MATERIALS SCIENCE
The Effects of Confinement
Block copolymers, which consist of chains of covalently connected dissimilar polymers, can adopt a wide range of morphologies, such as spheres or cylinders of the minority component within a bulk matrix. The morphologies are influenced by neighboring surfaces, which can disrupt the natural bulk periodicity. These interactions are particularly interesting when the polymers are confined to cylindrical channels that interact preferentially with one of the polymer blocks and where the diameter may or may not be commensurate with the natural dimensions of the polymer.

Wu et al. used block copolymers as surfactants for the formation of silica mesostructures and looked at the influence of the channel diameter. Using transmission electron microscopy (TEM), they imaged the structures that formed after calcination and backfilling of the channels with silver. For larger-diameter channels, they observed a double series of stacked rings that could be separated by sonication. As the diameter of the channel decreased, the rings became helices, which gradually became less densely packed. At a critical diameter, the inner helix transformed into a continuous channel, followed by a similar transition for the outer section as the diameter was decreased further. The ability to form highly tunable, coaxial, high-surface-area mesostructured wires from a number of metals may be of particular use in applications such as sensing and catalysis. — MSL


TEM images and models (color) of two of the mesostructures.

BIOCHEMISTRY
Catalytic tRNA
One of the central reactions in macromolecular biosynthesis is the formation of the peptide bond: the nucleophilic attack by the amino group (of the A-site amino acid that is added to the growing polypeptide) on the terminal carbonyl group of the growing polypeptide [which is attached via an ester linkage to the last base of the transfer RNA molecule (tRNA) that sits in the P site of the ribosome]. Structural analysis has revealed that there are no ribosomal proteins close enough to serve as chemical helpers for this reaction. Ribosomal RNA (rRNA), which is close enough, does not seem to help much either, according to mutagenesis results. On the other hand, recent work by Sievers et al. indicates that the ribosome may function as an entropy trap, accelerating the rate of reaction by a factor of 10^6 through careful positioning of the reactants and exclusion of water.

Weinger et al. have looked instead at the ribose portion of the last base (A76) in the P-site tRNA. By assessing the effects of replacing the 2′ hydroxyl with a hydrogen or fluorine atom, they conclude that the nucleophilic attack is helped (also by a factor of 10^6) by what is, in essence, part of one of the reactants. They propose that this substrate-assisted reaction may be a holdover from the period when RNA carried out much of biochemistry, before protein enzymes evolved into expert catalysts. — GJC


PALEONTOLOGY
Eating in the Dark
Bivalves can live relatively long lives in cold waters, and it has been suggested that cold temperature promotes longevity by reducing metabolic rates. Buick and Ivany counted the growth bands in the fossil clam *Cucullaea raea*, which lived in shallow waters off the Antarctic Peninsula about 45 million years ago, and found individuals that had reached the ripe old age of 100 years. When they measured the carbon and oxygen isotopic concentrations within the bands, however, they found that the clams had lived in relatively warm waters (with mean temperatures of 14°C) and that they did not grow much in the summertime. This seems odd because during the summers, when the sun never set, the waters would be full of nutritious phytoplankton. Instead, the data suggest that the shells grew during the austral winter, when there was little light and less food, with the clams adopting the strategy of devoting the less harsh summer months to reproduction in order to enhance larval survival. Hence, clam longevity may be tied to low food supplies and lean shells rather than to cold temperatures. — LR


BIOTECHNOLOGY
Gas Phase Drug Screening
Membrane proteins are prime drug targets, yet are fabulously difficult to work with because their structures are stabilized by both hydrophobic and hydrophilic interactions (with lipids, charged solutes, and water). These kinds of interactions need to be maintained in order to preserve functional integrity, such as the binding of small-molecule ligands, and this has meant coping with sample heterogeneity in the form of native and exogenous lipids and detergents. Ilag et al. have overcome these obstacles and developed an approach for characterizing the binding of the artificial substrate tetraphenyl phosphonium to the bacterial multidrug transporter EmrE in a dodecylmaltoside-solubilized state. Tandem mass spectrometry led to the identification of a broad peak at 6500 to 6800 m/z that contains protein, detergent, and...
and ligand, with these components being
dissociable from the parent complex in
reverse order as the collision voltage
was increased. — GJC


**CHEMISTRY**

**Phenyls with a Twist**

Planar arrays of fused aromatic rings are
stabilized by electron delocalization in
their extended $\pi$-network, which leads
to the bright colors that make these
molecules such useful dyes. However,
chemists interested in the competing
interplay of steric and electronic
factors have long tried to coax such
molecules out of planarity by appending bulky
substituents. Dai et al. have managed to
crowd four pendant phenyls along a
10-carbon stretch of a
diindenophenan-
threne framework. The compound was formed in 20%
yield from a precursor with four alkyne
spacers, which were fused into the
heptacyclic core through a series of
intramolecular rearrangements.
Crystallography revealed a severely
twisted, nonplanar core geometry,
particularly in the central phenanthrene
ring. The dangling phenyl substituents
are stacked parallel to one another in a
partial helix, with the outer phenyls
oriented $184^\circ$ apart, presumably the
result of both steric and $\pi$-stacking
interactions. Nuclear magnetic resonance
spectroscopy revealed a rotational barrier
of $-14$ kcal/mol for the outer phenyls
and a higher barrier for the two rings
between them. — JSY


**NEUROSCIENCE**

**Doing Without an Adaptor**

Adaptor proteins (APs) are involved in the
packaging of proteins into clathrin-coated
vesicles during intracellular transport. The
AP-3 subclass, in particular AP-3A, plays a
role in membrane protein transport and
in the biogenesis of lysosomes and
lysosome-related organelles. The AP-3B
adaptors are found only in neurons, and
their precise role has been unclear.
Nakatsu et al. describe the phenotype of
mice engineered to lack AP-3B and suggest
that this adaptor is important in the
biogenesis of synaptic vesicles. Mutant
mice were prone to spontaneous recurrent
epileptic seizures, and their brains
displayed synapses with morphological
abnormalities. In hippocampal slices, the
ability to release the inhibitory neuro-
transmitter GABA was diminished, probably
because of reduced levels of the GABA
transporter. Thus, AP-3B is important in
the production of a subset of synaptic
vesicles in inhibitory neuronal pathways,
and this mouse model may be useful in
future studies of epilepsy. — SMH


**Tolerating ER Stress**

Cells monitor how well the synthesis of proteins in the endoplasmic reticulum (ER) is going, and when stressful conditions cause the
accumulation of unfolded proteins, the unfolded protein
response (UPR) is initiated. Ito et al. used a microarray screen to detect genes whose products were expressed specifically in response to an agent causing ER stress. They identified *stanniocalcin 2* (*STC2*), which is related to a hormone originally described
in fish that functions to prevent hypercalcemia. Expression of *STC2* was increased in
cultured cells undergoing the UPR after exposure to thapsigargin, an inhibitor of the
sarco(endo)plasmic reticulum Ca$^{2+}$-ATPase. Like other UPR genes, *STC2* was also
expressed in rat brain tissue after transient cerebral ischemia. Expression of *STC2*
appears to require signaling from the PERK serine-threonine kinase, a known mediator of the
UPR, to the transcription factor ATF4, because mouse embryo fibroblasts
lacking PERK or ATF4 failed to increase expression of *STC2*. Increased synthesis of
*STC2*, which was secreted from cells undergoing ER stress, appears to contribute to
signaling mechanisms that help protect cells under stressful conditions. — LBR