COLLOIDAL LENSES TURN UP THE HEAT

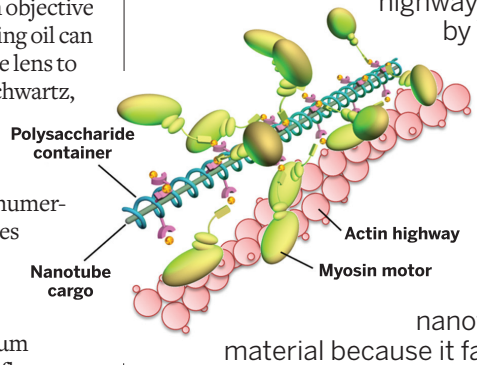
Some biological systems are too hot for single-molecule-imaging studies: At temperatures higher than 50 °C, heat conduction from the sample to the immersion objective through a refractive-index-matching oil can cause the high-numerical-aperture lens to fail. Stephen R. Quake, Jerrod J. Schwartz, and Stavros Stavrakis of Stanford University now show that spherical colloidal particles can be used in combination with low-numerical-aperture air objectives as lenses for high-temperature single-molecule imaging (*Nat. Nanotechnol.*, DOI: 10.1038/nnano.2009.452). Quake and colleagues attached 2-μm TiO_2 colloids to a glass surface via fluorescently labeled molecules. The colloids act as lenses for the molecules they are attached to. This setup allows the researchers to heat samples without also heating the lens. They used the method to study individual thermophilic DNA polymerase enzymes operating at temperatures as high as 70 °C. Such colloidal lenses could make it possible to use high-temperature polymerase enzymes in single-molecule DNA sequencing-by-synthesis technologies, the researchers suggest.—CHA

BETTER VIEW OF SOLID-STATE REACTIONS

Light-driven solid-state organic reactions, while potentially useful for environmentally clean industrial processes, are difficult to probe spectroscopically in fine powders or in single crystals because of high optical densities and light scattering. An international team that includes Malcolm D. E. Forbes of the University of North Carolina, Chapel Hill; Miguel A. Garcia-Garibay of the University of California, Los Angeles; and Valery F. Tarasov of the Semenov Institute of Chemical Physics, in Moscow, has turned to nanocrystals suspended in water as a system that maintains the properties of bulk solids but enables examination by solution techniques (*J. Am. Chem. Soc.*, DOI: 10.1021/ja909521u). The researchers studied the UV-induced conversion of dicumyl ketone to dicumene as a model system for synthesizing molecules with adjacent quaternary carbons. Laser flash photolysis of the ketone produced a nanocrystalline radical-pair triplet state, which the group observed transforming into dicumene by using time-resolved electron paramagnetic resonance spectroscopy. The work sets the stage for new depth of understanding and manipulation of organic solid-state reactions, the researchers say.—EKW

BIOCONTAINER TRANSPORT

When molecular cargo needs to be shipped to precise locations around a cell, biology often uses molecular motors that walk along molecular tracks with their load in tow. Scientists have been aiming to hijack these cellular highways to deliver drugs and other goods. A team led by Youichi Tsuchiya of Japan's RIKEN and Seiji Shinkai of the Institute of Systems, Information Technologies & Nanotechnologies, in Fukuoka, Japan, has now designed a molecular container that can encapsulate long, tubular cargo (*Angew. Chem. Int. Ed.*, DOI: 10.1002/anie.200904909). The researchers employed a triple-stranded helical sugar called schizophyllan as the container and showed that the polysaccharide can hold a carbon nanotube. Schizophyllan is a convenient container material because it falls apart in dimethyl sulfoxide solvent and reforms in water with the load encapsulated. The team observed that the nanotube-laden container is transported by the motor protein myosin at a speed of 95 nm per second along actin protein highways in cells. Because actin filaments connect to a cell's nucleus, the researchers believe the myosin motors and sugar containers could be commandeered to deliver gene therapies directly to their target.—SE



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TWO-FACED CATALYST

Tandem reactions taking place at the interface between organic and aqueous layers in a biphasic solvent system can now be catalyzed by different parts of the same nanoparticle, thanks to a new design by Daniel E. Resasco and coworkers of the University of Oklahoma (*Science* **2010**, *327*, 68). The team started by creating MgO-based nanoparticles, which can serve as a basic catalyst. The researchers then grew carbon nanotubes on the MgO surface and adsorbed palladium onto the nanotubes. The MgO surface prefers to be in water, but the nanotubes prefer an organic solvent, thus the nanoparticles end up residing in and stabilizing the emulsion layer of a water/emulsion/decalin solvent system. Resasco and coworkers used the recyclable nanoparticles to develop a tandem reaction that is useful in biofuel production, where the reaction mixture typically has a complex composition. In the first step, MgO catalyzes coupling of 5-methylfurfural and acetone in the aqueous phase. The product slips into the organic phase where a subsequent Pd-catalyzed hydrogenation takes place.—SR

FLU-FIGHTING PROTEINS

If you manage to escape swine flu, thank your interferon-inducible transmembrane (IFITM) proteins. Harvard Medical School's Stephen J. Elledge and Abraham L. Brass and colleagues have discovered that these proteins, which were previously associated with functions including immune cell signaling and bone mineralization, also serve as the body's first line of defense against the H1N1 virus (*Cell* **2009**, *139*, 1243). In experiments with cultured human and mouse cells, IFITM proteins prevented or slowed most virus particles from infecting cells. The proteins are activated by interferon, a protein alarm signal that cells emit when they're invaded by a virus. But the interferon response makes people feel ill when their bodies are fighting the flu. "If we can figure out ways to increase levels of these proteins without interferon," Elledge says, "we can potentially increase natural resistance to some viruses without all the side effects of the interferons." The researchers found that IFITM proteins also protect cells from West Nile virus and dengue virus.—SLR