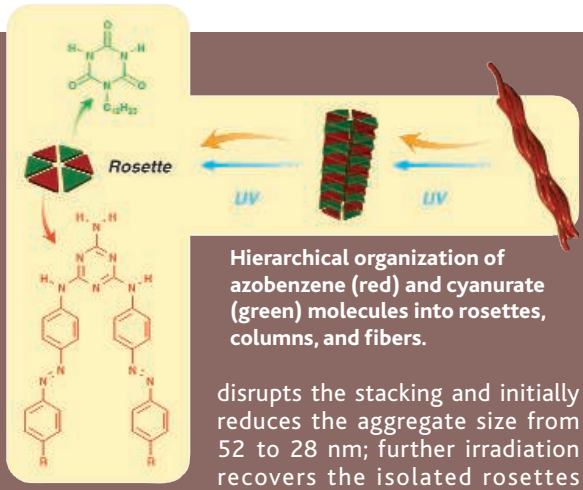
EDITORS' CHOICE

edited by Gilbert Chin

CHEMISTRY

Lightly Switched Gel

The formation of supramolecular assemblies can be controlled through light-induced structural movements, such as cis-trans isomerization, that alter the interactions between weakly bonding molecules. Yagai *et al.* have characterized disc-shaped hydrogen-bonded hexamers (rosettes) formed from two molecules: one a melamine bearing two long side chains containing azo groups and the other a much smaller cyanurate. In cyclohexane solution, the rosettes formed from the *trans*-azobenzene isomer can stack through aromatic interactions and bunch into columns that eventually intertwine and gel. Irradiation of the gel with ultraviolet light disrupts the stacking and initially reduces the aggregate size from 52 to 28 nm; further irradiation recovers the isolated rosettes (8-nm aggregates). The dissociation is reversible, and exposure to visible light and subsequent storage in the dark yields the gel with total conversion of the cis isomers back to *trans*-azobenzenes. — PDS



Hierarchical organization of azobenzene (red) and cyanurate (green) molecules into rosettes, columns, and fibers.

J. Am. Chem. Soc. 10.1021/ja052645a (2005).

PHYSICS

Cold Atom Coupling

The ability to control the interaction strength between atoms within strongly interacting Fermi gases by sweeping a magnetic field across a Feshbach resonance provides a powerful experimental system in which to study many-body physics. One example is the crossover from a Bose-Einstein condensate (BEC) regime, in which the atoms are strongly coupled into pairs, to the weak-coupling regime that mimics Bardeen-Cooper-Schrieffer (BCS) coupling of electrons in superconducting metals. Although behavior on either side of the resonance is fairly well understood, of immediate interest is to find out what happens in the BEC-BCS crossover regime. However, determining the relative contributions of atom pairing mechanisms is an experimental and theoretical challenge.

Partridge *et al.* use a molecular spectroscopy technique to probe how the atoms pair up near the resonance. A laser is used to dress pairs of atoms and project them onto a known molecular energy level. Locking the excitation rate onto the molecular level allows them to make a precise measurement of the contribution of each pairing mechanism. The technique should prove useful for closer studies of the many-body physics involved in these cold atom systems. — ISO

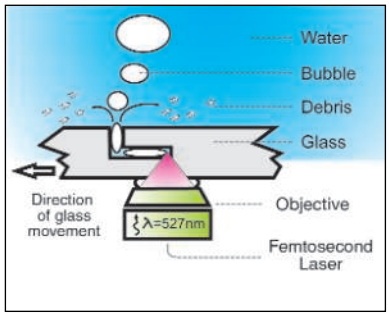
Phys. Rev. Lett. **95**, 020404 (2005).

CHEMISTRY

A Bit of Bubbly

The popularity of the rapidly advancing field of microfluidics is due in part to the simplicity of making parts from polymers through etching or patterning methods. Some of the limitations of the commonly used polydimethylsiloxane are solvent swelling, protein adsorption, leaching, and the inability to contain high pressures. Silica glass is often the best material for vessels for analytical and synthetic chemistry, but patterning glass at submicrometer dimensions is a challenge.

Ke *et al.* show that by using low-energy laser pulses, and by immersing the glass in a liquid, they can fabricate small channels in three dimensions. The laser is focused to a spot at the liquid/glass interface, so that a pulse both forms a hole in the glass and causes the liquid to expand as a bubble that pushes away the debris. Because the pulses are of low energy, the bubbles expand slowly and persist for much longer times than those associated with supersonic bubble collapse. The authors fabricated a number of architectures and channel designs, including a crisscross design that enhances the mixing of the fluids. — MSL



Schematic of the fabrication setup.

Anal. Chem. 10.1021/ac0505167 (2005).

BIOCHEMISTRY

An On-Off Cycle

The mechanisms by which the activities of regulatory enzymes are themselves regulated range from tight-binding inhibitors to covalent modification. Sivaramakrishnan *et al.* have used a small molecule model in order to explore the chemical feasibility of regulating protein tyrosine phosphatase 1B (PTP1B) by reversible oxidation of its catalytic sulfhydryl. Structural analysis of inhibited PTP1B revealed the presence of a 3-isothiazolidinone adduct, in which the side chain of the active site cysteine had become covalently linked to the amide nitrogen of the next residue. Using a benzene scaffold to juxtapose a β-sulfinyl propionic acid ester and a monosubstituted amide nitrogen, they find that the in situ–generated sulfenic acid (RS-OH) is sufficiently reactive for the heterocycle to form under mild conditions (pH 7.5 and 37°C). In terms of how the corresponding biochemistry occurs, hydrogen peroxide oxidizes the sulfhydryl to the sulfenic acid, and glutathione opens the ring, forming a mixed disulfide that regenerates the free sulfhydryl. These reactions together would then serve as a redox cycle, switching phosphatase activity on and off. — GJC

J. Am. Chem. Soc. 10.1021/ja052599e (2005).

IMMUNOLOGY

Sweet Relations

Although bacteria are often thought of as harmful, it is now recognized that the many bacteria species harbored by our intestines are essential for our well-being. Aside from their roles in eliminating toxins and extracting nutrients, there is much interest in understanding

CONTINUED ON PAGE 673

Published by AAAS

how the gut microflora might influence the development and function of our immune systems.

Building on previous work in which bacterial zwitterionic polysaccharides were shown to be presented as antigens in the activation of T cells, Mazmanian *et al.* observe that at least one such sugar—polysaccharide A (PSA)—can direct normal immune system development in the mouse. Reconstitution of germ-free mice with the bacterial commensal *Bacteroides fragilis* expanded T cell numbers and restored lymphoid structures that would otherwise have developed abnormally. Expression of PSA was sufficient and necessary for this activity and also reestablished balance in T helper 1 (T_H1) and T_H2 cell cytokine responses, through presentation of PSA by dendritic cells. The finding that a bacterial product can implement such direct governance over the mammalian immune system may explain how our microflora help maintain pathogen immunity while preventing unwanted inflammation and allergy. — SJS

Cell **122**, 107 (2005).

PSYCHOLOGY

On Being a Team Player

Participating in team sports, such as baseball, can bring into play an individual's competitive tendencies (vying for a starting position) even though cooperation, as in the execution of fundamental skills such as hitting behind the runner, may be needed for success at the highest level. Historically, statistical assessment has contrasted the relative achievements of players, particularly during contract negotiations, but recent analyses have used sophisticated approaches to quantify less tangible player contributions to team success, such as moving a runner into scoring position.

Stapel and Koomen have examined the influence of personal orientation (toward cooperation or competition) on an individual's evalution of self in relation to a target. They find that a cooperative mindset yielded an enhancement of one's self-evaluation relative to a high-achieving target—referred to as assimilation—whereas the same target attributes pushed downward the self-ratings of competitive subjects. Framing the target within a cooperative or competitive context either by manipulating the scenario explicitly or by activating goals implicitly were equally effective in influencing how subjects adjusted their self-appraisals upward or downward. Finally, these positive/negative shifts also applied to comparisons in which the same pair of photographs was labeled as more or less similar depending on whether the situation was deemed to be cooperative or competitive. — GJC

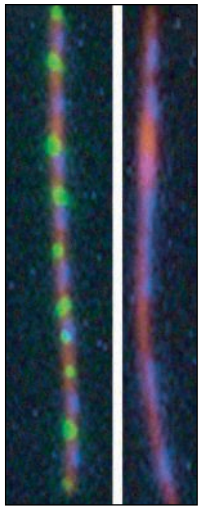
J. Pers. Soc. Psychol. **88**, 1029 (2005).

CELL BIOLOGY

Pole to Pole

Bacillus subtilis is a rod-shaped bacterium that is competent to bind, internalize, and eventually incorporate DNA in a process known as transformation. Hahn *et al.* describe the localization of three competence-mediating proteins and find that they are preferentially associated with the poles of the cells in a dynamic fashion. Using laser tweezers to manipulate single fluorescent DNA molecules, they observed that DNA binding and uptake occurs preferentially at the poles, too.

Kidane and Graumann also examine protein and DNA dynamics in *B. subtilis*. They find that the DNA recombination enzyme RecA colocalizes at the cell poles with one of the competence proteins, and during DNA uptake formed into threads. In comparison, another DNA recombination protein, RecN, was observed to oscillate from pole to pole on the scale of minutes; however, when DNA was added, RecN arrested at the same end where competence proteins were located, due to direct interaction with incoming DNA. The dynamic assembly and disassembly of the competence machinery are likely to govern exactly how transformable particular bacteria may be at a given time. — SMH



Filaments of *B. subtilis* (red) expressing (left) or not expressing (right) competence proteins (green) localized between nucleoids (blue).

CREDITS: HAHN *ET AL.*, *CELL* **122**, 59 (2005)

Cell **122**, 59; 73 (2005).