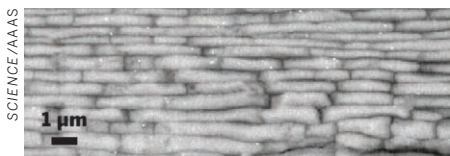


NACRE'S TRADE SECRETS REVEALED

Nacre, the iridescent composite that forms pearls and the lining of some mollusk shells, is composed of layers of bricklike aragonite calcium carbonate crystals embedded in a mortar of chitin and proteins. Nature has been stingy in surrendering



Pif proteins help calcium carbonate crystals form bricklike nacre (as shown in the SEM image), which lines a pearl oyster's shell.



the secrets behind nacre's orderly assemblage, but Japanese researchers have now discovered two proteins that are key to this process (*Science*, DOI: 10.1126/science.1173793). Hiromichi Nagasawa and colleagues of the University of Tokyo discovered one protein, Pif80, by searching for a protein that preferentially binds aragonite. The researchers determined that Pif80 has its origins in a precursor protein; when cleaved, the precursor releases Pif80 and the second protein, Pif97. When the researchers suppressed production of these proteins in oysters, crystal growth was slow and disordered, and the mollusks were unable to form pearly sheets of nacre. Nagasawa's team believes that Pif80 and Pif97 form a complex that binds to other proteins and chitin, concentrates calcium carbonate, induces formation of aragonite crystals, and regulates crystal orientation.—SLR

CLOSING IN ON PERSONAL GENOME SEQUENCING

The personal genome is coming. As the time and money required to sequence the DNA in an individual's genome continue to decrease, the day draws nearer when genome sequencing will be routine. Using commercially available single-molecule DNA-sequencing instruments and reagents from Helicos BioSciences and Illumina, Stephen R. Quake (a cofounder of Heli-

cos), Dmitry Pushkarev, and Norma F. Neff of Stanford University sequenced Quake's genome in four data collection runs on a single instrument (*Nat. Biotechnol.*, DOI: 10.1038/nbt.1561). The team acquired sufficient data on the genome without the need to clone or amplify the DNA first. Each run took a week, so there's still room for speeding up the analysis, the researchers note. They identified some 2.8 million single-nucleotide polymorphisms, which are individual base changes that are associated with differences between individuals or with disease states, with a less than 1% false-positive rate. The achievement suggests that sequencing, once the domain of large sequencing centers, is now within reach of individual laboratories.—CHA

CLATHRIN SMUGGLES QUANTUM DOTS INTO LIVING CELLS

Peptide coatings can help nanoparticles slip into cells, a process that may prove useful for in vivo imaging or drug delivery if scientists can clear up how it works. Now, Abdulaziz Anas, Mitsuru Ishikawa, Vasudevanpillai Biju, and coworkers with Japan's National Institute of Advanced Industrial Science & Technology have a better idea after thoroughly studying the insect neuropeptide allatostatin and learning that it helps CdSe-ZnS quantum dots pass through cell membranes by recruiting clathrin, a protein that facilitates endocytosis by forming vesicles around foreign substances (*ACS Nano*, DOI: 10.1021/nn900663r). The researchers

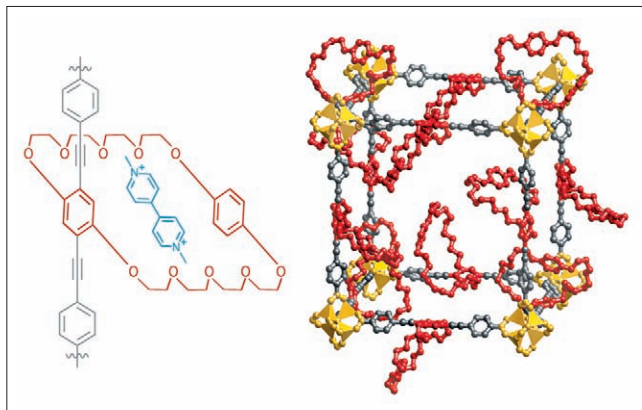
suspected that allatostatin might be gaining access to cells via galanin receptors. But when they blocked those receptors, it didn't have much influence on the influx of quantum dots. By inhibiting PI3K, a kinase that is crucial to the formation of clathrin vesicles, they noted that fewer than half of the quantum dots made their way in, leading the team to conclude that most of the nanoparticle entry is clathrin-mediated. The remainder of the quantum dots may be entering through electrostatic

interactions with molecules in the cell membrane, thanks to an arginine residue on allatostatin, they suggest.—AAR

NEW TRICK FOR MOFS

By incorporating macrocyclic polyethers into the three-dimensional porous structure of metal-organic frameworks (MOFs), a team of chemists from UCLA and Northwestern University has enhanced the capabilities of MOFs to include specific binding of organic molecules (*Science* 2009, 325, 855). Thousands of MOFs made up of metal-based joints connected by linear organic struts have been prepared and shown to nonspecifically bind small guest molecules according to their size or shape—adsorbing H₂ molecules within the pore structure, for example. But the team led by UCLA's Qiaowei Li and Wenyu Zhang created a novel type of MOF by using zinc cluster joints with long phenylethyne struts that contain large crown ethers at the midribs. The researchers show that

MOF-1001 (right) consists of Zn₄O(CO₂)₆ clusters (yellow) connected by phenylethyne struts (gray) containing a crown ether (red). Paraquat dications bind inside the MOF's polyether rings.



electron-deficient paraquat dications (1,1'-dimethyl-4,4'-bipyridinium) quantitatively and reversibly bind by threading through the middle of the crown ethers in a pseudorotaxane fashion. By comparison, frameworks lacking the polyethers exhibit negligible uptake of paraquat. The new MOFs are capable of binding incoming substrates in a manner akin to the docking of drug molecules within protein receptors, Li says, opening up possibilities for molecular-recognition applications.—SR