLOGY

Predicting El Niño

El Niño events occur every few years but predicting the timing and severity of the next event has been challenging. The prediction accuracy for the severe 1997-1998 El Niño event varied across models, and complex ones did not fare any better than simple ones. Clarke and Van Gorder now report that departures from normal zonal (east-west) wind patterns in the far-western equatorial Pacific are useful retrospective predictors of El Niño events, which originate in the far western tropical Pacific and travel slowly eastwards as they grow. The wind pattern anomaly leads the El Niño event by several months, and analysis of El Niño events since 1962 shows that predictions from a simple statistical model based on this anomaly compare favorably with those of two relatively successful models. — JU

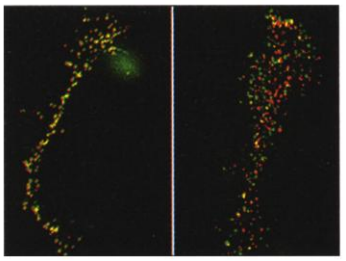
Geophys. Res. Lett. **28**, 579 (2001).

CELL BIOLOGY

Orchestrating Post-and-Beam Construction

Assembly of the presynaptic active zone in neurons is a crucial step in the formation of the chemical synapse. Within this region are calcium channels, protein aggregates (active zone material or AZM), and synaptic vesicles with their neurotransmitter cargoes.

Although many of the molecular components of the active zone have been identified, Harlow *et al.* have now performed a three-dimensional reconstruction of the AZM of the frog neuromuscular junction. With an array of interconnected pegs, ribs, and beams, the AZM appears to be a scaffold that juxtaposes the synaptic vesicles and calcium channels. At right angles to the centralized beams, the ribs appear to position synaptic vesicles for docking and fusion, and the pegs (to which the ribs are attached) seem to bind to (or may be) the intracellular domains of the presynaptic calcium channels.



Piccolo (green) travels with Bassoon (red, left) and not with the synaptic vesicle component synaptotagmin (red, right).

To address the question of how active zone components are assembled, Zhai *et al.* have investigated developing synapses of rat hippocampal neurons. The structural proteins Piccolo and Bassoon, along with syntaxin, SNAP-25, and N-cadherin, all arrive at the presynaptic staging ground in large (80 nanometer) granulated vesicles. Deciphering how these proteins relate to the pegs, ribs, and beams will be next. — OMS

Nature **409**, 479 (2001); *Neuron* **29**, 131 (2001).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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An Endostatin-Integrin Partnership

Endostatin is a cleavage product of an extracellular matrix (ECM) collagen and a potent inhibitor of angiogenesis. Tumor growth relies on the formation of new blood vessels, yet how endostatin achieves its inhibitory effect remains unclear.

Rehn *et al.* propose that endostatin may act as a ligand for α_5-and α_v-integrins, endothelial cell adhesion molecules that have been implicated in regulating angiogenesis and tumorigenesis. When presented as an immobilized substrate, endostatins promoted cell adhesion, motility, and survival in an integrin-dependent manner, and also induced downstream signaling events. In contrast, soluble endostatin acted as an integrin antagonist and inhibited these processes. Hence, modulating integrin function may be one means by which endostatins act. — LDC

Proc. Natl. Acad. Sci. U.S.A. **98**, 1024 (2001).

CREDITS: ZHAI *ET AL.*, *NEURON* 29, 131 (2001).