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Science Concentrates

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p. 32

- Sea hares' chemical alarm signal
- Truly metallic conducting polymers
- Trimethyl marks prove reversible
- Biocides end up in farm fertilizer
- Ultrafast sorting of molecules

Sea hares' chemical alarm signal

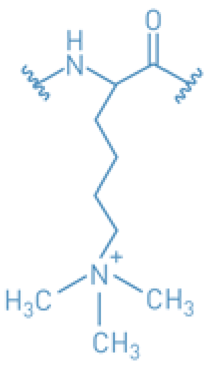

Photo
By Genevieve Anderson

If you are soft, devoid of tooth and claw, slow, and tasty to predators in your environs, chemical defenses are your best card. Indeed, when attacked, the sea hare *Aplysia californica* squirts out defensive cocktails from glands on its back. For several years, Charles Derby and Cynthia Kicklighter of Georgia State University and their colleagues have been teasing apart the chemistry and biology of these secretions. Last year, they reported that certain free amino acids in the secretions act like food decoys, causing lobsters to attend to the secretions instead of the hares (C&EN, April 4, 2005, page 14). On April 27 in Sarasota, Fla., at the annual meeting of the Association for Chemoreception Sciences, the researchers reported the identities of several other components, including the nucleosides uridine and cytidine, that carry alarm signals to nearby sea hares. When exposed to these in the lab, and presumably in the wild by brethren under attack, sea hares in the vicinity take to the hills, sometimes "galloping" away with inchworm motions, Derby notes.

Truly metallic conducting polymers

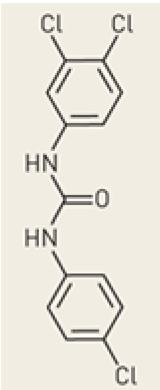
A new polyaniline synthesis allows thin films of the material to be prepared with minimal structural defects, leading to metallike properties that haven't been achieved before in electrically conducting organic polymers (*Nature* **2006,** *441*, 65). Mislinked monomer units and other defects interfere with polymer chain stacking and disrupt conduction bands in polyaniline, thereby preventing the polymers from fully functioning as metal equivalents in electronic devices. A team led by South Koreans Kwanghee Lee of Pusan National University and Suck-Hyun Lee of Ajou University solved this issue by devising a biphasic polymer synthesis in which the aniline hydrochloride monomer acts as a surfactant. The organic phase serves to diffuse away water-insoluble aniline oligomers and grown polymer chains so that the monomer radicals can meet the active polymer chain ends at the organic-aqueous interfaces to propagate the polymer with high structural integrity. Polyaniline prepared by this method exhibits a decrease in electrical resistance upon a decrease in temperature to 5 K, which is characteristic of metals.

Trimethyl marks prove reversible



A family of enzymes that specifically reverses a type of histone methylation long thought to be permanent has finally come to light. The methylation state of lysine and arginine side chains on DNA-packaging histone proteins helps to control access to and transcription of genomic DNA. Such methylation is regulated by histone methylase and demethylase enzymes. Enzymes that can strip methyl groups from both di- and monomethylated side chains have been identified, but it has remained unclear whether enzymes capable of demethylating histones bearing trimethyllysine (shown) exist. Confirming that the trimethyl mark is indeed reversible, a team led by Yang Shi of Harvard Medical School has now pinpointed such enzymes (*Cell* **2006,** *125*, 467). JMJD2A and its relatives use Fe(II) and a-ketoglutarate as cofactors to carry out hydroxylation-mediated demethylation, Shi's team reports. JMJD2A removes just one methyl group from trimethyllysine, while other relatives remove two.

Biocides end up in farm fertilizer



Triclocarban

Already concerned that he could detect the biocide triclocarban (TCC), used in antibacterial soaps and other personal care products, in water sources in Baltimore, Rolf U. Halden of Johns Hopkins University Center for Water & Health decided to track TCC (shown) after it goes down household drains (*Environ. Sci. Technol.*, published online April 26, dx.doi.org/10.1021/es052245n). Halden and coworkers found that some three-quarters of the compound going into a wastewater treatment plant survives the facility's physical, chemical, and biological treatments. Most of the surviving TCC ends up in the sludge, much of which gets recycled as fertilizer. Each of the largest of the U.S.'s roughly 18,000 wastewater treatment facilities could accumulate more than 1 ton of

TCC per year, Halden calculates. Whether TCC and other biocides in the environment pose actual hazards, such as contributing to the development of antibiotic-resistant bacteria, remains unknown. Some observers, including Hans Sanderson of the Soap & Detergent Association, argue that the benefits of the biocides outweigh their risks. He and Halden agree that neither the health risks nor the benefits of TCC in soaps have been well-documented, let alone quantified.

Ultrafast sorting of molecules

Need to separate a dozen or so molecules of one kind from a dozen of another kind? IBM scientists now have a way to do that-in just milliseconds. H. Kumar Wickramasinghe, Kerem Unal, and Jane Frommer at IBM's Almaden Research Center in San Jose, Calif., utilize a highly miniaturized version of electrophoresis. Instead of using a gel or capillary tube as the sorting medium, however, they use the 11.2-µm-long conical tip of an atomic force microscope (*Appl. Phys. Lett.* **2006,** *88*, 183105). An aqueous mixture of two DNA oligonucleotides is moved into a nanoreservoir at the base of the tip. Voltage pulses are then used to drive the molecules down toward the tip. Because their mobility depends on their size, the molecules travel at different rates, "eluting" off the tip and onto the underlying substrate at different times. By moving the tip over the substrate, the scientists can deposit a dozen molecules of A here, a dozen molecules of B there. The sorting process is more than 10,000 times faster than conventional electrophoresis and has the potential to improve medical lab tests and other technologies.

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