

The **Chemistry and Biochemistry Departmental Seminar Series** covers a broad range of fields in the Chemical and Biochemical Sciences. In past seminars, scientists from Academia, Government, and Industry have presented their most recent discoveries and contributions in their respective areas. This Seminar Series offers students and faculty the opportunity to interact directly with other leaders in their specializations and to gain a good overview of the entire range of fields in Chemistry and Biochemistry.

### **Spring 2021**

Seminars were held on Tuesdays via Microsoft Teams, 12:30 - 1:30pm, unless otherwise noted with special day/time information. All were invited to attend.

#### **Tuesday, February 2, 2021**

Dr. Marco Bonizzoni, Associate Professor, The University of Alabama

Title: *Macromolecular Chemical Fingerprinting Systems and The Problem of Mixtures*

Abstract: Artificial supramolecular receptors often rely on weak intermolecular interactions for their chemical recognition properties, so they may struggle to work in competitive media like water solutions. However, aqueous media are very important in analytical, environmental, and biomedical applications, so it is valuable to adapt our supramolecular tools to them. We have been using water-soluble polymers (e.g. dendrimers, hydrogels, conjugated polymers) as scaffolds to build multivalent supramolecular sensors that take advantage of the large number of interactions and of the preorganization of receptor sites afforded by such scaffolds to achieve improved affinity in competitive media. This approach has two key advantages. On the one hand, decorating an existing polymer scaffold with known receptor sites affords a modular approach to multivalency with minimal design and synthesis effort. On the other hand, water-soluble scaffolds impart water solubility to receptor groups that would otherwise be incompatible with water media. Combining these supramolecular sensors with analytical discrimination methods based on chemical fingerprinting, we have developed detectors for many guest families (e.g. carboxylate anions, simple saccharides, heavy metal cations, and polycyclic aromatic hydrocarbons). These systems, however, often suffer from what we call "the problem of mixtures": i.e. they may not handle mixtures of analytes directly, effectively requiring a preliminary separation step before identification and quantitation. We will present examples of judiciously chosen systems and controlled conditions that allowed us to overcome that problem as well, and achieve quali-quantitative discrimination of an important class of analytes.

Facebook Event: <https://www.facebook.com/events/740091673552552>

#### **Tuesday, February 16, 2021**

Dr. Loren Dean Williams, Professor, Georgia Institute of Technology

Title: *How to think about and study: the Origins, Evolution and Significance of the Ribosome*

Abstract: The ribosome is an ancient molecular fossil that provides a telescope to the origins of life. Made from RNA, protein and inorganic cations, the ribosome translates mRNA to coded protein in all living systems. The significance of translation is engrained in universality, antiquity, centrality, and biological economy. The translation machinery dominates the set of genes that are shared as orthologs across the tree of life. The lineage of the translation system defines the universal tree of life. Every coded protein ever produced by life on Earth has passed through the exit tunnel, which is the birth canal of biology. During the root phase of the tree of life, before the last common ancestor of life (LUCA), exit tunnel evolution is dominant and unremitting. Protein folding co-evolved with evolution of the exit tunnel. The ribosome shows that protein folding initiated with intrinsic disorder, supported through a short primitive exit tunnel.

Folding progressed to thermodynamically stable  $\beta$ -structures and then to kinetically trapped  $\alpha$ -structures, the latter were enabled by a long mature exit tunnel that partially offset the general thermodynamic tendency of all polypeptides to form  $\beta$ -sheets. RNA chaperoned the evolution of protein folding from the very beginning.

Facebook Event: <https://www.facebook.com/events/142358511075876>

## **Tuesday, March 23, 2021**

Dr. Austin Jones, Postdoctoral Research Fellow at Georgia Institute of Technology

Title: *Synthesizing Dioxythiophene Conjugated Polymers with High Conductivity using Direct(Hetero) Arylation Polymerization*

Abstract: In order to push conjugated polymers (CPs) toward industrial relevancy, strategies must be used that reduce the amount of synthetic steps, use high yielding reactions, and eliminate the use of toxic reagents. Dioxythiophene (co)polymers, and the synthesis thereof, have distinct chemical advantages that make them good candidates for large-scale manufacturing. Moreover, dioxthiophene (co)polymers have been applied to many redox-active applications including electrochromics, transparent electrodes, organic field effect transistors, and organic thermoelectrics due to their unique optoelectronic properties, potential for solution processing, and ability to delocalize/transport charge between and along polymer chains. Direct(hetero) arylation polymerization (DHAP) is a promising technique that reduces the amount of synthetic monomer steps by removing reactive groups, such as tin or boron substituents, and instead uses C-H activation in the catalytic cycle. A drawback for using DHAP is the reduced reaction selectivity where defects in the polymer chain, in the form of  $\beta$ -coupling and homocoupling, may exist. Dioxythiophene-based monomers are ideal reagents for DHAP due to their blocked 3- and 4-positions, which eliminates the possibility of branching defects along the polymer backbone due to  $\beta$ -coupling. With this in mind, I will present two studies using a dioxythiophene copolymer comprised of 2,2'-bis-(3,4-ethylenedioxy)thiophene (biEDOT) and 3,4-propylenedioxythiophene (ProDOT) substituted with either branched aliphatic or polar oligo(ether) side chains. The first study will investigate monomer homocoupling in different dioxythiophene copolymer (PE2) batches using matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometry (MS). This work will correlate differences in DHAP polymerization techniques with polymer structure and solid-state conductivity of the resulting material. The second study will build off this work by investigating alternative DHAP techniques for branched oligo(ether) functionalized PE2 polymers that will ultimately lead to CPs with acetone processability and average solid-state conductivities on the order of  $430 \pm 60$  S/cm.

## **Tuesday, March 30, 2021**

Dr. Amy Marschilok, Associate Professor at Stony Brook University

Title: *Batteries for a Green Energy Future: Progress and Opportunities*

Abstract: Batteries are ubiquitous in our everyday lives and often appear as black boxes. However, the chemistry inherent to their function is diverse and complicated. This talk will highlight progress and opportunities employing electrochemical energy storage to build a green energy future. Examples of mechanistic insight gained from in-situ and operando characterization of functional systems will be highlighted.

Facebook event: <https://www.facebook.com/events/497579048074093>