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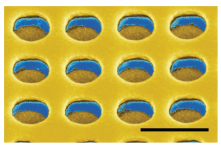
In This Issue

APPLIED PHYSICAL SCIENCES

Biosensing and imaging with plasmonic crystals

Plasmonic crystals are used in drug discovery and diagnostic bioassays, as well as for research in immunology, virology, cell signaling, and DNA–protein interactions. Matthew Stewart *et al.* developed a quasi-3D plasmonic crystal for use as a biological sensor and in 1D imaging. The authors used a nanostructured metal film, consisting of multilayered, regular arrays of sub-wavelength metal nanostructures, as the background for imaging samples. The highly uniform crystals possessed unusual geometries suited for biosensing and imaging and were used to image binding events over large areas with micrometer spatial resolution. Samples could be distributed over the crystal with a microfluidic network. Stewart *et al.* suggest that these crystals may be easier to use and more sensitive than traditional surface plasmon resonance spectroscopy. Because these devices are smaller than typical sensing or imaging systems, this technology could be used in developing the next generation of portable diagnostic sensors. — P.D.



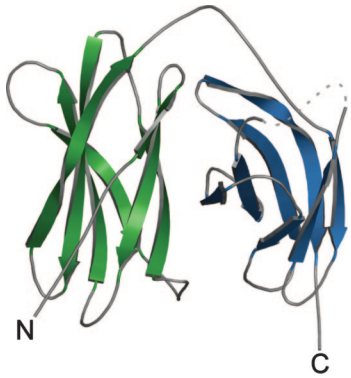
Quasi-3D plasmonic crystal.

"Quantitative multispectral biosensing and 1D imaging using quasi-3D plasmonic crystals" by Matthew E. Stewart, Nathan H. Mack, Viktor Malyarchuk, Julio A. N. T. Soares, Tae-Woo Lee, Stephen K. Gray, Ralph G. Nuzzo, and John A. Rogers (see pages 17143–17148)

BIOCHEMISTRY

Heparin helps Hedgehog binding

The cell-surface protein Interference Hedgehog (Ihog) is a recently identified component of the Hedgehog (Hh) signaling pathway, which mediates essential tissue patterning events during animal development and also plays a role in several adult human cancers. Jason McLellan *et al.* have identified how the Hh signaling molecule interacts with Ihog and found that heparin is required to mediate high-affinity interactions between Hh and Ihog. The authors used this insight to determine an x-ray structure of a complex of Hh and a fragment of Ihog. Hh and Ihog appeared to form a 2:2 complex in which Hh molecules bound independently to opposite sides of an Ihog dimer. Although heparin was not visualized in the crystal structure, a likely heparin-binding site spanning the Hh/Ihog complex was identified by charge- and site-directed mutagenesis. Interestingly, heparin also appeared to mediate Ihog dimerization independently of the formation of Hh/Ihog complexes. McLellan *et al.* say that characterization of the Hh/Ihog complex ties together several earlier observations and gives researchers a unique basis for studying Hh signaling. — P.D.



Ihog domains.

"Structure of a heparin-dependent complex of Hedgehog and Ihog" by Jason S. McLellan, Shenqin Yao, Xiaoyan Zheng, Brian V. Geisbrecht, Rodolfo Ghirlando, Philip A. Beachy, and Daniel J. Leahy (see pages 17208–17213)

GENETICS

Maintaining circadian rhythms in constant light

The light-input pathways of the *Drosophila* fly circadian clock system are regulated by a number of genes. Nicolai Peschel *et al.* identified a *Drosophila* strain, named *Veela*, that abnormally maintained circadian rhythms in constant light. The authors found that two mutations allowed this circadian rhythm maintenance in continual light exposure. The first mutation was a natural, less light-sensitive form of the Timeless protein, the light-dependent degradation of which plays a key role in regulating circadian rhythms. The second variant was a mutation in Jetlag, a protein that binds Timeless to promote its degradation. In the *Veela* strain, the presence of

Constant light-rhythmicity defines light-input components.

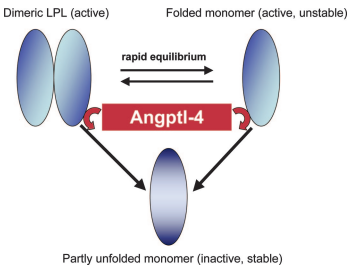
both variants resulted in blockage of light signals into the circadian clock; either mutation alone did not result in signal blocking. The two variants were found to genetically interact with the circadian clock photoreceptor Cryptochrome, and the light sensitivity of the circadian clock depended largely on the presence of one of two natural variants of Timeless. These findings reveal the complexities of the light-input pathways of the circadian clock. — P.D.

*"*Veela *defines a molecular link between Cryptochrome and Timeless in the light-input pathway to* Drosophila*'s circadian clock" by Nicolai Peschel, Shobi Veleri, and Ralf Stanewsky* (see pages 17313–17318)

MEDICAL SCIENCES

Chaperone controls unloading of fat

Molecular transporters circulate in the bloodstream, carrying triglycerides that are either utilized for energy or stored as fat. To unload their cargo, these transporters rely on lipoprotein lipase (LPL), an enzyme that directs when and where to unload triglycerides. During times of energy demand in working muscles, LPL breaks down the triglycerides into usable energy, whereas at other times, LPL activity leads to fat storage. To investigate how this enzyme is regulated, Valentina Sukonina *et al*. analyzed the activity of the candidate gene Angptl-4, which has been implicated as an LPL inhibitor, in rats during fasting and nonfasting times. The authors found that the expression of Angptl-4 and LPL was inversely related, suggesting that Angptl-4 is a negative regulator of LPL activity. Examining the Angptl-4 protein and its interaction with LPL, Angptl-4 acted in the fashion of a molecular chaperone. Instead of helping LPL fold into an active state, however, Angptl-4 appeared to help induce the unfolding of LPL into an inactive state. — T.D.



Angptl-4 activity in LPL chaperoning.

"Angiopoietin-like protein 4 converts lipoprotein lipase to inactive monomers and modulates lipase activity in adipose tissue" by Valentina Sukonina, Aivar Lookene, Thomas Olivecrona, and Gunilla Olivecrona (see pages 17450–17455)

PSYCHOLOGY, EVOLUTION

Culture shapes human spatial cognition

The development of cognition from infancy to adulthood is a major area of study in human psychology. A comparison of spatial cognition skills between humans from different cultures and the great apes shows that culture plays a strong role in shaping these skills. Daniel Haun *et al.* studied the performance and strategies used by great apes, and human children and adults from different cultures, in tests of spatial relationship skills. The authors found that human skills and strategies varied by culture at least from 8 years of age onward. Regardless of species, all of the great apes used environment-centered rather than self-centered processing, which was also used by human 4-year-old subjects. Haun *et al.* suggest that great apes and humans inherit similar preferences, but culture molds human preferences to different perspectives and strategies. Therefore, different cultures may mask the innate tendencies in humans, the authors say. Also, the results provide evidence that cognitive studies using Western subjects do not necessarily represent the entire set of human cognitive skills. — P.D.

"Cognitive cladistics and cultural override in Hominid spatial cognition" by Daniel B. M. Haun, Christian J. Rapold, Josep Call, Gabriele Janzen, and Stephen C. Levinson (see pages 17568–17573)