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Spotlights on Recent *JACS* Publications

RNA: THE MIDPOINT BETWEEN PRIMORDIAL OOZE AND ORGANISM

In the search for the origin of life, RNA plays a critical role—some scientists hypothesize that RNA not only predated DNA as organisms' genetic information of choice, but also played double-duty as the precursor to proteins and as the catalytic machinery necessary to power living systems. To study how RNA might direct such biological activities, many researchers use nonenzymatic template-directed polymerization reaction as a model. Jack Szostak and colleagues have collected conformational data that help explain why single-stranded RNA (ssRNA) templates are better than DNA templates at polymerizing ribonucleotides (DOI: 10.1021/ja212027q).

Using transferred nuclear Overhauser effect spectroscopy, which gives information about distances between specific protons in a molecule, Szostak's team analyzed ribonucleotides' sugar pucker, a region in the compounds' sugar ring whose bond conformation is integral for polymerization. When unbound to other molecules, ribonucleotides exist mostly with their sugar rings in a conformation unfavorable for polymerization into RNA. When ribonucleotides bind to ssRNA templates, the sugar pucker switches conformations to one favorable for polymerization—the same change does not occur on DNA templates.

This structural rationale for ssRNA's efficiency in polymerizing ribonucleotides can lead to more efficient research into life's origins on Earth. **Kenneth J. Moore**

IMPROVED CROSS-COUPLING METHOD USES OXYGEN LEAVING GROUPS

Catalyzing the formation of carbon-to-carbon bonds is essential for developing new therapeutic compounds and scaling up the synthesis of proven drugs for commercialization. Metal-catalyzed coupling reactions, such as the Heck reaction, Negishi coupling, and Suzuki coupling, have allowed gram-scale synthesis in academic research to be carried out on ton scale in industrial settings.

The field of cross-coupling chemistry is quite mature; however, researchers like Gregory Fu and co-workers continue to make great strides in developing new methods to catalyze cross-coupling reactions with greater efficiency and control over the chirality of the target compounds (DOI: 10.1021/ja300031w). Here, Fu and co-workers developed nickel-catalyzed cross-couplings of alkyl electrophiles that have oxygen leaving groups. Their reaction method is efficient and enantioselective, meaning there is control over chirality. Their method is also compatible with a variety of functional groups, and the two catalyst compounds used are commercially available and air-stable.

Previously, similar reactions that utilized oxygen leaving groups were limited to a narrow set of electrophiles and required the use of highly reactive reagents that were less compatible with different functional groups. Fu and co-workers' improved method is suited for smaller-scale synthesis at this stage, but future work could adapt it for larger-scale synthesis for the pharmaceutical industry. **Yun Xie, Ph.D.**

HIP TO BE SMALL AND SQUARE

Lead(II) and tin(II) sulfides, PbS and SnS, are semiconductors whose properties could be promising for a variety of applications, such as solar cells, infrared detectors, lasers, and telecommunication relays. Combining these materials into $PbSnS_2$, also called teallite, could lead to even more interesting and useful properties to exploit, but teallite has received modest attention in the literature and is not well characterized. What little is known is that bulk $PbSnS_2$ forms orthorhombic crystals, which have an elongated, rectangular shape, in contrast to the perfectly square faces of NaCl salt crystals. For $PbSnS_2$ this cubic form appears to be extraordinarily unstable and, hence, does not exist in bulk.

To the surprise of Mercouri G. Kanatzidis and co-workers, synthesizing teallite nanocrystals appears to create the impossible: $PbSnS_2$ as cubic crystals (DOI: 10.1021/ja211087q). The researchers synthesized the nanocrystals using a method that involved heating a lead and tin precursor solution, then rapidly injecting a sulfur precursor. Characterization of the $PbSnS_2$ product showed that this material exists as cubic crystals incorporating all three elements and remains stable up to 300 °C. The findings suggest that miniaturizing $PbSnS_2$ creates a whole new class of nanomaterials whose properties are impossible to recreate in the bulk form. **Christen Brownlee**

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