EDITORS' CHOICE

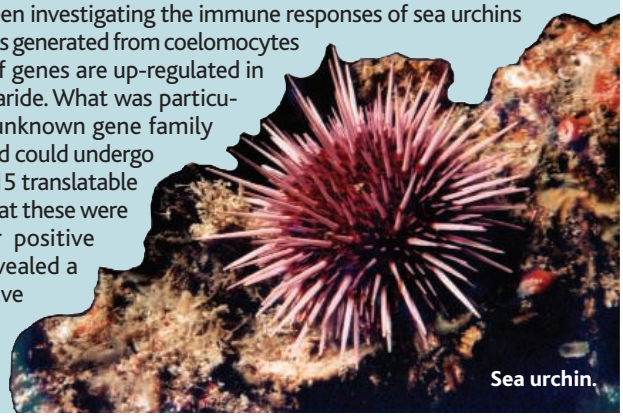
edited by Stella Hurtley

IMMUNOLOGY

Not So Spineless

Sea urchins are sophisticated invertebrates whose biology holds many clues to the evolution of the vertebrates. These organisms very effectively remove any invading bacterial pathogens and other foreign material from within their coeloms by means of a range of macrophage-like cells. It seems that sea urchins have a simplified version of the complement system that can mediate opsonization of pathogens. Nair *et al.* have been investigating the immune responses of sea urchins by analysis of expressed sequence tags generated from coelomocytes and discovered that a wide range of genes are up-regulated in response to bacterial lipopolysaccharide. What was particularly interesting was a previously unknown gene family that represented 60% of the ESTs and could undergo alternative splicing to yield around 15 translatable elements. The evidence suggested that these were immune response proteins under positive selection for diversification, and revealed a greater level of complexity of putative responses than anticipated for an invertebrate group. — CA

Physiol. Genomics **22**, 33 (2005)



Sea urchin.

CHEMISTRY

A Well-Fitted Coating

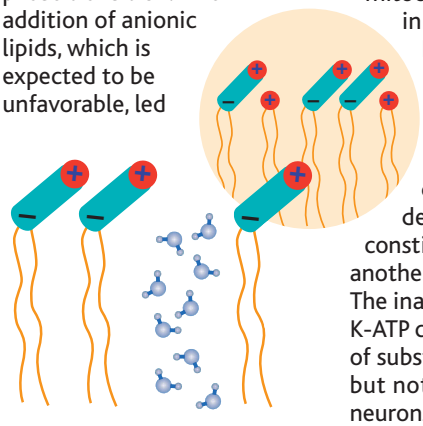
Most heterogenous metal catalysts consist of metal nanoparticles on a ceramic oxide support, but for systems that exhibit strong metal-support interactions (such as noble metals with cerium oxide), the maximum interaction might involve completely coating a metal nanoparticle with oxide. Yeung *et al.* have used a modified microencapsulation method, previously demonstrated for silica, for encapsulating platinum nanoparticles with ceria. Increasing the Pt loading from 1 to 5% created particles with larger Pt cores and thinner coatings of ceria. The thinnest coating (1.7 nm) increased the band transition for ceria from 3.18 to 3.33 electron volts, and increased the water-gas shift (WGS) activity ($H_2O + CO \rightarrow H_2 + CO_2$) from negligible CO conversion for pure ceria to 63%. Unlike most other noble metal–ceria catalysts, these nanoparticles, which expose few noble metal sites, exhibit no activity for the competing reactions of methanation and higher hydrocarbon formation. — PDS

J. Am. Chem. Soc. 10.1021/ja056102c (2005).

MATERIALS SCIENCE

Electrostatic Stitching

Supported lipid bilayers are often used as model systems for studying surface phenomena because of their well-defined planar geometry. One interesting phenomenon relates to the "fluid-to-gel" phase transition that occurs when the mobile liquid-crystalline ordering crystallizes as the temperature is lowered. However, it is difficult to study this phase transition in simple single-component bilayers, such as those composed of zwitterionic phospholipids, because of a high density of defects that form in the gel phase. The defects are most likely caused by shrinkage of the area occupied by a lipid molecule as the tilt angle of the headgroup changes on cooling. Zhang *et al.* tested this hypothesis by studying the effects of adding cationic or anionic lipids to a bilayer composed of a zwitterionic phosphatidylcholine. With the addition of the cationic lipid, defects no longer formed on gelation. Measurements of the headgroup orientation showed that the cationic lipid increased the tilt angle in the fluid phase, but that it no longer changed on cooling. The cationic lipid is expected to be well dispersed because of electrostatic repulsions, and they may act to stitch together the bilayer, thus giving it stability through the phase transition. The addition of anionic lipids, which is expected to be unfavorable, led to defects in the gel phase, supporting the stitching hypothesis. — MSL



Schematics of gel-phase morphologies without (main) and with (inset) cationic lipid.

J. Phys. Chem. B, 10.1021/jp055995s (2005).

NEUROSCIENCE

Parkinson's and Potassium Channels

Parkinson's disease (PD) results from the selective loss of dopaminergic neurons in the substantia nigra of the brain. However, dopaminergic neurons in nearby parts of the brain are not affected, even though the genes implicated in familial inherited PD, as well as toxins that can induce symptoms of PD, are not restricted in their effects. Why then is this small region targeted for destruction in PD? There are hints that substantia nigra neurons show disruptions in mitochondrial respiratory function. Diminished cellular metabolism, as well as oxidative stress, can in turn cause the potassium (K)–ATP channels of dopaminergic neurons to open. Liss *et al.* investigated the interaction between these channels, the signals that control their function, and the degeneration of neurons. The K-ATP channel mediates dopaminergic neuron degeneration in response to mitochondrial complex 1 inhibition, in response to PD-inducing treatment of susceptible mice, and also in the mutant *weaver* mouse, in which dopaminergic neuron degeneration is due to constitutive activation of another potassium channel. The inappropriate function of K-ATP channels is characteristic of substantia nigra neurons, but not of dopaminergic neurons in other nearby brain areas, in which the channels

CONTINUED ON PAGE 1873

CREDITS: (TOP) SUSAN FUHS/CONUNDRUM CONSULTING; (BOTTOM) ZHANG *ET AL.*, *J. PHYS. CHEM. B*, 10.1021/JP055995S (2005)

Published by AAAS

seem to be connected to cellular metabolism through different signaling networks. — PJH

Nat. Neuro **8**, 1742 (2005).

ASTRONOMY

Kuiper Belt Curiosity

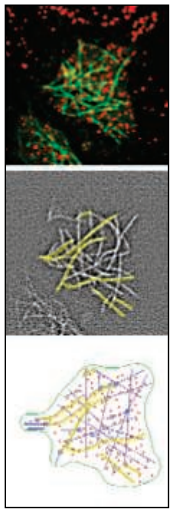
Pluto is only one of several large bodies in the outer solar system's Kuiper belt. Brown *et al.* describe the discovery of the largest object in orbit beyond Neptune, 2003 UB313, whose brightness suggests that it exceeds the size of Pluto. By tracing the object's motion in archival images, they show that it follows a highly eccentric orbit inclined 44° from the ecliptic plane, which contains most of the objects that are orbiting the Sun. Such an extreme orbit may have arisen if the body formed closer to the Sun and was scattered outward by gravitational interactions. Frozen methane is detected on the surface in infrared spectra, with characteristics very similar to Pluto. However, 2003 UB313 is not as red as Pluto, suggesting that the distribution of methane and other hydrocarbons on its surface is different and may even change with temperature as it swings closer to the Sun. — JB

Astrophys. J. **635**, L97 (2005).

CELL BIOLOGY

Organization Without an Organizer

Within cells, the tracks provided by microtubules are important for a whole variety of cellular processes, not least when microtubules form into a spindle in order to promote the separation of chromosomes during mitosis. Such microtubule arrays are arranged around organizing centers known as the centrosomes. However, within the cell there also exist well-organized arrays of microtubules that form without the aid of centrosomes. Reilein *et al.* describe the organizing principles involved in producing acentrosomal microtubule networks found in the basal cortex of epithelial cells. Microtubules are formed from tubulin monomers, and microtubule networks in a steady state contain growing and shrinking microtubules. Typically, in order to grow, microtubules need to be anchored somehow. By imaging microtubule dynamics in cytoplasts derived from the base of epithelial cells, the authors showed that networks of microtubules form based on microtubule-microtubule interactions and microtubule-cortex interactions. Each type of interaction increased microtubule stability. By modeling the parameters involved, in particular by including stabilizing interactions, the authors could replicate in silico the type of stable arrays observed within cells. — SMH



Microtubule networks (green, top) forming over 20 min. in situ (top and middle) and in silico (bottom); original microtubules are yellow (middle and bottom).

CREDIT: REILEIN *ET AL.*, *J. CELL BIOL.* **171**, 845 (2005)

J. Cell Biol. **171**, 845 (2005).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

Science's STKE www.stke.org

β-Arrestin Regulates Notch Abundance

β-Arrestin, well known for its role in G protein–coupled receptor regulation, is also being recognized for its roles in regulating other types of receptors. Mukherjee *et al.* report that *Drosophila* β-arrestin, Kurtz (Krz), is involved in controlling the abundance of the receptor Notch. Notch is a single transmembrane receptor that is cleaved in response to ligand binding, releasing a fragment that translocates to the nucleus to regulate transcription. Krz was found in two different screens for proteins that interacted with the Notch regulator and with putative E3 ubiquitin ligase Deltex (Dx). In flies, loss of Krz function led to increased Notch abundance. Overexpression of both Krz and Dx produced Notch loss-of-function phenotypes and reduced Notch protein abundance. In transfected *Drosophila* S2 cells, Krz and Dx together promoted ubiquitination of Notch. Notch signaling is highly sensitive to gene dosage effects, and β-arrestin appears to be one component that contributes to this sensitivity. — NG

Nat. Cell Biol. **7**, 1191 (2005).

Big online news from *Science*

New website – retooled and redesigned.

The new online version of *Science* is here! Packed with useful features, it gives you easy access to a world of scientific knowledge.
Visit www.sciencemag.org.

Science
AAAS