

DETAILED ANALYSIS OF PHOTOSYSTEM/LIGHT-HARVESTING COMPLEX

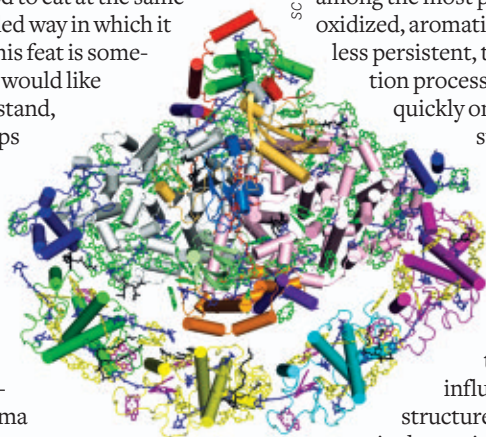
Photosynthesis produces oxygen and carbohydrates from water and carbon dioxide efficiently, giving living things oxygen to breathe and food to eat at the same time. The detailed way in which it accomplishes this feat is something scientists would like to better understand,

in part to perhaps mimic photosynthesis.

Tingyun Kuang, Jian-Ren Shen, and coworkers at the Chinese Academy of Sciences, in Beijing, and Okayama University, in Japan,

have now moved that goal one step closer to realization by determining the first atomic-resolution crystal structure of the pea plant's

photosystem I/light-harvesting complex I, a huge photosynthetic protein supercomplex found in higher plants (*Science* 2015, DOI: 10.1126/science.aab0214). One view of the structure (shown) makes it look like a pointy-headed jack-o'-lantern, in which subunits of photosystem I surround the eyes and a series of light-harvesting complex I proteins sit below the mouth. The structure, which reveals specific interactions between the supercomplex's components, including numerous pigments and other cofactors, could lead to a more in-depth fundamental understanding of the highly efficient energy transfer and photoprotection mechanisms of plant photosynthesis.—SB



Overall structure of photosystem I/light-harvesting complex I supercomplex from pea plants.

PERSISTENCE BY STRUCTURE

Life is short for some organic compounds dissolved in lakes and long for others. But what controls their life spans? The answer depends, at least in part, on specific structural motifs found in a lake's dissolved organic matter, reports a team of researchers led by Anne Kellerman and Lars Tranvik of Uppsala University, in Sweden (*Nat. Geosci.*

2015, DOI: 10.1038/ngeo2440). The team investigated the persistence of dissolved organic matter in 109 freshwater lakes in Sweden by using ultra-high-resolution mass spectrometry and optical spectroscopy. They found that reduced, aliphatic, and nitrogen-containing compounds are among the most persistent. In contrast, oxidized, aromatic compounds are much less persistent, they say, because degradation processes in the lakes work more

quickly on those species. The results challenge a paradigm in geological science that emphasizes extrinsic influences—such as temperature—as primary factors dictating the persistence of organic matter. Instead, the team argues that intrinsic influences, such as molecular structure, play an important role in determining the persistence of organic matter. The team also stresses that the observed persistence patterns are not unique to Swedish lakes but likely found elsewhere as well.—SE

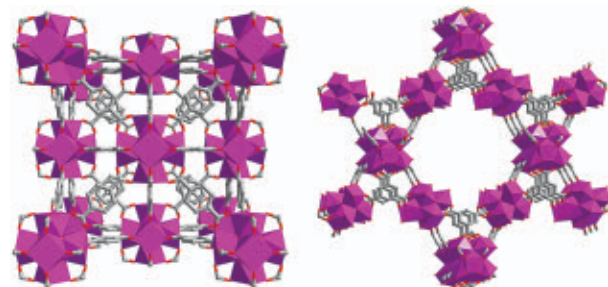
TETRAFLUOROETHYLENE IS GOOD FOR MORE THAN JUST TEFLON

Tetrafluoroethylene (TFE) has long been used as an economical feedstock for making fluorinated polymers. Researchers have also used the fluorinated olefin as a starting material in organic synthesis, but the chemistry remains relatively underdeveloped. Two research teams are now reporting reactions that broaden the scope of TFE's use as a reagent. In one case, a team led by Masato Ohashi and Sensuke Ogoshi of Osaka University, in Japan, has used TFE in nickel-catalyzed reactions with ethylene and aldehydes to make fluorinated aldehydes and ketones and with ethylene and other alkenes to make α -olefins with fluoroalkyl chains. The reactions proceed through an unprecedented five-membered "nickelacyclic" intermediate (*J. Am. Chem. Soc.* 2015, DOI: 10.1021/jacs.5b03587; *Organometallics* 2015, DOI: 10.1021/acs.organomet.5b00218). In a second case, Yusuke Takahira and Yoshitomi Morizawa of Asahi Glass, in Yokohama, Japan, have used TFE and other fluoroolefins in ruthenium

carbene-catalyzed cross-metathesis reactions with enol ethers to make ether-functionalized fluorinated olefins (*J. Am. Chem. Soc.* 2015, DOI: 10.1021/jacs.5b03342). The Asahi researchers believe their method of combining inexpensive fluoroolefins with a hydrocarbon counterpart will enable easy synthesis of new fluorinated building blocks for polymeric materials and medicinal chemistry.—SR

FRAMEWORKS FIGHT CHEMICAL WEAPONS

With their ability to hydrolyze the phosphate ester linkages in chemical warfare agents, zirconium-based metal-organic frameworks, or MOFs, are being eyed as materials for filters in gas masks and other decontamination equipment. Now two groups are reporting improvements on this technology. Chemists in Spain, led by the University of Granada's Jorge A. R. Navarro and Elisa Barea, boosted the hydrolytic powers of MOF UiO-66 by incorporating lithium alkoxide in its structure (*Angew. Chem. Int. Ed.* 2015, DOI: 10.1002/anie.201502094). The researchers wove this modified version of UiO-66 into a textile by spraying a suspension of the MOF onto silk fibroin fibers. In other work, Northwestern University chemists led by Omar K. Farha and Joseph T. Hupp explored a newer kind of Zr-based MOF—dubbed MOF-808—that can hydrolyze stand-ins for chemical warfare agents 350 times as fast as UiO-66 (*Angew. Chem. Int.*



UiO-66

MOF-808

Zr = purple, O = red, C = gray

Ed. 2015, DOI: 10.1002/anie.201502155). UiO-66 uses a dozen small organic connectors to bridge its Zr nodes; MOF-808 uses only six organic connectors to link Zr nodes. The difference leads to more reactive nodes as well as wider channels in MOF-808, which chemical warfare agents enter more easily.—BH

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