EDITED BY GILBERT CHIN AND JAKE YESTON

CHEMISTRY

Pass the Salt

As our global freshwater resources continue to be consumed at an unsustainable rate, the demand for new sources of abundant, clean water continues to rise. Desalinated seawater is an attractive option as a complement to natural freshwater sources, but it remains fraught with unresolved problems such as minimizing energy requirements for the process and improving the quality of the product stream. To further understand the latter concern, Agus and Sedlak analyzed the chemical by-products generated by the addition of disinfecting chlorine to seawater under pilot-scale as well as various bench-scale conditions. Although few harmful by-products exceeded the recommended drinking water thresholds, certain patterns emerged that may further improve water quality. Seasonal and geographic increases in seawater-dissolved organic matter correlated with increased levels of potentially toxic by-products such as brominated trihalomethanes. Blending common freshwater sources (e.g., river water) with desalinated seawater could reduce the potential for chlorinated by-product formation; however, because seawater is naturally rich in bromine, nontrivial levels of other harmful by-products, such as dihaloacetonitriles, may be produced. Ultimately, the quality of desalinated seawater should pose little threat to human health or aquatic ecosystems, thus increasing the likelihood that desalination will remain a viable option for meeting our freshwater demands. — NW

Wat. Res. 10.1016/j.watres.2009.11.015 (2009).

CHEMISTRY

Big Steps for Little Feet

Macroscopic robots can already walk—the trouble is getting them to think. At the molecular scale, though, channeling stochastic motion into something resembling a series of purposeful strides is still a great challenge. Von Delius *et al.* now show that carefully designed feet appended to a small hydrocarbon chain can shuffle to and fro along a four-site track under proper chemical stimulation. One foot forms disulfide bonds to two of the track sites, whereas the other forms hydrazone linkages to interspersed sites. By introducing acids or bases that selectively favor these respective reactions, the authors shift the chain's position one step at a time. Replacing the base treatment with a redox protocol asserts some degree of control over the directionality of the stroll. — JSY

Nat. Chem. 10.1038/nchem.481 (2009).

EVOLUTION

Sulfate Supplier

The mitochondrion was kidnapped from the ranks of free-living bacteria, and subsequently coerced in various ways by eukaryotic cells to supply them with energy in the form of ATP synthesized by means of aerobic respiration. Historically, anaerobic cells were thought to lack mitochondria, but this prohibition has been modified somewhat with the discovery of intracellular organelles sporting mitochondrion-like features such as a double membrane, the protein chaperonin 60, and enzymes that assemble iron-sulfur clusters (which are a component of many respiratory enzymes). The hydrogenosome of *Trichomonas* produces hydrogen and ATP, and the mitosome, which produces neither hydrogen nor ATP, is found in *Entamoeba*. Mi-ichi *et al.* have begun to tabulate the protein repertoire of the mitosome, which appears to have been patched together from two proteobacterial sources, as well as a eukaryote. Three of the dominant constituents were ATP sulfurylase, adenylyl-sulfate kinase, and inorganic pyrophosphatase, indicating that one of the functions of this organelle may be the activation of sulfate, quite possibly for incorporation into sulfolipids. — CA

Proc. Natl. Acad. Sci. U.S.A. **106**, 21731 (2009).

CLIMATE SCIENCE

Slow Roast

Of all the wildcards in the climate system, one of the most potentially important is oceanic methane hydrates. Methane hydrates are frozen associations of methane and water found worldwide in marine sediments within a field of stability that extends from near the sediment surface down several hundred meters. Huge quantities of methane are thought to exist in these hydrates, and that is what makes them such a concern to climate scientists—as we warm the world by burning fossil fuels, the ocean eventually may warm enough to destabilize the hydrates and add methane (a potent greenhouse gas) to the atmosphere. Substantial release of this stored methane could accelerate the rate and amount of global warming considerably above current estimates. Sadly, we still understand little about this possibility. Archer *et al.* present initial calculations of the amount of methane contained in the hydrates, as well as estimates of how much might be released in various anthropogenic global warming scenarios. Their calculations show that humankind does have the capacity to cause large methane releases from the sea floor, and correspondingly great additional warming, and that the impact of such release is likely to occur over millennia rather than abruptly over the next century, making the issue a long-term danger rather than an immediate one. — HJS

Proc. Natl. Acad. Sci. U.S.A. **106**, 20596 (2009).

CREDITS (TOP TO BOTTOM): DAVID BUIMOVITCH/AFP/GETTY IMAGES (INSET) ISTOCKPHOTO.COM; USGS

Science

Pass the Salt

Nicholas S. Wigginton

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