EDITORS' CHOICE

edited by Gilbert Chin

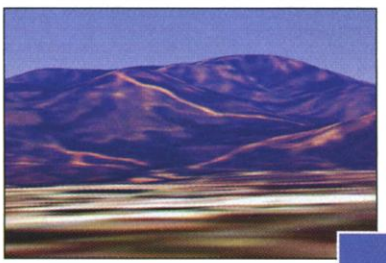
POLYMER TECHNOLOGY

Disintegrating Drug Deliverers

A biological cell uses a set of messengers, such as cyclic AMP, in order to transmit the detection of changes in its environment (registered at the cell surface) to intracellular compartments. One key participant is the cyclic AMP–dependent protein kinase (PKA), which phosphorylates residues on target proteins, causing changes in conformation and function.

Katayama *et al.* have developed a model system by taking a PKA substrate peptide and grafting it to a temperature-responsive polymer chain. When phosphorylated, the upper solubility temperature of the graft copolymer increases from 33°C to above 37°C, which is nominal body temperature. A third unit, when incorporated into the unphosphorylated copolymer, caused it to form micellar particles, which disintegrated on treatment with PKA. When these micelles were preloaded with a fluorescent dye and then incubated with PKA, a gradual release of the fluorescent molecules was observed. The authors envision that swapping the PKA-responsive peptide for one recognized by aberrantly expressed kinases may yield targeted drug delivery vehicles that would deliver their contents only to dysfunctional cells. — MSL

Macromolecules, 10.1021/ma010966a.



Three images of the San Gabriel Mountains (clear day, top; summer day, bottom; with emission controls, right) from a distance of 7 kilometers.

ENVIRONMENTAL SCIENCE

Toward a Clear Day

On winter mornings in downtown Los Angeles it may be possible to see nearby snow-capped mountains—if there is little smog. In summer, a view of the mountains is even rarer. Reduced visibility is a common and convenient measure of air pollution, and the one used most often by locals. Because there are numerous sources of pollutants in a large city, it can be difficult to assess specific control efforts or to determine how best to combine them to minimize economic costs. Kleeman *et al.* use visibility as a measure of smog in a model of air pollution in Los Angeles to compare control efforts with respect to specific emission sources. An aggressive program of diverse emission controls could double visibility in Los Angeles and provide more frequent views of the surrounding peaks. — BH

Environ. Sci. Technol., 10.1021/es001865f.

CLIMATOLOGY

The Southern Influence

Changes in oceanic thermohaline circulation, triggered by variations in the flux of glacial melt water to the North Atlantic Ocean that affect the formation rate of North Atlantic Deep Water, can produce rapid dramatic changes in climate. Deep water does not originate exclusively in the North Atlantic, however; it also is made around the edges of Antarctica, where it is referred to as Antarctic Bottom Water. Although most of the attention given to the question of how the modification of sea surface salinity by the addition of glacial melt waters affects thermohaline circulation is still directed at Northern Hemisphere deepwater formation sites, the role of the Southern Ocean is now being investigated more vigorously.

Seidov *et al.* use an ocean circulation model to examine the character of deepwater formation as a function of systematic changes in freshwater fluxes in both the Northern and Southern Hemispheres. They find that thermohaline circulation is driven by both deepwater sources and that the Southern Ocean can overpower the North Atlantic and become a major factor in long-term climate change, illustrating the importance of high-latitude freshwater fluxes in governing climate. — HJS

Global Planet. Change **30**, 257 (2001).

ECOLOGY/EVOLUTION

Not Anthropogenic

In 1983, the coral reefs of the Caribbean underwent a dramatic ecological change. Populations of a hitherto abundant sea urchin, *Diadema antillarum*, the most important herbivore in this system, plummeted to less than 3% of their former level. Despite limited recovery in some areas, *Diadema* numbers have remained low, permitting increased algal growth at the expense of coral, which may hasten the degradation of Caribbean reefs.

Since the mass mortality, there has been controversy as to whether *Diadema* owed its former abundance to human activities (for example, depletion of the urchin's predators by fishing) or whether it was abundant before humans inhabited the Caribbean. Lessios *et al.* use mitochondrial DNA sequences to trace the history of *Diadema* populations, and find that the species has had large population sizes for at least the past 100 millennia, demonstrating that humans probably were not responsible for the pre-crash population levels. This result is relevant to discussions of restoration and management of degraded reefs in the Caribbean. — AMS

Proc. R. Soc. London Ser. B **268**, 2347 (2001).

CHEMISTRY

Just Add Water

Polymer syntheses that can be performed in environmentally friendly aqueous media are of

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SOURCE: (TOP) KLEEMAN *ET AL., ENVIRON. SCI. TECHNOL.*, 10.1021/ES001865F; (BOTTOM) NOAA

current interest. Aqueous emulsion polymerization already is used in industry to make coatings and dyestuffs. It would be desirable to extend such methods to metallocene catalysts, which offer a high degree of structural control in the polymerization of olefins, but metallocene complexes are very electrophilic and have to be handled in strictly water-free environments.

Manders *et al.* now demonstrate that titanium metallocenes can be used in the emulsion polymerization of styrene. In their system, the catalyst is encapsulated, and thus shielded from water, during a prepolymerization step. It remains sufficiently accessible to the styrene monomers so that the bulk of the polymer is produced within the emulsified droplet. — JU

Angew. Chem. Int. Ed. **40**, 4006 (2001).

MICROBIOLOGY

Death and Destruction

Staphylococcus aureus is a common cause of sepsis and toxic shock. These processes can result in tissue damage and cell death, presumably by necrosis or apoptosis. Bantel *et al.* now show that in cultures of Jurkat T cells, apoptosis can be induced not only by infection with *S. aureus* itself but also by *S. aureus* culture supernatants. The active ingredient in these supernatants was one of the secreted toxins, α-toxin. Death was not induced when *S. aureus* strains lacking the toxin were used nor when antibodies that could bind α-toxin were added. The mechanism of apoptosis induction appears to be via the intrinsic death pathway leading directly to cytochrome c release from mitochondria, rather than via death receptors. Given the increasing incidence of antibiotic resistance in *S. aureus* strains, these findings provide potential leads for therapeutic intervention during staph infections. — SMH

J. Cell Biol. **155**, 637 (2001).

BIOCHEMISTRY

Reducing Difficulties

A major consideration in designing an organic synthesis is the selective activation of a center that enables a new bond to be made or an existing bond to be broken. For instance, protons bound to a carbon that is adjacent to a carbonyl are more readily abstracted than alkyl protons. The synthetic chemist is able to bring to bear a sophisticated armamentarium of reagents and catalysts in addition to the capability of manipulating the solvent and environmental conditions. In contrast, microbes rely on enzymes that, in most cases, operate at ambient temperatures and pressures in aqueous solution at physiological pH.

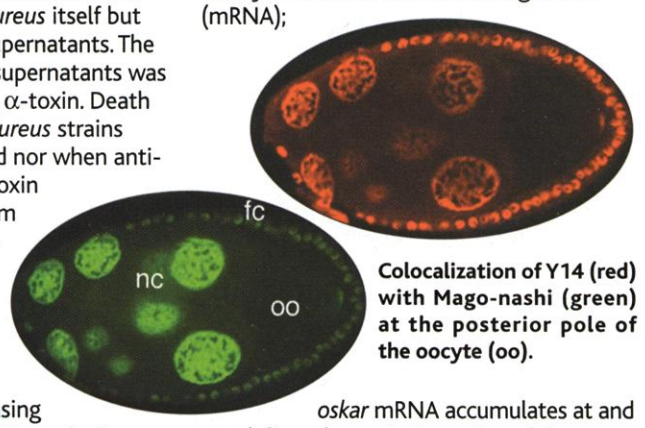
In one such case, the energetically difficult reduction (dearomatization) of benzoyl-CoA is achieved by using the stoichiometric hydrolysis of ATP to drive the addition of two electrons to the aromatic ring, in a fashion that is somewhat similar to the even more difficult reduction of dinitrogen that is catalyzed by nitrogenase. Unciuleac and Boll present biochemical evidence for the formation of a phosphorylated intermediate of benzoyl-CoA reductase. They suggest that the energy of the phosphoanhydride bond is used to activate an electron in the guise of converting one of the intrinsic [4Fe-4S] clusters into a high-spin state that then initiates the reduction of the substrate. — GJC

Proc. Natl. Acad. Sci. U.S.A., 10.1073/pnas.241375598.

MOLECULAR BIOLOGY

A Posterior Bar Code

One of the primary codes by which spatial information is specified in the *Drosophila* embryo is localization of messenger RNA (mRNA);



Colocalization of Y14 (red) with Mago-nashi (green) at the posterior pole of the oocyte (oo).

oskar mRNA accumulates at and defines the posterior region of the embryo. Several proteins have been shown to be required for *oskar* mRNA localization. Hachet and Ephrussi identify another such protein, the *Drosophila* homolog of human Y14, and show that neither *oskar* mRNA nor the associated RNA-binding protein Staufen is correctly located in *y14* mutants.

Why is this of interest? Other work has established that Y14 serves as a marker, deposited on mRNAs at exon-exon junctions after the introns have been removed by splicing. Thus, this marker is recognized by components of the macromolecular assemblies that mediate nuclear export of mRNAs; nonsense-mediated decay of defective mRNAs; and, as these results suggest, cytoplasmic localization of messages. — GJC

Curr. Biol. **11**, 1666 (2001).

CREDITS: HATCHET AND EPHRUSSI, *CURR. BIOL.* **11**, 1666 (2001)