# EDITORS' CHOICE

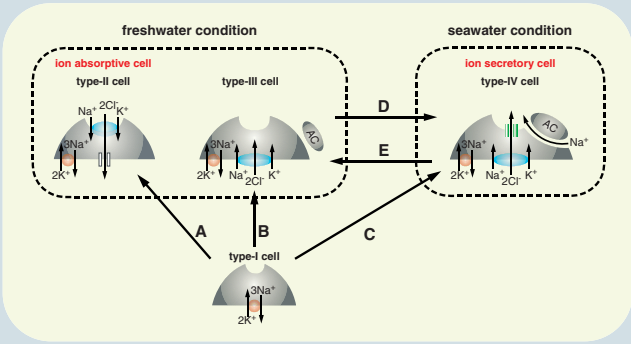
edited by Gilbert Chin

PHYSIOLOGY

## Regulating Salt Intake

Euryhaline fish, such as Mozambique tilapia (*Oreochromis mossambicus*), are able to live in waters with a wide range of salinity. Mitochondrion-rich cells (MRCs, also known as ionocytes) are located in the gills of adult fish and are thought to regulate internal ionic composition, either by secreting excess salt in a seawater environment or by taking up needed ions during a freshwater stage of life.

Hiroi *et al.* have examined the adaptive deployment of ion transporters in MRCs, which are found in the yolk sac membrane in developing embryos, by transferring the embryos from fresh water to salt water or vice versa. The three primary molecular components are a Na/K-ATPase, a Na/K/2Cl cotransporter, and a chloride channel, and the authors used immunoflurorescence microscopy to group the MRCs into four types: (i) an immature type-I MRC that can give rise to any of the other three types; (ii) a salt-accumulating type-II cell for freshwater living; (iii) a dormant type-III cell held in reserve; and (iv) a seawater, salt-extrusion type-IV cell derived from and apparently convertible back into type-III cells. The remarkable changeover from absorption to secretion (fresh water to sea water) is achieved by moving the Na/K/2Cl cotransporter from the apical to the basolateral surface and by replacing it with the chloride channel. — GJC




**Locations in the four types of MRCs of Na/K-ATPase (red), Na/K/2Cl cotransporter (blue), and chloride channel (green).**

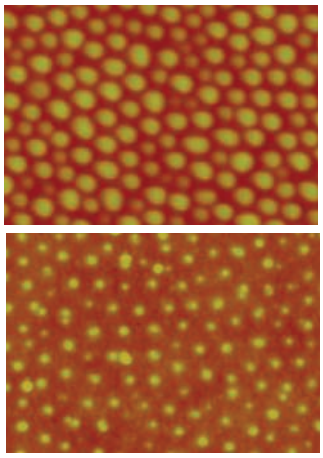
*J. Exp. Biol.* **208**, 2023 (2005).

CHEMISTRY

## Scattershot Patterning

Although many methods exist for the patterning of semiconductor surfaces, for large-scale fabrication, a system that can self-assemble would be ideal. Recent work has shown that block copolymers are compatible with industrial silicon-based processing, thus these materials are attracting renewed interest.

Aizawa and Buriak have devised two methods to use block copolymers to direct reactions at semiconductor surfaces in a spatially defined manner. In the first approach, block copolymer micelles are loaded with reagents that react with the semiconductor surface on deposition. In the second, they can deposit a monolayer of self-assembling block copolymers onto a substrate, which is then immersed in the reactive reagent. This variation has the advantage of not limiting the reagent concentration to that available in the loaded micelles. The reactions studied were based on the galvanic reduction of oxidizing metal ions, which can bond to the substrates as particles, films, or other morphologies. The diblock copolymer consisted of polystyrene joined to poly-4-vinylpyridine (P4VP); the latter material is known to associate with metal ions or complexes. Thus, by controlling the location of the P4VP blocks, one can control the size and spacing of the metal particles. — MSL



**Deposited copolymer micelles (top) and the resultant pattern of Ag nanoparticles (bottom).**

*J. Am. Chem. Soc.* 10.1021/ja052281m (2005).

BIOMEDICINE

## Cultured Cancer Killers

Adoptive cell transfer represents a highly promising therapy for treating some forms of cancer. Isolated antitumor T cells are stimulated and expanded in culture before they are transferred back into the patient. Although this approach has yielded encouraging success in treating malignant melanoma, there is room for improvement.

Using a mouse tumor model, Gattinoni *et al.* observed that the duration of stimulation of antitumor T cells in culture had a negative impact on their subsequent ability to kill tumors in vivo. As expected, T cells that had undergone successive rounds of stimulation in vitro did acquire the capacity to kill tumor cell lines when tested in vitro, indicative of a persistently robust cytotoxic activity. However, the acquisition of an activated phenotype—including changes in the pattern of lymph node–homing receptors and responsiveness to the T cell growth factor interleukin-2—was accompanied by a reduced ability to replicate and to eradicate tumors upon subsequent transfer into mice. These results highlight important parameters to consider, as efforts to select and generate effective antitumor T cells for adoptive cellular immunotherapy are refined. — SJS

*J. Clin. Invest.* **115**, 1616 (2005).

GEOLOGY

## Coastal Ups and Downs

A subduction zone extending along the northwest margin of North America, from northern California up to the Aleutians, is capable of generating giant earthquakes and tsunamis. One means for assessing the current hazard is to reconstruct records of past major tremblors. From a coastal lake in Oregon, Kelsey *et al.* have obtained a detailed and well-dated history of tsunamis stretching back 7000 years. The lake sediments reveal the periodic input of beach sand and saline water, which likely was associated with tsunami incursions. Tsunami-generating earthquakes clustered, with

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three to four occurring every 1000 years, and clusters were separated by earthquake-free periods lasting about 1000 years; the most recent large event, in 1700, followed a 700-year quiescent span.

Separately, Hawkes *et al.* show that noticeable changes in the foraminifera and diatom populations in tidal marshes near two recent large earthquakes along the Alaskan and Oregon coasts may reveal subtle subsidence that began several months before the earthquakes. Additional verification of this provocative signal is needed, including whether such changes are connected to recently recognized aseismic slip along these subduction zones. — BH

*Geol. Soc. Am. Bull.* **117**, 1009; 996 (2005).

CHEMISTRY

## Gaseous Dihydrides

The reduction of solutions of zinc, cadmium, and mercury ions generates gas-phase compounds that likely are the dihydrides of these metals, but the identity of these gas-phase products has been uncertain, and the solid forms of these compounds decompose back to the elements rather than vaporize. Shayesteh *et al.* synthesized the dihydrides of Hg, Cd, and Zn by the direct reaction of excited-state atoms with $H_2$ and were able to characterize the products through analysis of their infrared emission. The short bond lengths obtained by fitting the rotational-vibrational spectra indicate that the dihydrides are more stable than the monohydride radicals. The authors note that, given the production of other hydrides, such as $SnH_4$ and $AsH_3$, by anaerobic bacteria, these species might be produced naturally as well. — PDS

*Chem. Eur. J.* 10.1002/chem.200500332 (2005).

CELL BIOLOGY

## Perfect Peroxisome Partitioning

During successful cell division, mother and daughter cells arrive at an equitable allocation of each type of membrane-bounded organelle. Molecular mechanisms that guarantee faithful organelle partitioning in budding yeast involve the polarized actin cytoskeleton and myosin-related motors and are well established for mitochondria, the vacuole, secretory vesicles, and the endoplasmic reticulum. However, peroxisomes are low-copy-number organelles involved in lipid metabolism whose inheritance has been less well characterized.

Fagarasanu *et al.* examined the role of a peripheral peroxisomal membrane protein, Inp1p (for inheritance of peroxisomes protein 1). In budding yeast, overexpression of Inp1 led to the failure of efficient peroxisome delivery to the bud, whereas deletion of the *INP1* gene often left the mother cell without any peroxisomes. It appears that Inp1p helps to anchor peroxisomes within cells, and having the right amount of it is critical to a fair and harmonious division of accumulated assets. — SMH

**Peroxisomes (green) partition between mother and bud in wild-type cells**

CREDITS: FAGARASANU *ET AL.*, *J. CELL BIOL.* **169**, 765 (2005)

*J. Cell Biol.* **169**, 765 (2005).

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## Screening for Sensitivity to Drugs

Inappropriate cell death or survival can lead to various diseases, such as neurodegenerative disorders and cancer. MacKeigan *et al.* performed large-scale screens using short interfering RNAs (siRNAs) transfected into cultured human cell lines to identify kinases and phosphatases involved in cell survival. Seventy-three kinases and 72 phosphatases were identified as contributing positively to cell survival, based on an increase in markers for programmed cell death (apoptosis) when the levels of these proteins were reduced. The phosphatase siRNA library was used to screen for phosphatases involved in cell death induced by cisplatin, Taxol, or etopside; 12 such death-promoting phosphatases were identified. The RNA interference screen was also used to identify kinases that, when downregulated, conferred an increased sensitivity to apoptosis-inducing drugs. For instance, Taxol combined with the siRNA for serum and glucocorticoid-regulated kinase increased cell death as compared with the siRNA or the drug alone. Taken all together, these results may suggestion new combination therapies. — NG

*Nat. Cell Biol.* **7**, 591 (2005).





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