

Southeast Polymer 2026 Oral Presentation Title and Abstracts

Speaker: Weinan Xu

Title: ***Sustainable polymer-/bio-composites with high thermal conductivity through unconventional biosynthesis and interfacial engineering***

Abstract:

Thermal interface materials are essential for heat management in advanced electronics and typically consist of polymer matrices filled with thermally conductive nanomaterials. However, limited structural control, energy-intensive processing, and poor sustainability constrain their performance. Here, I will present a fundamentally new approach for fabricating high thermal conductivity (TC) biocomposites via synergistic microbial biosynthesis.¹ Our materials are formed through in situ biosynthesis of bacterial cellulose (BC) nanofibers in the presence of fluorographene (FG), with an optional second nanofiller that is also biosynthesized by engineered bacteria. This programmable process enables biocomposites with highly ordered internal architectures composed primarily of BC and FG. The resulting materials exhibit exceptional in-plane and through-plane TC of up to 30 and 6 W/m·K, respectively, along with excellent thermal stability, mechanical strength, and electrical insulation. This work establishes microbial biosynthesis as a sustainable platform for advanced thermal materials and expands its applications beyond its conventional uses in pharmaceuticals and bioproducts.

Speaker: Charles Sing

Title: ***Controlling Dynamics and Thermodynamics of Polymer Materials with Rearranging Bonds***

Abstract:

Dynamic bonds, which can break and reform or undergo exchange, have long been a key motif in polymer science. Their role in controlling the mechanical properties of polymer networks has been historically important in the context of rubber, and to tune or control the viscoelastic properties in both melt networks and swollen gels. There has recently been a dramatic increase in chemistries – and consequently applications – available to polymer scientists as they realize the possibilities of this class of materials. These advances have benefited from progress in polymer physics, where molecular-level physical insights can guide molecular-level design of dynamic networks.

This talk will show examples from our recent research where computational and theoretical polymer physics is used to understand both dynamic and thermodynamic phenomena in dynamic networks, in close collaboration with several experimental and theoretical colleagues. We show how the kinetic and mechanistic attributes of dynamic bonds can be engineered to control material dynamics. In the glassy state, we show how activated segmental motions couple to molecular bond exchange events. In the rubbery state, we can predict how competition between bond exchange mechanisms can be used to engineer stimuli-responsive molecular rearrangements. Finally, we predict how bond exchange motifs can be harnessed to affect polymer blends. These examples highlight not only the promise of this important class of materials, but the abundance of scientific questions that remain to be addressed in our understanding of these fascinating systems.

Speaker: Michael Bortner

Title: ***Overview of the Macromolecules Innovation Institute at Virginia Tech***

Abstract:

This talk will explain how MII is dedicated to advancing fundamental knowledge and technical innovations in Macromolecular Science and Engineering at Virginia Tech

Speaker: Jennifer L. Schaefer

Title: ***Polymer electrolytes for next generation electrochemical energy storage devices***

Abstract:

Advances in energy storage devices are required for the widespread implementation of intermittent renewable electricity generation technologies such as photovoltaics and wind power. In addition, electrification of transportation will allow for the substitution of liquid fossil fuel energy with renewably sourced energy. Energy storage platforms based on more abundant resources are essential for sustainable solutions. High energy density storage devices with enhanced safety are also needed. In this seminar, I will discuss my group's research efforts in understanding ion transport in solid and quasi-solid materials relevant for next generation energy storage devices. Topics will include the i) ionomeric interlayers for application in metal-sulfur batteries and ii) electrolytes with dense ionic clusters. Fundamental understanding of the relevant charge transport behavior is possible via the tandem use of a variety of materials characterization techniques.

Speaker: Phillip Barnett

Title: ***Development of Print Parameter Optimization Calibration Geometry for Enhanced Interlayer Bonding in the Fused Filament Fabrication Process***

Abstract:

Additive manufacturing has unlocked unique manufacturing capabilities that have changed the design and prototyping paradigm for small and medium enterprises. Fused Filament Fabrication (FFF) has emerged as the most prominent of these technologies due to the low feedstock and equipment costs, relative ease of use, and concentrated training efforts at the K-12 level. However, FFF-printed parts are often limited to low-stress applications due to process variability and relatively low performance caused by poor interlayer bonding controlled by processing variables such as the print temperature, toolhead speed, and extrusion flow ratio. In this work, a combination of rheological, surface topology, and in-situ infrared thermography are used to predict the degree of welding between print roads in the FFF process. A multi-parameter calibration geometry is developed to enable performance predictions that reduce the experimental burden for selecting appropriate print settings. The approach provides a powerful tool for rapidly identifying print parameters for new materials and can be extended to in-situ optimization of interlayer bonding for complex geometries.

Speaker: Xiao Sun

Title: ***Carbonized Hollow Fiber Supported Copper Conductors for Power and Sensing Applications***

Abstract:

Copper is the dominant conductor for modern power transmission; however, its limited electrical conductivity and associated Joule heating lead to significant energy losses during long-distance delivery. Addressing this inefficiency requires conductor architectures that simultaneously enhance electronic and thermal transport. In this study, we develop a carbonized hollow fiber-based hybrid conductor to overcome these limitations. Using a custom-designed nozzle for dry-jet wet spinning, PAN/PMMA composite fibers were fabricated, where PMMA served as a sacrificial component to generate a uniform hollow structure upon carbonization. The resulting carbonized hollow PAN fibers provide a lightweight and mechanically robust scaffold. Copper was subsequently electrodeposited within the lumen to form a conformal metallic core, followed by the formation of a conductive carbon layer on the Cu surface. The carbon layer introduces additional conductive pathways for electron transport while acting as an effective thermal-spreading layer to mitigate resistive heating under high current densities. Structural characterization confirms uniform Cu deposition and continuous carbon coverage. Transport measurements demonstrate enhanced electrical conductivity and reduced thermal resistance compared with conventional Cu fibers. Beyond power transmission, the carbon-copper hybrid structure also enables sensitive surface charge interactions, making it suitable for volatile organic compound (VOC) gas-sensing applications. This work presents a scalable strategy for engineering carbon-copper hybrid conductors supported by carbonized hollow fibers, offering a promising route toward reducing transmission losses while extending functionality to sensing applications in advanced electronic systems.

Speaker: Daniel Hallinan

Title: ***Polymer Vignettes – Blends for Batteries, Critical Ion Separations, and Preceramic Grafted Nanoparticles***

Abstract:

This talk will cover three vignettes on active research projects in my group.

The first is a collaborative work with FSU Chemistry and ORNL, studying blends of charged and polar polymers as soft single-ion conductors for lithium batteries. We have studied a precise polystyrene analogue made by ring opening 4-phenylpentene in two ionic forms: sulfonate (S) and trifluoromethylsulfonimide (TFSI). The polyanions were blended with poly(ethylene oxide) (PEO) in various proportions and miscibility characterized via thermal, optical, and electrochemical properties. Phase behavior was predicted by a field theory developed for such blends, and a record-setting, soft, single-ion conductor was found.

In the second vignette, I will review our recent report regarding ion selectivity of commercially available polyelectrolyte membranes (Nafion and Aquivion). In this work, we found that ion permeability and conductivity have strong dependence on water content, so much so that a reversal was observed in the selectivity of the membranes for lithium over sodium ions. Water content was controlled via processing: as-received membranes were lithium selective, while pretreated membranes with high water content were sodium selective. This was thought to be due to water screening ion-membrane interactions.

The final vignette will cover a fundamental study on a model preceramic system: poly(dimethyl siloxane) (PDMS) grafted to silica nanoparticles. In this work, we observed dramatic dependence of rheological properties on the grafting density of the polymer grafted nanoparticles (PGNs). With decreasing grafting

density, chains were more able to interpenetrate causing a transition from a simple fluid at high grafting density to a viscoelastic solid at low grafting density. The solid behavior was surprising because the PDMS was well below its entanglement molecular weight, but the results align with a report on another chemistry in which the grafts were just above entanglement molecular weight.

Speaker: Jason Locklin

Title: ***Polymer Chemistry and Engineering at the University of Georgia***

Abstract:

In this talk, I will highlight the work of myself and several other faculty in the field of polymer science and engineering at UGA. This includes fundamental research, work in the NSF IUCRC: Center for Bioplastics and Biocomposites, and industry funded projects.

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Speaker: Chathurika J. Kosgallana

Title: ***Structure and Organization of Enzymes at Hydrated Chitosan Interfaces Revealed by Neutron and X-ray Reflectometry***

Abstract:

Chitosan is a biocompatible polysaccharide capable of forming hydrated thin films, making it an attractive platform for enzyme immobilization at soft interfaces. Carbonic anhydrase (CA) catalyzes the hydration of CO₂ to bicarbonate and is of interest for applications in carbon capture and biocatalysis. Understanding how the hydrated structure of chitosan influences protein organization at the polymer interface is essential for designing functional enzyme-immobilization platforms, yet remains challenging because of the diffuse and highly hydrated nature of these systems. In this work, we investigate the adsorption and interfacial organization of CA on highly deacetylated chitosan thin films using neutron reflectometry (NR) and X-ray reflectometry (XRR), complemented by ellipsometry and quartz crystal microbalance with dissipation (QCM-D). Reflectometry provides nanometer-scale resolution of interfacial structure, with neutron scattering offering sensitivity to isotopic composition and X-ray reflectometry providing complementary electron-density profiles. To enhance contrast between the enzyme and polymer matrix in NR measurements, deuterated CA was employed, enabling direct characterization of the protein distribution within the hydrated chitosan layer. Ellipsometry and QCM-D were used to characterize film formation and adsorption behavior, while multi-contrast NR measurements on the same interface were used to constrain structural models. XRR provided complementary structural information and helped validate film thickness and density profiles. Preliminary combined neutron and X-ray reflectometry analysis indicates substantial swelling of the chitosan film under hydrated conditions. The reflectivity profiles are consistent with a distributed protein-containing region within the swollen polymer layer, suggesting that enzyme adsorption is coupled to the hydrated structure of the chitosan interface. These results demonstrate how isotopic labeling combined with complementary neutron and X-ray reflectometry can resolve polymer-protein organization at hydrated soft interfaces and provide structural insight relevant to the design of functional chitosan-based materials.

Speaker: Qixuan Xiang

Title: ***Programming Internal Interfaces by Image-Guided Multimaterial Direct Ink Writing for Biointerfaces and Anisotropic Carbon Devices***

Abstract:

Precise control over internal material interfaces is essential for translating multimaterial additive manufacturing into functional biological and electronic systems, yet conventional extrusion-based printing remains largely constrained by nozzle-defined feature sizes and empirical process optimization. Here, we present an image-guided multimaterial direct ink writing (MDIW) strategy that combines hierarchical stream multiplication with predictive process optimization to program PAN/PAN-CNT lamellar architectures across multiple length scales. A video-based computational framework integrates spatiotemporal image segmentation, morphology-based printability quantification, and Gaussian-process optimization to establish processing conditions for high-fidelity multilayer formation. Using this approach, continuously printed architectures with internal features as small as approximately $3.4\ \mu\text{m}$ were achieved while retaining macroscopic processing throughput. More importantly, the programmed interfaces provide distinct functional states: before carbonization, lamellar spacing regulates cell localization and mechanobiological responses, whereas thermal conversion transforms the same architecture into anisotropic conductive carbon networks capable of rapid Joule heating to above $1300\ ^\circ\text{C}$. These results establish a processing-architecture-function framework in which image-guided optimization governs structural fidelity and programmed interface spacing directs application-specific biological and electrothermal functionality.

Speaker: Sivakumar Irla

Title: ***Liquid Crystal Elastomers with Covalently Incorporated Ionic Segments for Multifunctional Electromechanical Applications***

Abstract:

Multifunctional liquid crystal elastomers (LCEs) that integrate thermomechanical actuation with electrical responsiveness offer promising opportunities for soft active materials and electromechanical applications. However, incorporating ionic functionality into LCE networks can disrupt liquid-crystalline organization and affect their mechanical and electromechanical properties. Previous ionene LCE systems synthesized in our laboratory via a one-pot thiol-acrylate approach relied on relatively low ionic content in the elastomer backbone and exhibited electrical instability due to the leaching of non-covalently bound ionic species from the polymer matrix, limiting their potential for electromechanical applications.

Here, we investigate an alternative strategy for covalently incorporating higher ionic content into the polymer backbone through a two-step process. Diallylimidazolium (IM) and 2,2'-(ethylenedioxy)diethanethiol (EDDT) were first reacted via UV-initiated thiol-ene polymerization to form ionic prepolymer chains, followed by incorporation of RM82 during secondary network formation to produce ionically modified LCE films. Varying the RM82:EDDT ratios resulted in a broad range of mechanical stiffness and extensibility, with several formulations exhibiting substantial thermomechanical strain and work output under applied load. Ionic liquid (IL) doping further enhanced ion mobility, increasing the electrical conductivity by two to three orders of magnitude while maintaining mechanical compliance. An optimal formulation was identified that provided a favorable balance of mechanical properties, thermomechanical response, and electrical conductivity, highlighting the potential of covalent ionic incorporation for developing multifunctional LCE networks.

Speaker: Anisur Rahman

Title: ***Upcycling Consumer Plastic Waste into High-Performance Multifunctional Materials***

Abstract:

The growing accumulation of consumer plastic waste demands strategies that move beyond conventional recycling to recover its chemical value and create higher-performance materials. Here, we present a versatile upcycling approach that transforms post-consumer polyethylene terephthalate (PET) into functional macromonomers for high-performance, multifunctional polymer networks. Through controlled depolymerization and molecular redesign, PET-derived building blocks are incorporated into dynamic covalent networks that combine strong mechanical performance with repairability, reprocessability, and chemical recyclability. This platform enables diverse material applications, including tough reversible adhesives, shape-memory polymers, and recyclable carbon-fiber-reinforced composites. The resulting adhesives exhibit strong bonding to multiple substrates, retain performance underwater and under harsh conditions, and can be thermally debonded, repaired, and rebonded. Incorporation of bio-derived functional building blocks further provides intrinsic flame retardancy and programmable shape-memory behavior while maintaining robust fiber-matrix adhesion in composite systems. At the end of their service life, these dynamically crosslinked materials can be mechanically reprocessed or chemically deconstructed to recover valuable constituents. By integrating waste-derived feedstocks, dynamic polymer chemistry, and application-driven materials design, this work establishes a scalable pathway for converting consumer plastic waste into durable, repairable, and recyclable materials with value extending far beyond the original plastic.

Speaker: Shucong Li

Title: ***Air-permeable hydrogels through viscoelastic phase separation of aerogels***

Abstract:

Hydrogels are widely used in biomedical interfaces, in which effective gas exchange (for example, O₂, CO₂) within a water-rich environment is essential. However, hydrogels show intrinsically limited air exchange efficiency, owing to the low solubility (C) and diffusivity (D) of non-polar gases in the polar water medium¹. This limitation poses a substantial bottleneck in long-term applications, such as wearable health monitors and tissue engineering. Existing methods to enhance air permeability suffer from poor robustness and/or an inherent trade-off between permeability and water content (for example, <50 vol%). Here we introduce a viscoelastic phase separation (VPS)-enabled strategy to create a non-collapsible, air-rich network in high-water-content hydrogels, achieving a record-high oxygen permeability of 185 barrer with 70 vol% water—a tenfold increase compared with pristine hydrogels. VPS, a ubiquitous phenomenon in soft matter, is used to drive hydrophobic, dry gas particles within a hydrophilic, wet medium into a thin, stable three-dimensional network. This approach allows the facile and scalable fabrication of air-permeable hydrogels across diverse chemistries and form factors. Physiological tests over a 10-day continuous wear condition confirmed their effectiveness in preventing fluid accumulation and maintaining skin health. This strategy paves the way for hydrogels in long-term biomedical applications in which efficient and sustained air exchange becomes critical.

Speaker: Tomonori Saito

Title: ***Soft Matter Research at ORNL***

Abstract:

Oak Ridge National Laboratory (ORNL) conducts variety of soft matter research. In my presentation, I will cover some highlights of soft matter capability and research at ORNL. I will also discuss a snapshot of research results on precision depolymerization of polymers as well as understanding non-equilibrium states of multi-dynamic polymers.

Speaker: Scott Danielsen

Title: ***Post-Polymerization Modification and Upcycling of Aromatic Thermoplastics***

Abstract:

Aromatic thermoplastics derive their exceptional thermal, mechanical, and chemical stability from rigid aromatic backbones, which also render them difficult to chemically modify. Conventional post polymerization modification strategies often alter chain packing, crystallinity, and segmental dynamics, creating a long-standing tradeoff between introducing functionality and preserving polymer performance. Developing approaches that overcome this tradeoff would enable the transformation of commodity, engineering, and specialty plastics into higher-value functional materials while creating new opportunities to control polymer structure and properties. Gold-catalyzed hydroarylation provides a route to direct aromatic functionalization through the attachment of commercially available phenylacetylene derivatives. By controlling catalyst structure and alkyne electronics, competing crosslinking and homopolymerization pathways are suppressed, enabling the incorporation of diverse functional groups across polystyrene, polyethylene terephthalate, polysulfone, polyetherimide, and related aromatic polymers. Surprisingly, substantial levels of backbone functionalization are achieved while largely preserving glass-transition temperatures, thermal stability, rheological behavior, and mechanical performance. In semicrystalline materials, even more unexpected behavior emerges, with syndiotactic polystyrene retaining crystallinity at high levels of modification and polyethylene terephthalate exhibiting enhanced crystallization behavior following functionalization. These results suggest that direct aromatic post-polymerization modification can partially decouple chemical functionality from polymer structure and dynamics, establishing new opportunities for functional upcycling, crystallization engineering, and morphology control in aromatic thermoplastics.

Speaker: Brent Sumerlin

Title: ***Depolymerization as a Design Tool***

Abstract:

Our group has explored decarboxylation as a versatile strategy for polymer deconstruction, using carbon dioxide extrusion to generate reactive intermediates that promote chain cleavage, depolymerization, or architectural remodeling. By installing redox-active carboxylate derivatives at chain ends or as pendent groups, we can trigger carbon-centered radical formation through electrochemical or thermal activation. This approach provides a programmable handle for initiating unzipping reactions in vinyl polymers under comparatively mild conditions, moving beyond strategies that rely on weak end groups, high temperatures, or harsh reagents.

Building on this foundation, we show that depolymerization to volatile monomer can be repurposed as a constructive design strategy rather than only a recycling tool. By embedding depolymerizable domains within polymerization-induced microphase-separated block copolymers, we developed depolymerization etching of PIMS materials, or DEPIMS. In this platform, decarboxylation-triggered radical formation removes selected domains through monomer release while retaining the surrounding matrix, producing mesoporous materials

with high surface areas and tunable adsorption properties. This solvent-free process circumvents diffusion limits of solution-based etching, yields recoverable monomer, and connects fundamental deconstructive reactivity to the scalable fabrication of functional nanostructured polymers.

Speaker: Kirill Efimenko

Title: ***Establishing Design Rules for Catalytically Active Hydrogels: A "Capture, Degrade, and Release" Platform for Organophosphates***

Abstract:

Hydrogels offer a highly tunable, robust platform for addressing complex environmental challenges, particularly the remediation of persistent pollutants like organophosphate (OP) esters. The overarching goal of our research is to establish the fundamental regulation rules that govern hydrogel performance, specifically focusing on how the polymer microenvironment controls adsorption capacity, target selectivity, and adsorption kinetics.

To demonstrate these principles, we developed catalytically active hydrogel networks functionalized with two distinct catalysts: an imidazole derivative (APIm) and a molybdate complex. These tailored hydrogels are engineered to accomplish three sequential tasks: (1) actively capture targeted organophosphates from the surrounding environment, (2) catalytically degrade the toxins via hydrolysis, and (3) release the captured orthophosphate byproducts on demand.

By utilizing a polyethylenimine-crosslinked polymer matrix, the hydrogel acts as a highly specialized, localized micro-reactor. Crucially, these catalytically active systems exhibit a unique "self-buffering" capacity, allowing them to self-regulate the pH within the polymer matrix. This intrinsic buffering decouples the internal reaction conditions from the external environment, enabling the system to treat contaminated water across a significantly expanded pH range without losing efficacy. Beyond this environmental independence, the network dictates selectivity by enriching anionic OPs through targeted electrostatic interactions while actively rejecting the resulting cleaved degradation byproducts. Confining the catalysts within this tailored microenvironment, combined with the polymer backbone's inhibition of hydrogen bonding, significantly enhances reaction kinetics compared to bulk solution. Ultimately, establishing these structure-property rules provides a scalable, generalizable blueprint for designing efficient materials for environmental detoxification and resource recovery.

Speaker: Colleen Scott

Title: ***Structure/Property Relationship Governing Charge Transport in Polyaniline Derivatives***

Abstract:

Our group has established a collaborative research program focused on the design of conjugated polymers for optoelectronic applications, with an emphasis on overcoming the limitations of polyaniline (PANI). We have demonstrated that incorporating electron-rich heterocycles and fused-ring structures into the polymer backbone significantly enhances solubility and electrochemical stability while maintaining high electrical conductivity. In addition, our studies revealed that proton doping increases the amorphous character of these polymers without compromising charge transport. In this presentation, we will discuss how steric effects, backbone twisting, and electron-donating and electron-withdrawing substituents influence the redox properties and charge transport of these materials. We will also present our findings on the relationship between polymer structure and the formation and evolution of polaronic bands along the polymer backbone, providing new insights into the structure-property relationships that govern charge transport in conductive polymers.

Speaker: Christopher Li

Title: ***Network Solid Polymer Electrolytes for All-Solid-State Batteries***

Abstract:

Solid polymer electrolytes (SPEs), combining electrochemical functionality with mechanical integrity, are promising materials for a wide range of energy storage and harvesting applications. Their molecular architecture and mesoscale structure provide versatile opportunities to tailor ion transport, mechanical properties, and electrochemical behavior. This presentation focuses on how polymer morphology and network structure govern ion transport, metal electrodeposition, and dendrite formation in SPEs. We demonstrate that mechanical modulation of the internal electrolyte structure can significantly alter metal plating and dendrite growth. By systematically varying polymer architecture, network structure, and chemistry, we establish relationships among molecular design, ion transport, mechanical response, and electrodeposition behavior. These results provide insights into the coupled transport and mechanical processes that govern metal deposition in polymer electrolytes and offer design principles for developing safer and higher-performance solid-state batteries.

Speaker: Michael Schulz

Title: ***Thermodynamic Insights into the Interactions of Metal-Chelating Polymers with Rare Earth Elements in Solution***

Abstract:

Rare-earth elements (REEs: La–Lu, Y, and Sc) are essential components in numerous advanced technologies; however, global demand continues to surpass available supply. Metal-chelating polymers show substantial promise for selective REE extraction and separation, but effectively controlling the polymer–metal interaction remains challenging. To investigate the interplay between polymer structure and metal chelation, we synthesized a series of polymers with controlled variations in key structural parameters, including the chelating group, degree of polymerization, tacticity, and hydrophobicity. Using isothermal titration calorimetry, we quantified the binding affinity, enthalpy changes, heat capacity changes, and binding stoichiometry between these polymers and a range of REEs in solution, providing comprehensive thermodynamic profiles for each polymer–metal combination. Subsequent analysis of the hydration-shell and inner-sphere coordination environments revealed additional insights into how structural modifications impact polymer–lanthanide interactions. Ultimately, this structure–function information will guide the design of new materials that are increasingly effective for REE extraction and separation.

Speaker: Rana Ashkar

Title: ***Polymer–Membrane Hybrids: A Bioinspired Platform for Programmable Soft Materials***

Abstract:

Hybrid soft materials that combine the adaptive architecture of biological systems with the tunability of synthetic components offer new opportunities for designing responsive and multifunctional materials. Specifically, coupling polymers with lipid membranes—the structural scaffold of cells—provides a versatile platform for controlling material structure, mechanics, dynamics, and interactions across multiple length scales. Such polymer–membrane hybrids can leverage the reconfigurability and responsiveness of biological membranes while introducing synthetic functionality and tunable interactions. This talk will highlight our efforts to establish polymer–membrane coupling as a design principle for engineering next-generation soft materials with programmable and adaptive behavior. By establishing relationships between polymer–membrane interactions and emergent material properties, we seek to develop design rules for soft materials

with programmable morphology and function. These systems have significant implications for emerging technologies such as artificial cells, drug delivery, and nanorobotics.

Speaker: George Degen

Title: ***Mussels, mucus, and mouthfeel***

Abstract:

Mucus dictates the health and function of epithelial surfaces, from preventing infection to mediating the perception of foods and beverages. The beneficial properties of mucus stem from bioactive, cysteine-rich proteins called mucins, motivating research on mucin-derived hydrogels for biomedical applications, as well as on the interactions of salivary mucins with food components critical to oral food perception. Here, I present two research thrusts investigating the interactions of mucin proteins at interfaces. I first show that a previously overlooked mechanism of marine mussel adhesion can be used to drive gelation and adhesion of purified mucins, yielding bioactive hydrogels with tissue adhesive and antifouling properties. I then demonstrate that sweet proteins alter the friction of salivary films, with implications for the mouthfeel of beverages containing alternative sweeteners. The results highlight the potential of engineering mucin interfaces for diverse applications in biomedicine and food science.

Speaker: Adrian Figg

Title: ***Agentic Design of Protein-Targeting Acrylic Oligomers: Molecular Design and High-throughput Synthesis***

Abstract:

Random hetero oligomers (RHOs) are promising polymeric materials to target proteins of interest. RHOs are designed by analyzing the chemical composition of the target protein surface and developing monomer combinations with complementary interactions. Recent work from our lab has shown that RHOs can modulate the function of green fluorescent protein (GFP) through sub-micromolar binding interactions. However, because of the expansive library of available acrylic monomers, developing design criteria for RHOs requires significant synthetic effort. This talk will discuss recent work automating the synthesis of 1056 RHOs and analyzing their interactions with GFP using the facilities at BioPacific MIP. From this work, we identified novel RHO compositions that showed improved interactions and gain-of-function modulation of GFP. Finally, we incorporated these data into an artificial intelligence/machine learning (AI/ML) platform to identify global design criteria of RHOs and predict additional novel monomers for RHOs. Overall, we will highlight the impact of automated high-throughput synthesis and AI/ML on discovering novel polymeric protein binders.