

SPRING 2015 CHEMISTRY COLLOQUIA



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University**

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**12:30 Seminar
112 Hamilton Hall**



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“The Nature of the DNA Bond”

For decades the biological roles of nucleic acids as catalytic enzymes, intracellular regulatory molecules, and as the carriers of genetic information have been studied extensively. More recently, the sequence-specific binding properties of DNA that make it so ubiquitous among all living systems have been hijacked to direct the assembly of materials at the nanoscale. In such cases, it has become useful to consider the DNA as an artificial bond that facilitates nearly infinite tailorability in the interactions between nanomaterials via bond (i.e. oligonucleotide) length, strength, orthogonality, and even directionality. Although this powerful concept can be applied in variety of contexts including DNA tiles, origami scaffolds, and supramolecular constructs, here we explore the use of rigid inorganic nanoparticles functionalized with DNA that act to orient oligonucleotides perpendicular to their surfaces to dictate DNA bonding interactions. By elucidating a series of design rules for the nature of these DNA bonds, we show the construction of nanoparticle superlattices with over 35 different crystal symmetries with precise control over particle size and spacing. In some cases, these materials can be prepared so that they form large single crystalline domains with a well-defined crystal habit indicative of the minimum energy Wulff polyhedron of the parent superlattice. Finally, we show opportunities for dynamic and reconfigurable superlattices facilitated by the unique properties of the DNA bond.