



## Science Concentrates

May 15, 2006

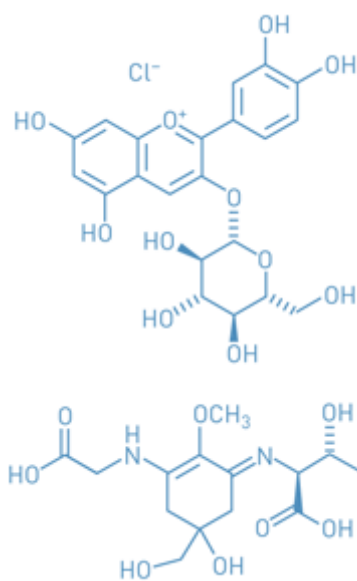
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## Natural sun blocks



Researchers are adding to the body of knowledge about natural products that show potential as sunscreens. Previous work has shown that an anthocyanin found in colorful foods such as berries and red grapes can protect skin cells from UV-A radiation, which can cause skin cancer. Now, Francesco Cimino at the [University of Messina](#), in Italy, and colleagues report that the compound can also protect skin cells from UV-B radiation, which can cause sunburn as well as cancer (*J. Agric. Food Chem.*, published online May 9, [dx.doi.org/10.1021/jf060253x](https://doi.org/10.1021/jf060253x)). The

compound, cyanidin-3-O-glucoside (top), appears to block an oxidative stress response that occurs in skin cells exposed to sun. Meanwhile, Morris Srebnik of Hebrew University of Jerusalem and colleagues have found that the bacterial metabolite porphyra 334 (bottom) can provide broad-spectrum UV-A protection (*Photochem. Photobiol. Sci.* **2006**, 5, 432). That performance contrasts with those of most commercially available sunscreens, whose UV-A coverage is limited to short-wavelength radiation, according to the researchers.

## Biomolecule breakdown is inorganic

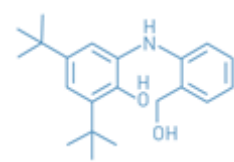
After organisms die, their biomolecules decompose and end up on ocean floors and integrated into sediments, where they can eventually become oil and natural gas. It's long been thought that microbial processes could be responsible for the initial transformations of biomolecules such as  $\beta$ -carotene, steroids, and terpenoids into biomarker compounds such as carotane, phytane, and steranes. But now, researchers show that abiotic processes may in fact be responsible. [Yanek Hebting](#), now a postdoc at MIT, and colleagues at [Louis Pasteur University](#) in Strasbourg and ETH Zurich, studied a number of reduced carotenoids in samples of sediment from Lake Cadagno in Switzerland. They found that the reductions were not stereospecific, and therefore, not biologically produced (*Science*, published online May 11, [dx.doi.org/10.1126/science.1128966](http://dx.doi.org/10.1126/science.1128966)). Rather, inorganic  $\text{H}_2\text{S}$ , produced by bacterial sulfate reduction, is likely responsible for reducing the biomolecules, a hypothesis strengthened by the group's laboratory experiments.

## Designer DNA snaps into holey crystals

While attempting to cocrystallize DNA and protein molecules, Paul J. Paukstelis, a crystallographer with the [Institute of Cellular & Molecular Biology](#) at the University of Texas, Austin, was disappointed: Only the DNA crystallized. Then Paukstelis wondered if he could design DNA oligomers that would assemble into crystals with a regular network of pores that could host hard-to-crystallize proteins and other molecules with a regularity amenable to

crystallographic analyses. By designing oligomers that exhibit both classic binding between C–G and T–A nucleotides and nonclassical pairings such as A–A and G–G, he has taken "a first step," he reports. When he expands these "assembly strands" with spacer strands, the expanded oligonucleotides self-assemble into sugar-grain-size crystals with long-range, 9-nm pores along one of the crystal's directions. Paukstelis reports that proteins below a threshold size infiltrate these pores but larger molecules do not, a trait important for the applications he has in mind (*J. Am. Chem. Soc.*, published online May 9, [dx.doi.org/10.1021/ja061332r](https://doi.org/10.1021/ja061332r)).

## Mixed-valence trimanganese complex made



The first known example of a trinuclear manganese complex in which the three manganese ions are in different oxidation states has been synthesized by a team of German chemists (*Dalton Trans.* **2006**, 2169). Multinuclear manganese complexes are of interest as mimics for the tetramanganese photosystem II oxygen-evolving complex involved in plant photosynthesis. A variety of mixed-valence tri- and tetramanganese complexes containing Mn(II), Mn(III), or Mn(IV) centers are known. But generally the combination of manganese atoms is limited to two of the three oxidation states. One exception is the photosystem II complex, which has an intermediate with a Mn(II)–Mn(IV)–Mn(IV)–Mn(III) combination. [Phalguni Chaudhuri](#) and colleagues at [Max Planck Institute for Bioinorganic Chemistry](#), Mülheim, have now synthesized the Mn(III)–Mn(II)–Mn(IV) complex,  $\text{Mn}_3\text{L}_4\text{Cl}$ , by reacting  $\text{MnCl}_2$  with the novel ligand (L) shown.

## Titan's complex ion chemistry

Titan, Saturn's largest moon, has a substantial ionosphere on the night side, and complex ion chemistry is operating there, according to the first analysis of mass spectral data gathered last year during

the *Cassini* spacecraft's flight through the moon's ionosphere (*Geophys. Res. Lett.* **2006**, 33, L07105). Titan's dense atmosphere is composed of molecular nitrogen and methane with minor amounts of many hydrocarbon and nitrile species. Past studies have shown that solar radiation and energetic electrons from Saturn's magnetosphere ionize neutral molecules in Titan's atmosphere, creating an ionosphere above 800 km. That ionosphere has now been found to persist into the night, according to [Thomas E. Cravens](#) of the University of Kansas. He and his colleagues confirmed the presence of several ions that were previously predicted by ionospheric models, such as  $\text{HCNH}^+$  (the most abundant ion),  $\text{C}_2\text{H}_5^+$ ,  $\text{CH}_5^+$ , and  $\text{C}_3\text{H}_5^+$ . The data also revealed unexpectedly high densities of other ions, such as one of mass 18, which the researchers suggest is  $\text{NH}_4^+$ , even though its neutral precursor,  $\text{NH}_3$ , hasn't yet been detected in Titan's atmosphere.

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