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Spotlights on Recent *JACS* Publications

JUST SAY NO TO ANTIBIOTIC RESISTANCE

Because of the ever-growing and extraordinarily difficult problem of antibiotic resistance, researchers are exploring new ways to attack bacteria beyond traditional antibiotics. One possibility is nitric oxide (NO), a molecule that kills even highly drug-resistant bacterial strains. Though gaseous NO has proven effective at fighting chronic skin and soft tissue infections in previous studies, many challenges remain in effectively delivering this agent to wounds without harming healthy tissue. As such, several teams have explored controlled delivery systems that release NO through triggers such as temperature, water, or pH.

Seeking a practical alternative NO delivery system for the battlefield, where many antibiotic-resistant infections arise, Pradip Mascharak and co-workers have developed a system that releases NO in response to light (DOI: 10.1021/ja3022736). The researchers entrapped a photoactive manganese NO complex in a porous host material. Tests show that this composite material releases NO under light exposure, either steadily or in bursts, depending on whether light is delivered continuously or in pulses.

Application of the powder to an infected wound followed by exposure to daylight or even just a well-lit room for a few minutes will deliver high doses of NO to the infected sites and significantly reduce the bacterial loads of both drug sensitive and drug resistant *Acinetobacter baumannii*, a common battlefield infection. The authors suggest that this delivery system could hold significant potential for fighting resistant infections. **Christen Brownlee**

ORDERING OF WATER MOLECULES IS MORE EXTENSIVE THAN EXPECTED

Jeremy O'Brien and Evan Williams use infrared photodissociation spectroscopy to describe how ions solvated in nanodroplets of water affect the molecular structure of the water (DOI: 10.1021/ja303191r). Because dissolved ions influence the solubility of proteins in water, this work provides insight into the mechanisms at play in protein solvation.

One hundred twenty years ago, Hofmeister ranked ions by their ability to precipitate hen egg albumin in aqueous solutions, but the physical origin of these effects is not fully understood even today. O'Brien and Williams found that monovalent ions—ions with either a single positive or negative charge—have a small and consistent effect on the hydrogen-bonded structure of the water droplet. However, divalent ions affect the H-bonding network of water molecules well past the first solvation shell, all the way to the surface of the nanodroplet.

The authors conclude that the extent to which divalent ions affect the H-bonding structure of water gives "new insights into ion hydration and how ions may affect various physical properties" such as protein solubility. **Polly Berseth, Ph.D.**

CATIONIC HYBRID CRYSTALS HAVE THAT CERTAIN LIGHT

There are two main types of crystalline nanoporous materials potentially useful in sensors, hydrogen gas storage, and solid-state lighting: metal−organic frameworks (MOFs) and phosphorus-based metal oxides (MPOs). While both are crystalline in nature, MOFs consist of metals with coordinating organic molecules, while MPOs are salts of oxygen and various metals. Both are large structures containing pores or channels that can bind another molecule to turn on a sensor or act as a nano-storage unit. While MOFs are generally easier to build, MPOs tend to be more adaptable.

Now, Sue-Lein Wang and Yu-Chuan Chang have combined the best of both types to form a class of hybrid molecules known as organo-metallophosphates (DOI: 10.1021/ja302009h). Using a metal-based framework strung together with organic linker molecules, the researchers synthesize four new highly luminescent crystalline structures with cationic pores in a one-pot reaction. This easy preparation does not use any organic solvent or catalyst to proceed, and creates very large crystals that can be separated without any further purification. The first of their kind, these molecules can be varied based on starting materials, and because they change color upon heating or upon binding guest molecules, they have great potential in the sensor industry. **Leigh Krietsch Boerner, Ph.D.**

TASTE OF THE SWEET SIDE OF CELLS

The surface of many human cells is coated with proteins, called cell surface receptors, which serve as liaisons between the outside world and the inside of the cell, transmitting signals that direct important processes such as cell growth and movement. The receptors are topped with strings of sugar molecules, called glycans, which assist in mediating these complex signaling processes. To help explore the precise role of the glycans in these incredibly intricate processes, researchers may use metabolic glycan labeling. In this method, specially designed carbohydrate analogues, called azidosugars, are incorporated into the glycans, which enables the detection and imaging of the glycans in cells and even within living animals.

Xing Chen and co-workers build on this clever approach for probing glycan function by developing a strategy for delivering the azidosugars only to specific cell types (DOI: 10.1021/ja303853y). They encapsulate the azidosugars in molecular vehicles called liposomes, which are designed to target specific cell types. The liposomes deliver the azidosugars to their target cells, enabling analysis of the glycans on just those cells. This approach offers a sophisticated tool for deciphering the roles played by glycans in different cell types. **Eva J. Gordon, Ph.D.**

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BERYLLIUM BOROHYDRIDE STRUCTURE IS NOW CRYSTAL CLEAR

Beryllium borohydride compounds have long been of interest in alternative energy for their potential in hydrogen gas storage, since they have the largest hydrogen capacity of all metal borohydrides. However, the structure of these compounds, and thus how exactly they would store hydrogen, has been a puzzle for over 70 years. Now, Gregory H. Robinson and co-workers at The University of Georgia have discovered the structure of a new beryllium borohydride molecule, ending the long-standing ambiguity (DOI: 10.1021/ja304514f).

In the past, scientists have proposed multiple different arrangements for the monomeric boron−beryllium−boron bonds in the gas phase, and the number and position of hydrogen atoms in the structure were also unknown. Additionally, solid beryllium borohydride is known to exist as polymers forming a helix, adding to the confusion about the individual structures.

The new beryllium borohydride molecule, stabilized by a carbene ligand, sports a five-coordinate beryllium arranged in a distorted square pyramid. Beryllium borohydrides are known to be highly reactive, even explosive compounds, but Robinson's molecule is stable for several days on the benchtop. This first unequivocal crystal structure advances the chemical understanding of these types of compounds, opening the way for future development of new systems for hydrogen storage and alternative fuel technology. **Leigh Krietsch Boerner, Ph.D.**

NOVEL LANTIBIOTIC SYNTHETASE WORKS BACK-TO-FRONT

Lantibiotics are peptide-based, bacterially derived antimicrobial compounds, at least one of which is in clinical trials. In vivo, they are synthesized as peptides; synthetases selectively modify serine, threonine, and cysteine residues to produce the final, active molecule. The question is, how does that post-translational conversion take place? Now Roderich Süssmuth and colleagues have solved that problem for one particular enzyme, LabKC (DOI: 10.1021/ja3040224).

LabKC synthesizes labyrinthopeptin A2 (LabA2) in a multistep GTP-dependent process in which each of four serine residues is first dehydrated to 2,3-didehydroalanine. Previous studies on other lantibiotic synthetases suggested that these dehydration reactions proceeded along the peptide chain, moving from the amino terminus to the carboxy terminus. But LabKC is different.

Using mass spectrometry and a series of deuterated peptides, the team probed the LabKC reaction mechanism. They found that dehydration proceeds primarily toward the LabA2 N-terminus, generally modifying the serine residues in reverse order.

Another ribosomally synthesized and post-translationally modified peptide (RiPP), classified as a microcin, was also recently found to be processed in the C-to-N direction. "Together with our results, these are the first reports on this mode of processing for RiPPs," the authors conclude. **Jeffrey M. Perkel**

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