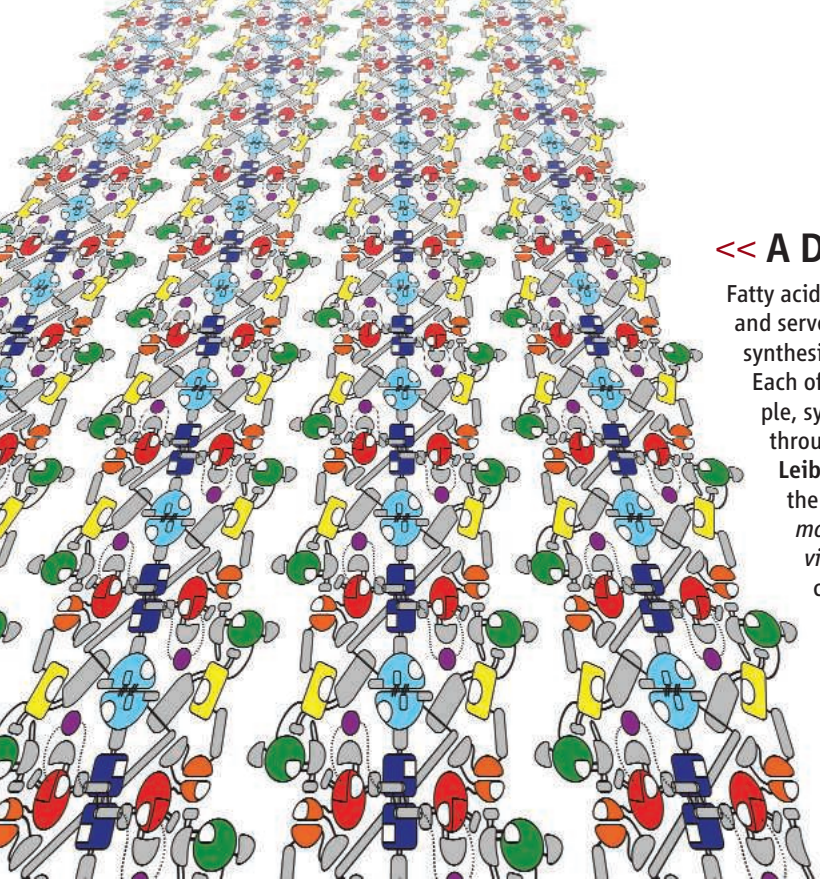
EDITED BY STELLA HURTLEY AND PHIL SZUROMI



<< A Double-Tethered Switchblade

Fatty acids, which are comprised mainly of long hydrocarbon chains and serve essential structural and energetic functions in cells, are synthesized by adding two-carbon building blocks to a starter unit. Each of the additions involves a series of four reactions; for example, synthesis of a palmitate chain requires cycling seven times through this set of four catalytic sites. **Jenni *et al.*** (p. 254) and **Leibundgut *et al.*** (p. 288) describe the crystal structures of the fatty acid synthase complexes from the fungus *Thermomyces lanuginosus* and the yeast *Saccharomyces cerevisiae*. For the fungal enzyme, a complete mapping of the catalytic domains within the two-chambered heterododecameric (a_6b_6) complex is provided. The yeast data reveals the cyclical path taken by the acyl carrier protein (ACP) domain to which the nascent fatty acid is attached. The ACP moiety is tethered to the wall and to the floor of the chamber, which constrains its movements as it visits the nearby four catalytic sites. Upon arrival, it unfolds the growing acyl chain like a switchblade.

CREDITS (TOP TO BOTTOM): M. LEIBUNDGUT AND S. JENNI; KLAJN *ET AL.*

Proton Tug-of-War

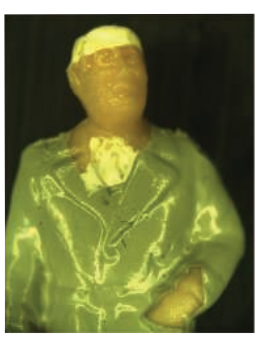
In acidic aqueous solutions, protons are shared and shuttled by the solvent molecules or dissolved bases, as opposed to moving about as free H^+ ions. Probing such structures is challenging, however, because the many energetic configurations that form at ambient temperature lead to very broad spectral bands. **Roscioli *et al.*** (p. 249) have used gas-phase argon clusters to isolate and probe the vibrations of complexes in which a proton bridges two molecules of widely varying basicity, ranging from water and ammonia to alcohols, ethers, and noble gases. The infrared spectra of these cold complexes show sharp absorption bands that clarify how the proton affinities and skeletal vibrations of the flanking bases impact the motion of the H^+ ion confined between them.

All-Organic Frameworks in Three Dimensions

Numerous metal-organic framework compounds have been reported in which high surface areas are achieved by the metal centers directing the assembly of linking organic groups. **El-Kaderi *et al.*** (p. 268; see the Perspective by **Budd**) now report the synthesis and structural characterization of high-surface-area, covalent organic frameworks through the condensation of subunits that can form four bonds tetrahedrally with another type of subunit that can form three bonds triangularly. After target networks were chosen, molecular design programs were used to optimize the choice of subunits. The strong covalent bonds in the framework (C–C, C–O, C–B, and B–-O) lead to high thermal stability (400° to 500°C), and the use of only light atoms leads to low densities (0.17 grams per cubic centimeter).

Nanoparticles Take Shape

Ceramics are often made from "greenwares," in which aggregates of small colloidal particles are molded or shaped before thermal reactions remove solvent and bond the particles together. **Klajn *et al.*** (p. 261) show that metal nanoparticles (NPs) can be similarly molded into macroscopic objects. The metal NPs are coated with a surfactant that can undergo ultraviolet-induced isomerization from a trans to cis configuration. The higher dipole of the cis form causes the NPs to aggregate into larger "superspheres" 50 to 300 nanometers in diameter. These superspheres adhere to each other and allow formation of shapes and coating of objects (such as small figurines). Subsequent annealing creates hardened polycrystalline porous materials that can be made from either single or mixed metal NPs.



Raman Probes Shape Up

Raman spectroscopy can provide a wealth of information about molecular vibrations and provide fingerprint signatures for identification, but even when signal strength is boosted by coherently exciting the vibrations with laser pulses, a fluctuating background signal hinders many practical applications in sensing. **Pestov *et al.*** (p. 265; see the Perspective by **Lucht**) now describe a method in which a probe pulse is delayed and has its shape optimized so to minimize the nonresonant background contributions. The authors apply this method to the detection of picolinates, the characteristic component of bacterial spores such as anthrax.

A Light Touch for Spin

Differences in the pressure of warm sunlight being reflected and re-radiated from the surface

Continued on page 171

Published by AAAS

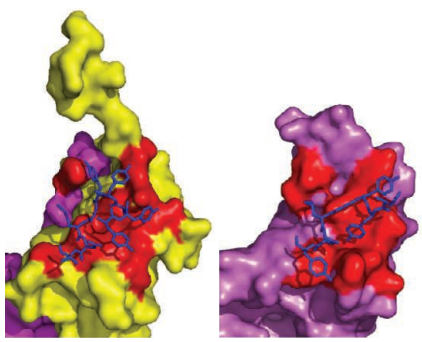
Continued from page 169

of an asteroid during its orbit can change how it spins. This process, called the Yarkovsky-O'Keefe-Radzievskii-Paddack (YORP) effect, has been predicted but not seen directly. Two reports describe the detection of the YORP effect acting on the near-Earth asteroid 54509 (2000 PH5); see the Perspective by **Rubincam and Paddack**. **Lowry *et al.*** (p. 272, published online 8 March) monitored the reflected optical light from the asteroid to show how the spin rate of the asteroid is decreasing. **Taylor *et al.*** (p. 274, published online 8 March) have mapped the asteroid's shape using radar observations to show that this slowing is precisely as predicted by the YORP effect.

Ancient Collagen Signatures

Soft tissues have been thought to be rarely if ever preserved in the fossil record, aside from some samples entombed in amber or for a few million years in ice. Recently, a femur of a *Tyrannosaurus rex* dating to about 67 million years ago was recovered that seemed to preserve internal soft tissues, including blood vessels within its bone. **Schweitzer *et al.*** (p. 277) and **Asara *et al.*** (p. 280) have further analyzed these tissues, as well as samples from a mastodon, and show that original collagen proteins were preserved. Mass spectrometry was used to recover at least some of the original collagen sequence. Thus, aspects of genetic information can be obtained from select samples of extinct species preserved for tens of millions of years.

Spotlight on the Pre–B Cell Receptor



The pre–B cell receptor (pre-BCR), comprising a heavy chain and a heterodimeric surrogate light chain (SLC), a signaling complex that acts as a checkpoint in B cell development. **Bankovich *et al***. (p. 291) report the structure of a pre-BCR Fab-like fragment at 2.7 angstrom resolution. The structure shows how the requirement for pairing with the SLC might constrain the repertoire of heavy chains in the mature antibody population. The crystal structure, together with electron microscopy data and biochemical analysis, supports a model of antigen-independent, SLC-mediated dimerization of the pre-BCR to promote pre–B cell activation and expansion.

Making LIGHT of Lipid Metabolism

Atherosclerosis results from a combination of lipid dysregulation and inflammation-mediated pathology of the vasculature. **Lo *et al.*** (p. 285; see the Perspective by **Hansson**) show that increased expression of related members of the tumor necrosis factor family of inflammatory cytokines, LIGHT and lymphotoxin (LT), on T cells can elevate circulating blood cholesterol and triglycerides in mice. This effect appeared to be mediated via lymphotoxin β receptor (LTβR) signaling in hepatocytes, leading to a drop in the activity of hepatic lipase, an enzyme central to lipid metabolism. The normally high lipid levels found in mice that lack the low-density lipoprotein receptor gene were reduced when LTβR signaling was inhibited. These results raise questions about how the immune system detects and subsequently exacerbates dyslipidemia, and whether this process makes any direct contribution to atherosclerosis in humans.

Double Source for S1P

Sphingosine-1-phosphate (S1P) is a circulating lipid mediator that induces the egress of lymphocytes from lymphoid organs. The immunomodulatory effects of S1P are made apparent by the absence of circulating lymphocytes in mice that are unable to support its production and by the encouraging results of clinical trials aimed at targeting this pathway to suppress transplant rejection and autoimmunity. **Pappu *et al.*** (p. 295, published online 15 March; see the Perspective by **Chun**) use a combination of conditional gene deletion and bone marrow chimerism to illuminate two sources of S1P in the blood and lymphatic circulation. By sustaining S1P levels outside the lymphoid organs, these supplies allow lymphocytes to follow a gradient between the lymphoid tissue—where S1P is catabolized to low levels—and the two circulatory systems. This insight may help refine approaches of immune suppression and activation via the S1P pathway.

CREDIT: BANKOVICH *ET AL.*

Published by AAAS