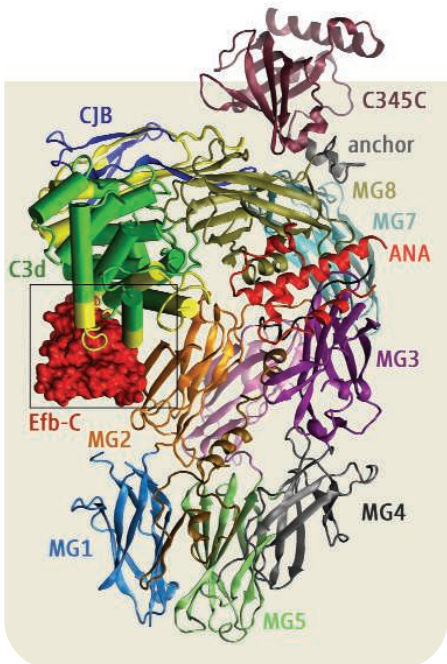
IMMUNOLOGY

A Bacterial Anticomplement



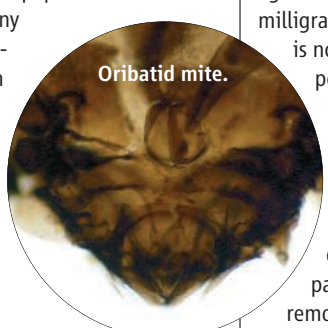
The complement system generates a finely regulated, yet potent antimicrobial response, making it an attractive target for bacterial virulence factors. Most commonly, endogenous regulatory proteins of the complement system are usurped to switch off complement activation, but the widespread human pathogen *Staphylococcus aureus* can inactivate the complement cascade by a more direct means. Previous work has shown that the extracellular fibrinogen-binding protein (Efb-C) generated by *S. aureus* blocks the complement pathway by binding to the thioester-containing domain of the complement C3b protein; indeed, *S. aureus* strains that lack Efb-C display reduced virulence. Hammel *et al.* resolve the crystal structures for the C3-binding domain of Efb-C in its unbound state and in complex with the C3d domain of C3 (shown at right). Structure-based functional studies suggest that native C3 is bound by Efb-C in a way that alters its conformation. As a consequence, conversion to C3b is prevented, and participation in the subsequent activation of the complement cascade is also blocked. As well as binding native C3, Efb-C also had high affinity for C3b, again appearing to induce conformational changes, this time in the already activated form of the complement component. Effective targeting of the interface between Efb-C and the C3d domain by a small molecule could be useful in the treatment of *S. aureus* infection. — SJS

Nat. Immunol. 10.1038/ni1450 (2007).

ARCHAEOLOGY

Fall of the Mitey

Within a century after the arrival of Spanish conquistadors in Peru in the 1530s, the population of the Inca empire fell from an estimated 9 million to around 600,000, due largely to introduced diseases, forced resettlement, and exploitation for labor. It is difficult to reconstruct the demographic history of that collapse because the Inca had no written language. Chepstow-Lusty *et al.* employed a new palaeoenvironmental tool, the abundance of soil-dwelling oribatid mites, to help fill in gaps in the record of population decline. These mites, which are tiny arthropods related to spiders, thrive on a diet rich in animal excrement (in Peru, mostly that of llamas). By measuring the abundance of these creatures' remains in pastures where the animals would have grazed, the authors were able to determine how the abundance of livestock, and by inference the level of human activity, changed in the area around the imperial capital Cuzco from about 800 to 1800 CE. The correspondence of the mite record to the historical accounts of the Spanish invaders bolsters the accuracy of the technique. — HJS


Oribatid mite.

J. Archaeol. Sci. **34**, 1178 (2007).

BIOCHEMISTRY

Making Complexes Simply

Even though proteomic studies may overestimate the number and variety of functionally important protein-protein interactions in cells, most such complexes are not abundant enough to be purified via classical biochemistry. Heterologous expression of well-folded proteins in the milligram amounts needed for structural studies is not straightforward—especially not for posttranslationally modified eukaryotic proteins—and arranging stoichiometric assembly is yet another hurdle.

Fitzgerald *et al.* describe a baculovirus-based system for making multigene expression vectors and demonstrate its utility for producing in parallel a combinatorial set of chromatin-remodeling complexes built of wild-type or truncated subunits. Incorporating a phosphatase into the expression vector quantitatively yielded the de-phospho form of the complex. — GJC

Structure **15**, 275 (2007).

CHEMISTRY

Rearranging Nitriles

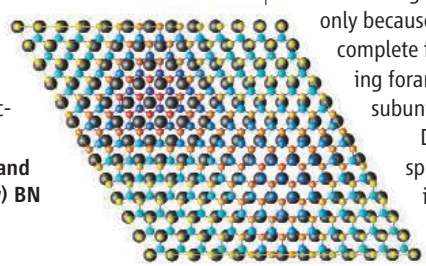
Although catalysis of alkene and alkyne metathesis has recently flourished, the analogous transformation of nitriles, which bear C-N triple bonds, has proven more challenging. This reaction is appealing in part because of the relative ease with which CN groups can be introduced to diverse organic molecules. However, the strength of metal nitride bonds can inhibit turnover. Geyer *et al.* have prepared a tungsten complex with trifluoromethyl-substituted alkoxy ligands that acts as an effective catalyst for the metathesis of aryl nitriles R-CN to the corresponding alkynes R-CC-R, with 3-hexyne serving as a N acceptor to yield propionitrile as a co-product; the reaction does not form N_2 in the absence of an acceptor. Alkyne metathesis occurs more rapidly under the reaction conditions than nitrile alkyne cross-metathesis, and the authors note the conserved gas-phase thermodynamic preference for coupling the aryl partners and transferring N to the alkyl moiety. The catalyst tolerates halides, methyl ester, and vinyl groups, as well as thiophene substrates. — JSY

J. Am. Chem. Soc. **129**, 10.1021/ja0693439 (2007).

SURFACE SCIENCE

Buckled BN

A covalently bonded overlayer on a metallic surface can be distorted to varying degrees, depending on the extent of lattice mismatch. For example, boron nitride (BN) overlayers can form simple monolayers on close-packed Cu(111) and Ni(111) surfaces, but complex moiré patterns are observed on Pt and Pd surfaces. On Rh(111) and Ru(111) surfaces, scanning tunneling microscopy helped reveal the formation of "nanomeshes" in which 2-nm depressions formed a hexagonal lattice with a 3-nm periodicity. For the Rh system, this pattern was initially attributed to a bilayer structure in which the depressions were holes exposing the underlying metal. Laskowski *et al*. now propose an alternative structure that better explains the ultraviolet photoelectron spectra for this surface and that avoids the energetic penalty posed by the many dangling bonds in the two-layer structure. Density functional calculations were used to create a force field for a BN layer strained by 8%, its lattice mismatch with Rh(111). When this overlayer was allowed to relax on the Rh(111) surface, it adopted a nanomesh geometry of flat depressions ("holes") where the lattice match with the substrate was high, surrounded by a region about 0.6 Å higher, where poor lattice matching led to overlayer repulsion. This steplike corrugation in the surface normal direction relieves strain while maintaining the lateral dimensions of the BN layer. — PDS



High (blue and red) and low (cyan and yellow) BN on Rh(111) (black).

Phys. Rev. Lett. **98,** 106802 (2007).

ECOLOGY/EVOLUTION

Pelagic Ecology

Investigations of the ecology of planktonic marine organisms run into the problem of reconciling the anonymity of morphological uniformity with the potential for ubiquitous distribution in the continuity of the oceans and the observed genetic diversity. Foraminifera are good model organisms for disentangling protist biogeography, not only because they have left an unusually complete fossil record, but also because living forams display high rates of small-subunit ribosomal RNA evolution. Darling *et al.* find that one widespread morphospecies has evolved into several types with distinct global distribution patterns that seem to have arisen during Northern Hemisphere cooling in the Quaternary. Subsequently, gene flow has been restricted by the equatorial oceans and especially by the Gulf Stream. Adaptations for survival at cold temperatures have since developed and are related to niche: that is, living within ice brine channels, in subpolar oceans, in upwellings, and so on. — CA

Proc. Natl. Acad. Sci. U.S.A. **104**, 5002 (2007).

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<< Cheering Up with VEGF

Although the molecular mechanisms of antidepressant action remain unclear, one hypothesis suggests that stimulation of growth factor signaling and of adult neurogenesis in the hippocampus may be implicated in their effects. Warner-Schmidt and Duman investigated the effects of different classes of antidepressants on hippocampal expression of the neurotrophic and proangiogenic factor vascular endothelial growth factor (VEGF), which their research group had previously shown to be enhanced by electroconvulsive seizure (ECS) treatment. The abundance of VEGF mRNA increased in the hippocampal granule cell layer of rats treated for 14 days with fluoxetine (a serotonin-reuptake inhibitor) or desipramine (a norepinephrine-reuptake inhibitor), as did the abundance of VEGF in hippocampal homogenates. Pharmacological blockade of the VEGF receptor Flk-1 inhibited the increase in cell proliferation in the hippocampal subgranular zone (SGZ) produced by ECS or by chronic exposure to fluoxetine or desipramine, whereas intracerebroventricular delivery of a VEGF isoform stimulated SGZ cell proliferation. Furthermore, pharmacological blockade of Flk-1 inhibited the effects of desipramine on behavioral responses in chronic and subchronic rat models of depression, whereas VEGF had an antidepressant-like effect. Noting that antidepressants promoted the proliferation of hippocampal endothelial cells as well as hippocampal neurogenesis, the authors speculated that this could play a role in the treatment of certain forms of depression that are associated with vascular abnormalities. — EMA

Proc. Natl. Acad. Sci. U.S.A. **104**, 4647 (2007).

CREDIT: LASKOWSKI *ET AL., PHYS. REV. LETT.* **98**, 106802 (2007)

Pelagic Ecology

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Science **315** (5820), 1769.
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