

UNIVERSITY OF RHODE ISLAND
Department of Chemistry
SEMINAR

Room 105, Beupre Center
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**“Controlling Dynamic Behaviors
in Biomimetic Materials: From
Switching to Self-Assembly”**

HOST

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Controlling Dynamic Behaviors in Biomimetic Materials: From Switching to Self-Assembly

Dynamic, stimuli responsive materials represent an ever growing area of research owing to their reprocessability and reconfigurability of important materials properties on demand. We will discuss two sets of chemically-distinct, biomimetic macromolecules with unique dynamic behaviors. Synthetic helical polymers mimic naturally occurring biopolymers such as proteins and DNA in their chiral, helical backbone secondary structures. Discussed herein, includes the transition-metal mediated polymerization of functional polycarbodiimide homopolymers and block copolymers. In particular, the dynamic, tunable chiroptical switching behavior observed in specific polycarbodiimides was exhaustively studied to unambiguously identify the mechanism of action in this unique process. Furthermore, this interesting property was utilized in applications such as non-specific VOC sensors and molecular motors. The synthesis and self-assembly of rod-coil block copolymers with chiral, helical polycarbodiimide segments is also described allowing for the formation of up to six different nanoscale assemblies simply by altering the solvent combinations. In the second project discussed, the facile incorporation of aryl aldehyde and acyl hydrazide functionalities into peptide oligomers via solid-phase copper-catalyzed azide-alkyne cycloaddition (SP-CuAAC) click reactions will be described in detail. When mixed, these complementary functional groups rapidly react in aqueous media at neutral pH to form bioactive, peptide-peptide intermolecular macrocycles with highly tunable ring sizes. Moreover, sequence-specific figure eight, dumbbell-shaped, zipper-like, and multi-loop quaternary structures were formed selectively as confirmed by MALDI-TOF MS, SDS-PAGE, and 2D-¹H-DOSY NMR. Controlling the proportions of reacting peptides with mismatched numbers of complimentary reactive groups results in the formation in higher MW (>14 kDa) sequence-defined ladder polymers. Finally, the interesting antimicrobial property enhancements of these unique peptide assemblies will be reviewed.