

edited by Stella Hurlley

## CLIMATE

## Pushing and Pulling

The global average surface temperature increased by approximately 0.4°C between 1960 and 1990, even though incident shortwave radiation (sunlight) at land surfaces decreased significantly over the same period. This apparently contradictory pair of observations requires either an increase in the downward longwave radiation (heat) that outweighs the decrease in shortwave radiation, or a decrease in surface cooling due to reduced surface evaporation. Wild *et al.* used a global climate model to calculate how much downward longwave radiation may have changed but could explain a third or less of what is needed to account for the upward temperature trend. The authors suggest instead that reduced evaporative cooling at the land surface is responsible for the divergence of the trends in surface radiative heating and temperature. Recent independent reports also show that the rate of pan evaporation (how fast water evaporates from an open container or body) has decreased during that time. Thus, increased advection of moist air from ocean to land areas may explain the apparent contradiction. — HJS

*Geophys. Res. Lett.* 31, L11201 (2004).

## IMMUNOLOGY

## Sweet Presentation

During an immune response, CD4<sup>+</sup> T cells are activated by peptides derived from endocytosed and processed proteins, which bind class II molecules of the major histocompatibility complex (MHC) and eventually traffic to the cell surface. Although this process has been assumed to operate exclusively on protein anti-

## ECOLOGY/EVOLUTION

## Long Live the Queen's Eggs

In many social insects, workers as well as queens are capable of producing eggs. In honeybees, worker-laid eggs, all of which are parthenogenetic males, are usually removed from the nest by other workers. This behavior, known as worker policing, has become a well-known example of kin selection: Workers would tend to be more closely related to the queen's sons than to the sons of other workers, and hence policing would be adaptive. This conclusion had been supported by *in vitro* studies indicating that the viabilities of worker- and queen-produced eggs were similar. However, Pirk *et al.* have found that worker-produced eggs have lower viability under natural conditions in the nest. Thus, a more parsimonious explanation for worker policing could be that the workers are simply discriminating between live and dead eggs. — AMS

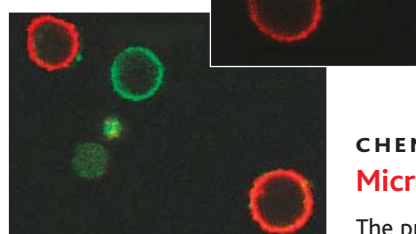
*Proc. Natl. Acad. Sci. U.S.A.* 101, 8649 (2004).



Worker tends egg.

gens, some evidence has suggested that specific types of bacterial repeating carbohydrate motifs might also undergo intracellular processing to activate T cells.

Using confocal microscopy, Cobb *et al.* followed zwitterion polysaccharides (ZPS) as



APC (red) and T cell (green) before (left) and after (right) forming immunological synapse (yellow).

they colocalized with MHC class II in the endocytic pathway after uptake by antigen-presenting cells (APCs). First ZPS was partially degraded by the action of nitric oxide, generated during the oxidative burst of the cell, leading to the presence of reduced-molecular-weight fragments within the endosome. Fusion with MHC class II-containing endocytic vesicles then allowed for presentation of ZPS

fragments to T cells and the formation of immune synapses between the ZPS-presenting APCs and the responding T cells. The processing of specific carbohydrates by APCs, and the fact that this shares much of the pathway used for conventional peptide presentation, could have important implications for T cell immunity and vaccine design. — SJS

*Cell* 117, 677 (2004).

## CHEMISTRY

## Microgel Reactors

The procedures for synthesizing nanoparticles of metals, semiconductors, or magnetic materials are often very material-specific. Current methods aimed at loading nanoparticles into the interior of microspheres either lead to low loading concentrations or alter the properties of the nanoparticles. By using the spherical container as the synthesis template, Zhang *et al.* show that they can successfully load microspheres and also synthesize a wide range of inorganic nanoparticles, while achieving narrow size distributions. Polymer microgels of highly cross-linked

polymer chains with diameters between 200 and 600 nm were produced. Then ion exchange reactions were used to dope the microgels with metal particles, which could then be oxidized, reduced, or exposed to a counterion to form nanoparticles of the desired type. Tuning the level of metal ion, and controlling the size and void structure of the microgel particles through variations in temperature and acidity, controlled particle size and distribution. Heat treatment of the microgels doped with semiconducting nanoparticles reduced the polydispersity of the particle sizes and allowed for tuning of the photoluminescence spectra. — MSL

*J. Am. Chem. Soc.* 10.1021/ja031523k (2004).

## BIOMEDICINE

## LARGE Role in Muscle Health

Muscular dystrophy (MD) encompasses more than 30 distinct inherited disorders, all characterized by progressive muscle wasting. As new causative genes are identified, researchers continue to refine their mechanistic models of

CONTINUED ON PAGE 1721

how MD arises. Several congenital forms of MD are caused by defects in genes encoding putative glycosyltransferases (enzymes that add sugar chains to proteins), and a key muscle protein called  $\Delta$ -dystroglycan ( $\Delta$ -DG), is hypoglycosylated in these disorders. One of these glycosyltransferases implicated in MD, LARGE, is the subject of two new studies. Barresi *et al.* find that overexpression of LARGE restores  $\Delta$ -DG function in cells from patients with genetically distinct forms of congenital MD and prevents muscle degeneration in a mouse model. Kanagawa *et al.* reveal that  $\Delta$ -DG glycosylation is LARGE-dependent and that disruption of the interaction between the two proteins leads to loss of  $\Delta$ -DG function, ultimately causing muscle cell death. These results suggest that enhancement of LARGE activity may be a useful therapeutic approach for certain forms of MD. — PAK

*Nature Med.* 10.1038/nm1059 (2004);  
*Cell* 10.1016/S0092867404005434 (2004).

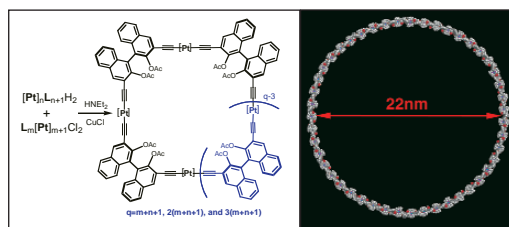
## CHEMISTRY

### Mesoscale Metallo-cycles

Entropy causes the formation of large metallo-cycles, in which alternating metal centers and bridging ligands form a ring structure, to become more difficult as the rings become larger. Metallo-cycles are typically limited to triangular or

square topologies. Jiang and Lin have reported on a synthetic method that yields larger rings, up to octomers. They now report on an alternative approach that reduces the entropic penalty by starting with longer oligomers that can fuse into chiral metallo-cyclic rings of up to 47 units (or a diameter of 22 nm).

The ligand L that they use is 2,2'-deacetoxy-1,1'-binaphthyl-3,3'-bis(ethyne). Longer oligomers were made by reacting  $L[Pt]_2Cl_2$ , where [Pt] is



Synthesis scheme and the 47-unit metallo-cyclic.

*trans*-Pt(P(CH<sub>2</sub>CH<sub>3</sub>)<sub>3</sub>)<sub>2</sub>, with L-H<sub>2</sub>. Reaction of metal-terminated  $L_m[Pt]_{m+1}Cl_2$  species with the ligand-terminated  $[Pt]_nL_{n+1}H_2$  species afforded cyclic species in [1+1], [2+2], or even [3+3] cyclization processes. These compounds were characterized by a variety of methods, including mass spectrometry and circular dichroism spectroscopy. Size-exclusion chromatography indicates that metallo-cycles are more compact and rigid than linear oligomers with the same number of units. — PDS

*J Am. Chem. Soc.* 125, 8084 (2003).

## HIGHLIGHTED IN SCIENCE'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT



### When a Tug Is As Good As a Ligand

Mechanical stress on the heart due to increased blood pressure leads to hypertrophy of heart cells and increases the risk of heart failure. The effects of mechanical stress are mediated, at least in part, by angiotensin II type 1 (AT1) receptors. Pharmacological blockade of such receptors can limit cardiac hypertrophy and subsequent heart failure. To explore how AT1 receptors actually sense mechanical stress, Zou *et al.* studied cells cultured on silicone-based dishes that could be stretched to apply mechanical stress to the cells. Mechanical stretching caused activation of the mitogen-activated protein kinases ERK1 and ERK2 only if the cells were first transfected with the AT1 receptor. This receptor activation appeared not to result from secretion of angiotensin II (All) as previously proposed, and was observed even in cells expressing a mutant receptor with an altered binding site that could not bind All. In *ATG<sup>-/-</sup>* mice, which don't make All, mechanical stress still caused hypertrophy *in vivo*, supporting a biologically relevant role for the mechanical stress-induced, ligand-independent regulation of the AT1 receptor. It now remains to be seen whether the receptor itself is the sensor, being physically stretched into an active conformation, or whether some other associated molecule might provide an activating signal. — LBR

*Nature Cell Biol.* 6, 499 (2004).

# Science

## Sweet Presentation

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