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Spotlights on Recent *JACS* Publications

ENZYME RESTORES FLUORESCENCE TO OXIDIZED CARBON NANOTUBES

Carbon nanotube (CNT) toxicity is directly correlated with both nanotube length and surface properties. To fabricate safer nanotubes for drug delivery, researchers oxidize CNTs with strong acid, which causes them to break into shorter particles. But the harsh acid treatment also introduces defects that suppress the intrinsic near-infrared (NIR) fluorescence of semiconducting single-walled CNTs (SWCNTs).

Now researchers report a method for restoring fluorescence to acid-treated SWCNTs with the help of an enzyme (DOI: 10.1021/ja400699y). The team, led by Alexander Star, uses horseradish peroxidase (HRP) in conjunction with hydrogen peroxide to enzymatically oxidize the defective particles, yielding less-defective, shortened (<300 nm) nanotubes with restored NIR fluorescence. But not just any enzyme will do: When the scientists treat nanotubes with myeloperoxidase and hydrogen peroxide, they find the nanotubes are completely degraded. The findings suggest HRP and H_2O_2 do the trick by consuming defects on SWCNTs to restore their optical properties.

The resulting nanotubes may be developed into cellular NIR imaging agents or drug delivery systems that can both carry a therapeutic payload and enable fluorescence visualization for diagnostic purposes. **Christine Herman, Ph.D.**

TOXIN GETS SUPPORT FROM A CROWD

Most of what we think we know about proteins may only be partial truth. Scientists typically study proteins in purified solutions, where they have plenty of room to stretch their amino acid arms. The situation in an organism is far more crowded, with biomolecules of every sort crammed together. Alexandre Chenal and colleagues are interested in how crowding affects intrinsically disordered proteins—which are floppy under normal conditions and thus may be particularly susceptible to the influence of a crowd (DOI: 10.1021/ja404790f).

The researchers chose to study an intrinsically disordered protein derived from a bacterial toxin that forms a rigid structure upon binding to calcium. They examine the protein's conformation and stability by spectroscopic methods in both the calcium-free and calcium-bound states, with and without the addition of Ficoll70, a large neutral polysaccharide that crowds proteins. They discover that both the disordered state and the ordered state of this protein are stabilized by the presence of Ficoll70. Their data further suggest that the inside of a crowded bacteria cell, which has low levels of calcium, favors an elongated unfolded structure, which can more easily escape from inside the cell than a compact form. Once the toxin is secreted from *Bordatella pertussis* into the calcium-rich human respiratory tract, the crowding may then help the protein to fold into its toxic calcium-bound form. **Erika Gebel Berg, Ph.D.**

FINE-TUNING THE FORMATION OF CATALYST-INCORPORATED MICROPORES

Supercritical CO_2 processing can significantly boost catalytic rates and enhances substrate accessibility for catalysts-incorporated microporous polymers. Researchers led by Omar K. Farha, Joseph Hupp, and SonBinh Nguyen demonstrate a nearly ten-fold increase in catalytic activity after fine-tuning the conditions for integrating an Al(porphyrin)-based catalyst into a porous organic polymer (DOI: 10.1021/ja405495u).

The team previously demonstrated that supramolecular Al(porphyrin) catalysts can degrade a nerve agent simulant known as *p*-nitrophenyl diphenyl phosphate, showing their utility for neutralizing phosphate-based toxic pesticides and chemical warfare agents. Now, they report enhanced rates of catalysis and additional advantages, such as ease of recyclability, resulting from the integration of Al(porphyrin) into a microporous environment. Prior to this integration, the team temporarily complexes the Al(porphyrin) with a large axial ligand, resulting in increased catalyst spacing within the micropores and making the catalyst moieties more accessible to the bulky phosphate substrates. An even greater catalytic activity boost can be achieved with supercritical CO_2 processing, which yields larger micro- and mesopores.

Their results suggest supercritical CO_2 processing could also be explored for the formation of highly active microporous materials with applications beyond catalysis, such as gas storage, separations, and sensing. **Christine Herman, Ph.D.**

A BETTER WAY TO WATCH PROTEINS

Labeling cellular proteins with fluorescent compounds is a powerful strategy for examining protein function and location in live cells. Building on the numerous protein labeling methods that have been developed, Kazuya Kikuchi and co-workers devise an improved approach that tackles two technical challenges that often accompany the process: high background fluorescence and slow labeling times (DOI: 10.1021/ja405745v).

Their method involves genetically tagging a protein of interest with photoactive yellow protein (PYP), a small protein that comes from purple bacteria. Addition of specially designed cell-permeable fluorogenic probes, which become fluorescent only upon binding PYP, enables rapid visualization of the protein with dramatically diminished background fluorescence. The authors use this strategy to image the localization of a DNA methylation-recognizing protein in living cells, providing a new method to investigate the role of DNA methylation in the regulation of gene expression.

This PYP−fluorogenic probe system is a valuable addition to the molecular toolbox of protein labeling reagents. The improved signal and faster labeling times inherent in the system offer a more versatile and practical method for visualizing a wide range of biological processes in live cells. **Eva J. Gordon, Ph.D.**

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