

Spotlights on Recent JACS Publications

■ LIGHT-ACTIVATED ASSEMBLY–DISASSEMBLY OF HELICAL NANOSTRUCTURES

For years, chemists have taken inspiration from biology in the design of self-assembling, stimuli-responsive helical nanostructures. Such structures could provide insight into biological systems and enable the design of smart materials. Now, researchers led by Wei-Hong Zhu and Lifeng Chi describe a helical, hydrogen-bonded nanostructure that reversibly switches between open and closed forms in the presence of visible and UV light, respectively (DOI: [10.1021/jacs.5b11580](https://doi.org/10.1021/jacs.5b11580)).

The team reports the synthesis of the molecular precursors, which are composed of small organic building blocks based on dithienylethene with homochiral amino acid side chains. They characterize the self-assembled and thermally stable left- and right-handed superhelical nanostructures using microscopy and find that the light-activated switching between open and closed forms is accompanied by changes in morphology, fluorescence, and helicity, reminiscent of biological systems such as protein and DNA. This demonstration of photoswitchable chiral amplification from small organic building blocks may serve as the basis for better understanding chiral communication between molecular and supramolecular chirality.

Christine Herman, Ph.D.

■ WETTABILITY: A CENTURIES-OLD SCIENCE INSPIRES MODERN-DAY MATERIALS

Throughout the world, countless examples of the phenomenon of wettability can be seen, from the way water washes up onto a shore to the manner in which ions move through microscopic channels embedded in cell membranes. Wettability is defined as the ability of a liquid to maintain contact with a solid surface—a characteristic that is largely determined by molecular interactions between the two phases.

In a new Perspective, Lei Jiang and colleagues present an overview of the centuries-old field of wettability science (DOI: [10.1021/jacs.5b12728](https://doi.org/10.1021/jacs.5b12728)). They describe both bottom-up and top-down approaches to the design of superwetable materials, including a brief history of products that have been designed on the basis of superwetable materials found in nature. For example, water-repellent coatings with hydrophobic microstructures draw inspiration from lotus leaves, whose hydrophobic surfaces are able to stay clean despite growing in the mud.

Beyond commercial applications, the authors discuss the potential for superwetable materials that offer control over chemical reactions, assist in the collection of reaction products, enable the study of the growth of precipitates, and align/assemble nanoscale building blocks. The Perspective provides a holistic introduction to the field and helps the reader understand the structure–property relationship of bioinspired interfaces with superwettability.

Christine Herman, Ph.D.

■ WATCHING SELF-ASSEMBLY ON LIQUID SURFACES

Boaz Pokroy and co-workers tailor surfaces on the nanoscale by forming self-assembled monolayers (SAMs) on liquid surfaces (DOI: [10.1021/jacs.5b10446](https://doi.org/10.1021/jacs.5b10446)). In contrast to commonly used solid surfaces, liquid surfaces provide a more ideal, defect-free support for SAM growth, which may enable new applications such as protein self-assembly and the stabilization of emulsions and foams in addition to facilitating improvements to existing applications like surface wettability to corrosion resistance.

Formation of SAMs on liquid surfaces changes the liquid's surface tension, which results in macroscopic shape changes to drops that can be monitored by optical tensiometry. By analyzing the curvature of a drop in a gravitational field, the researchers extract the surface tension of SAMs with different molecular weights on various liquid substrates ranging from mercury to water and fluorocarbons.

These measurements provide direct insights into the thermodynamics of SAMs and their slow structural evolution in the course of adsorption, on the time scale from seconds to days. The optical technique illustrates a simple yet powerful concept with the potential to be used in future sensor applications for various organic surfactants.

Dalia Yablon, Ph.D.

■ RARE NEW FORM OF CHIRALITY OBSERVED IN ROTAXANES

Owing to their many distinctive features, mechanically interlocked molecules have come into the spotlight in the quest for new organic catalysts. Molecules in a class known as rotaxanes are composed of a dumbbell-shaped molecule threaded through a second macrocyclic molecule, which can conceal or expose certain reactive groups on the thread to promote different reactivity modes. Previous reports have demonstrated the use of rotaxanes as chiral ligands that coordinate with metal ions to catalyze organic reactions. Now, researchers led by David Leigh report the use of a previously unexplored feature of rotaxane architectures in organo-catalysis—a new form of chirality that is induced by a mechanical bond (DOI: [10.1021/jacs.6b00303](https://doi.org/10.1021/jacs.6b00303)).

Point chirality typically arises from having four different covalent groups attached to an atom's tetrahedral center. Here, the researchers show that by threading an achiral molecule through another achiral macrocycle, they can create a structure with point chirality that is induced by the mechanical bonding. The team demonstrates the use of the chiral rotaxane in asymmetric catalytic reactions and says that the so-called “mechanochirogenesis” they observe with this system could be further enhanced through the structural optimization of the rotaxane components.

Christine Herman, Ph.D.

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