BIOCHEMISTRY

An Endonuclease Tango

The degradation of mRNA transcripts is an important cellular mechanism contributing to the regulation of gene expression. In *Escherichia coli*, the first step of this process involves internal cleavage of mRNA into fragments by the endoribonuclease RNase E. The structure of the RNase E catalytic domain in complex with short RNA substrates revealed a tetramer in which RNA is bound by two subdomains of one monomer and cleaved at the catalytic site of another monomer. Koslover et al. have determined the structure of the unliganded RNase E catalytic domain and discovered large conformational differences relative to the substrate-bound protein. In the unliganded structure, the two subdomains of each monomer that furnish the RNA binding residues (shown in space-filling representation) are rotated away from the rest of the monomer and from the neighboring catalytic site by about 60°, which allows the substrate easy access. Pivoting then carries the RNA into close proximity to the catalytic site. In addition, the quaternary structure of the tetramer is substantially reorganized in unliganded RNase E, suggesting a high degree of structural flexibility that may permit the enzyme to accommodate RNA molecules of various sizes and shapes by using different combinations of binding and catalytic sites within the tetramer. — NM*


CHEMISTRY

Stable Pyramids

Lead sulfide commonly crystallizes into cubes, dominated by the stability of the {100} faces, with the occasional formation of an octahedron or tetrahedron that involves the growth of {111} faces. Though other growth faces such as the {113} are possible, their much lower stability means that they are not observed during fast crystallization processes. Fan et al. combined a toluene solution of lead diethylthiocarbamate with an aqueous solution containing a slight stoichiometric excess of sodium sulfide. At the interface, they observed the slow growth of upright pyramids of PbS with only {113} facets. The pyramids were uniform in size and randomly distributed across the water/toluene fluid interface, as a result of the capillary and van der

*Nilah Monnier is a summer intern in Science’s editorial department.
Waals forces overcoming the intrinsic dipolar repulsion of the highly charged crystals. The authors believe that at the interface, an emulsive supersaturated layer forms, which serves as the growth medium for the pyramids and also limits the number of growth directions. They found that the height of the toluene column was critical in determining the type of crystal that formed, thus offering an additional variable to consider for the growth of kinetically unfavored crystal habits. — MSL


**MATERIALS SCIENCE**

**An Inside View of Foam**

From lending texture to a perfect pint, to mediating fluid flow in porous rock, and even capturing space dust in the wake of a comet, foams have a diverse set of mechanical properties, geometrical structures, and applications. Their remarkable strength-to-weight ratio makes them sought after as physical supports, with their large surface area making them ideal scaffolds for catalytic applications. They tend to be rather delicate, however, and the mechanisms whereby the various structures form and then limit the resulting physical properties have not been clear. Barty et al. use coherent x-ray diffraction to provide a detailed three-dimensional image of the internal structure of the highly porous form of tantalum oxide known as aerogel, often described as “frozen smoke.” Combining the exquisite structural information with detailed simulations, they show that the observed blob-and-beam network structure explains why the materials are weaker than expected. Such insight offers a route toward improving the properties through better control of the preparation process. — ISO


**IMMUNOLOGY**

**An Entrapment Defense**

Eosinophils are white blood cells that play a critical role in protecting vertebrates from parasitic infections and also are believed to participate more broadly in immune defense. Yousefi et al. suggest that eosinophils serve to protect the gastrointestinal tract from unwanted bacterial invaders, and they do so by engaging an unusual mechanism. Analyzing colon tissue from patients with Crohn’s disease (a chronic intestinal inflammatory disorder), they found that a subset of the infiltrated eosinophils were associated with extracellular structures that contained DNA and eosinophil-derived granule proteins. In vitro studies revealed that when treated with lipopolysaccharide from bacterial pathogens, eosinophils released their mitochondrial DNA in an explosive fashion. This DNA release was dependent on priming of the cells with cytokines and resulted in rapid death of co-cultured bacteria, although the eosinophils themselves remained viable. Mice that had been manipulated genetically to overproduce eosinophils displayed similar extracellular structures in their intestine in response to surgically induced sepsis, and they survived longer than control mice. Thus, these eosinophil-derived structures appear to trap and kill bacterial invaders in the gut. Other researchers had shown previously that neutrophils and mast cells also produce extracellular traps with antimicrobial activity, but in those instances the expelled DNA was nuclear rather than mitochondrial, and that strategy resulted in the death of the immune cells. — PAK


**MICROBIOLOGY**

**Trawling Hidden Waters**

Lake Vostok is a vast lake currently buried under a 4-km-thick glacier in Antarctica; it has long been an object of curiosity to microbiologists. What could possibly live at **−2°C**, under 400 atm, in complete darkness, and with few available nutrients? D’Elia et al. have anticipated the delayed breakthrough by the Russian drilling team in their microbiological examinations of the frozen lake surface that has accreted on the underside of the glacier. They were surprised to discover that more than 60 taxa of cold-tolerant bacteria grew in their long-term cultures, all related to known environmental species. Microscopy revealed algal cells and evidence of fungi. Because a variety of samples were taken, distinct ecological zones could also be distinguished. Despite these apparent riches, there were still far fewer organisms in the lake ice than in other environments on Earth. When the Russian team do bore through the entire ice sheet, they are very unlikely to find a microbiological paradise, unless it is one they have brought with them. — CA

Trawling Hidden Waters
Caroline Ash

Science 321 (5892), 1021.
DOI: 10.1126/science.321.5892.1021c