



APT TEC

8th Annual Research Symposium
November 6 and 7, 2020

Virtual Program

Hosted by



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The APTEC Team

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Samuel Bliesner (Albert Group)
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McKenna Redding (Grayson Group)
Ashley Miles (Grayson Group)
Brennan Curole (Grayson Group)
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Gather Map



Navigating the Gather Platform

Welcome to the [2020 APTEC Gather Space!](#)

Room	What it is for
Poster Rooms (1 - 5)	Poster Sessions
Keynote Room	Keynote Talks, Lightning Round, Career Panel
Presentation Room 1	Student Talks I.A and Student Talks II.A
Presentation Room 2	Student Talks I.B and Student Talks II.B
Front Desk	Check-in, Info
Lounge	Breaks and Networking Session
APTEC Board Room	APTEC Board Meeting



Functionality	What it is for
1	Customize your character
2	For makers only
3	Mini Map
4	Choose your interaction distance
5	Share your screen
6	Raise your hand
7	Set your availability
8	More Settings (AUDIO and VIDEO)

Watch our instructional video [HERE](#) for more details on how to navigate the Gather Platform.

PS.: This is an example video, the space you will find during the Conference might not be the exact same.

Conference Schedule

Friday Nov 6 (7:45 AM - 12:35 PM CST)		
7:45 - 8:00	Check-in	@ Front Desk
8:00 - 8:10	Welcome/Intro	@ Keynote Room
8:10 - 8:40	Keynote: Dr. Karen Wooley	@ Keynote Room
8:40 - 9:20	Lightning Round	@ Keynote Room
9:20 - 9:30	Break	
9:30 - 11:00	Student Talks I (A and B)	@ Presentation Rooms
11:00 - 12:00	Poster Session I	@ Poster Rooms 1-3
12:00 - 12:30	Keynote: Dr. H. N. Cheng	@ Keynote Room
12:30 - 12:35	End of Day 1	@ Keynote Room
Saturday Nov 7 (8:00 AM - 1:30 PM CST)		
8:00 - 8:10	Welcome Day 2	@ Keynote Room
8:10 - 9:10	Poster Session II	@ Poster Rooms 4-5
9:10 - 9:20	Break	
9:20 - 10:50	Student Talks II (A and B)	@ Presentation Rooms
10:50 - 11:00	Break	
11:00 - 12:00	Career Panel	@ Keynote Room
12:00 - 1:30	Networking Session	@ Keynote Room
12:00 - 1:00	APTEC Board Meeting	@ APTEC Board Room

PS.: ALL times in US Central Standard Time (CST).

Keynote Talks



Dr. Karen L. Wooley (Nov 6 - 8:10 AM CST @ Keynote Room)
Texas A&M

[Synthetic Strategies by Which to Afford Natural Product-based Polymers Materials: Impacts on Sustainability, Life, Health and the Environment](#)

A primary interest in the Wooley laboratory is the production of functional polymers from renewable sources that are capable of reverting to those natural products once their purpose has been served. This holistic life cycle approach is of importance from the perspectives of sustainable sourcing of materials feedstocks, creating mechanisms for dealing with the breakdown products from polymer compositions, structures and properties at the same time that the functional performance application is defined, and also the need to address the increasing accumulation and associated hazards of plastic pollution from the environmental persistence of non-degradable polymer systems. Moreover, the inherent stereochemical and functional diversities of natural products provide opportunities to expand the scopes, complexities and properties of polymer materials, by utilizing fundamental synthetic organic chemistry approaches. This presentation will highlight synthetic strategies for the development of polymers, block polymers and crosslinked network materials, which can be produced by relatively simple approaches from glucose,¹ quinic acid,² honokiol,³ thymide,⁴ or other complex polyhydroxyl natural products and can be made to exhibit a range of properties. Examples will highlight contributions that polymer chemistry can make toward bulk technological materials that are capable of impacting global needs, such as water-food-energy-health, and the grand challenges that must be solved in the coming decade.

Dr. H. N. Cheng (Nov 6 - 12 PM CST @ Keynote Room)
ACS President-Elect

[Prospects and Opportunities in Chemistry](#)

I am honored to serve as ACS President-Elect in 2020. For many of us, chemistry is a wonderful profession, a central science that covers a broad range of theoretical, experimental, synthetic, and analytical topics, and its principles underlie the fundamental aspects of not only chemistry, but biology, medicine, agriculture, and materials. In this talk, I shall use several recent developments to build a picture of future prospects and opportunities in chemistry – a field that cuts across interdisciplinary boundaries and traditional dimensions. In fact, the solution of the grand challenges of today (e.g., medicine, food, energy, environment, climate change, clean air and water, and population growth) needs the skills and the participation of chemists and chemical engineers. These trends fit well with the theme of “Growth, Collaboration, and Advocacy”, which is my focus for next year. I look forward to working with all of you during my year as ACS President in 2021.



¹ (a) Mikami, K.; Lonckecker, A. T.; Lim, Y. H.; Felder, S. E.; Besset, C. J.; Wooley, K. L. "Four Different Regioisomeric Polycarbonates Derived from One Natural Product, D-Glucose", *Macromolecules*, **2016**, *49*(20), 7857-7867, DOI: 10.1021/acs.macromol.6b00591. (c) Su, L.; Khan, S.; Fan, J.; Lin, Y.-N.; Wang, H.; Gustafson, T. P.; Zhang, F.; Wooley, K. L. "Functional sugar-based polymers and nanostructures comprised of degradable poly(D-glucose carbonate)s", *Polym. Chem.*, **2017**, *8*, 1699-1707, DOI: 10.1039/C6PY01978A. (d) Song, Y.; Ji, X.; Dong, M.; Li, R.; Lin, Y.-N.; Wang, H.; Wooley, K. L. "Advancing the Development of Highly-functionalizable Glucose-based Polycarbonates by Tuning of the Glass Transition Temperature", *J. Am. Chem. Soc.*, **2018**, *140*(47), 16053-16057, DOI: 10.1021/jacs.8b10675. (e) Felder, S. E.; Redding, M.; Noel, A.; Grayson, S. M.; Wooley, K. L. "Organocatalyzed ROP of a Glucopyranoside Derived 5-Membered Cyclic Carbonate", *Macromolecules*, **2018**, *51*(5), 1787-1797, DOI: 10.1021/acs.macromol.7b01785. (f) Osumi, S.; Felder, S. E.; Wang, H.; Lin, Y.-N.; Dong, M.; Wooley, K. L. "Construction of nanostructures in aqueous solution from amphiphilic glucose-derived polycarbonates", *J. Polym. Sci., Part A: Polym. Chem.*, **2019**, *57*, 432-440, DOI: 10.1002/pola.29229. ² (a) Besset, C. J.; Lonckecker, A. T.; Streff, J. M.; Wooley, K. L. "Polycarbonates from the Polyhydroxy Natural Product Quinic Acid", *Biomacromolecules*, **2011**, *12*(7), 2512-2517, DOI: 10.1021/bm2003048. (b) Link, L. A.; Lonckecker, A. T.; Hearon, K.; Raymond, J. E.; Maitland, D. J.; Wooley, K. L. "Photo-crosslinked Poly(thioether-co-carbonate) Networks Derived from the Natural Product Quinic Acid", *ACS Appl. Mater. Interfaces*, **2014**, *6*(20), 17370-17375, DOI: 10.1021/am506087e. ³ Wacker, K. T.; Kristufek, S. L.; Lim, S.-M.; Kahn, S.; Wooley, K. L. "Bio-based Polycarbonates Derived from the Neolignan Honokiol", *RSC Advances*, **2016**, *6*, 81672-81679, DOI: 10.1039/C6RA19568G. ⁴ (a) Tsao, Y.-Y.; Wooley, K. L. "Synthetic, Functional Thymidine-Derived Polydeoxyribonucleotide Analogues from a Six-Membered Cyclic Phosphoester", *J. Am. Chem. Soc.*, **2017**, *139*(15), 5467-5473, DOI: 10.1021/jacs.7b01116. (b) Tsao, Y.-Y.; Smith, T. H.; Wooley, K. L. "Regioisomeric Preference in Ring-opening Polymerization of 3',5' Cyclic Phosphoesters of Functional Thymidine DNA Analogues", *ACS Macro Lett.*, **2018**, *7*, 153-158, DOI: 10.1021/acsmacrolett.7b00858.

Lightning Round

Nov 6 – 8:40 to 9:20 AM (CST) @ Keynote Room

Student	Advisor	Affiliation
Amanda J Kennell MS	Andrei Stanishevsky	University of Alabama in Birmingham
Eric R. King	Jason D. Azoulay	University of Southern Mississippi
Travis Laws	Gila E. Stein	University of Tennessee-Knoxville
Jorge Alfonso Belgodere	Jangwook P. Jung	Louisiana State University
Christopher Bottoms	Gila E. Stein and Manolis Doxastakis	University of Tennessee-Knoxville
Karthika Madathil	Gila E. Stein	University of Tennessee-Knoxville
Jonathan P. Coote	Gila E. Stein	University of Tennessee-Knoxville
Raman Hlushko	Svetlana Sukhishvili	Texas A&M University
Karina Reynolds	Sergei Nazarenko	University of Southern Mississippi
Chathuranga Rathnamalala	Colleen N. Scott	Mississippi State University
Alexander Fortenberry	Zhe Qiang	University of Southern Mississippi

Oral Presentations

Student Talks I.A

Nov 6 – 9:30 to 11 AM CST @ Presentation Room 1 (or [HERE](#))

09:30

Gold Catalyzed Direct C–H Activation Polymerization for the Synthesis of Aromatic Polymers

Eric R. King, University of Southern Mississippi

Homogeneous gold complexes have exhibited widespread utility in contemporary organic chemistry; however, their application in polymer synthesis remains rare. We have demonstrated the first catalytic application of Au complexes toward the copolymerization of alkyne-containing comonomers and heteroarene substrates. Polymerizations proceed through successive intermolecular hydroarylation reactions to give high molecular weight aromatic copolymers with 1,1-disubstituted alkene backbone linkages. Correlations between the rate and degree of polymerization were established based on reaction design. The polymerizations proceed with remarkable efficiency and exceptional degrees of polymerization (DP > 1000). The reactivity is broad in scope, enabling the copolymerization of highly functionalized aromatic and aliphatic monomers, producing unique macromolecular structures. These results highlight the untapped utility of Au in the design of new macromolecular chemistries.

09:50

Self-healing Polymer Composites for Stereolithography (SLA) 3D printing

Vinita V. Shinde, Auburn University

SLA 3D printed components typically show poor mechanical strength due to brittle fracture behavior of thermoset polymers, leading to increased potential for material damage during fabrication and use. Additionally, many of the polymer material options for 3D printing are not intrinsically recyclable, requiring disposal if they suffer any damage which increases environmental waste through premature end of their useful life. The attraction of this method is not only reduction of polymer waste and extension of usable life, but also the ability to fabricate parts with superior reliability, particularly for application in medical implants and prototypes in space where damage detection is difficult and repair is costly or impossible. Here, we aim to improve the lifetimes of 3D printed polymeric objects through the incorporation of self-healing properties. Inspired by biological self-healing, in which a damage event triggers an autonomic healing response, microcapsules containing healing agents can be embedded into a host material. During a damage event these microcapsules rupture, release the healing agent and heal the surrounding material by polymerization, entanglement or cross-linking. Microcapsules are incorporated into the host polymer matrix to create 3D printed objects capable of self-healing. Microcapsule survivability and self-healing properties after 3D printing are evaluated via examination of the healing efficiency and mechanical properties of the 3D printed objects.

10:10 **Efficacy of Zinc Salts as Flame Retardant Additives for Epoxy Amine Networks**

Karina Reynolds, University of Southern Mississippi

While polymeric materials have found uses in a wide variety of applications, their poor flame-retardant properties impede continued growth. With new health and safety legislature, the importance of investigating environmentally friendly and non-toxic flame retardants (FRs) is higher than ever. While halogenated FRs are being phased out, metal hydroxides have become of interest. Due to their intumescent FR behavior and water release upon degradation, these FR additives show great promise. However, the high loading necessary to accomplish notable improvements in flammability lead to a significant decrease in mechanical properties. While some zinc salts, such as zinc borate and zinc hydroxystannate have been used as synergists with existing FR additives, the full potential of zinc salts is yet to be realized. Here, a new class of FR additives based on zinc organic salts was investigated to determine the efficacy as the sole FR additive. We investigated zinc organic salts in epoxy amine networks (EANs) and studied FR behavior via Cone Calorimetry. The miscibility of the salts was investigated via XRD and found to greatly impact the FR behavior of the overall network. Zinc acrylate was further investigated. Zinc acrylate was investigated incorporated within the network and as a small additive and was found to outperform traditional FR additives for epoxy-amine networks similar additive concentrations.

10:30 **A Bottom-Up Approach to Assess the Molecular Structure of Aqueous Poly(N-Isopropylacrylamide) at Room Temperature via Infrared Spectroscopy**

Habtom Gobeze, Louisiana State University

Poly(N-isopropylacrylamide) (PNIPAM) is a thermo-responsive polymer which has numerous applications in the areas of textile, biomaterials, and drug delivery. Though the phase transition behavior of PNIPAM in water has been known for a long time, its structure in solution is still an unresolved topic. Here, we investigated the structure of PNIPAM in water with a bottom-up approach using the monomer, dimer, and trimer as models and using a combination of IR spectroscopies, including linear FTIR and two dimensional (2D) IR, along with theoretical studies (molecular dynamics (MD) simulations). 2DIR spectroscopy is an important tool which can provide bond specific structural and dynamical information with a fast resolution of subpicosecond time scale. Our MD simulation results show, the oligomers have distinct backbone conformation in solution due to a vibrational coupling between neighboring amides. These conformers have distinct IR signatures expressed in the amide I bands of the oligomers as revealed by the FTIR and 2D IR studies. The bottom-up approach allowed us to infer that such backbone conformations also exist in PNIPAM as it reveals the same IR signatures. The proposed molecular model successfully describes PNIPAM amide I band changes with temperature in terms of its molecular structure. This new model strongly suggests that PNIPAM does not have a completely random backbone structure, but distinct backbone conformers between neighboring amides.

Oral Presentations

Student Talks I.B

Nov 6 - 9:30 to 11 AM CST @ Presentation Room 2 (or [HERE](#))

09:30

Surface-Induced Ordering Depresses Through-Film Ionic Conductivity in Lamellar Block Copolymer Electrolytes

Jonathan P. Coote, University of Tennessee

Lamellar block copolymers based on polymeric ionic liquids (PILs) show promise as electrolytes in electrochemical devices but often display structural anisotropy that depresses the through-film ionic conductivity. This work hypothesizes that structural anisotropy is a consequence of surface-induced ordering, where preferential adsorption of one block at the electrode drives a short-range stacking of the lamellae. This point was examined with lamellar diblock copolymers of polystyrene (PS) and an acrylate-based PIL. The bulk PS-PIL structure was comprised of randomly oriented lamellar grains. However, in thin PS-PIL films (100–400 nm), the lamellae were stacked normal to the plane of the film and surface relief structures were formed when the as-prepared film thickness was incommensurate with the natural lamellar periodicity. Both of these attributes are well-known consequences of preferential wetting at surfaces. The ionic conductivity of thick PS-PIL films (50–100 μm) was approximately 20x higher in the in-plane direction than in the through-plane direction, consistent with a mixed structure comprised of randomly oriented lamellae throughout the interior of the film and highly oriented lamellae at the electrode surface.

09:50

Easy to pattern, chemically resistant 1-dimensional polymer photonics

Mark Robertson, University of Southern Mississippi

1-dimensional photonic crystals (PCs) reflect electromagnetic waves at certain wavelengths by manipulating light propagation through periodic dielectric layers with mismatched refractive indices. While many systems using polymers and/or inorganics have been developed to fabricate PCs, challenges remain to create a robust PC that is stable under harsh chemical environments. Furthermore, patterning PCs to provide spatial control of reflected light often requires additional processing steps that can be complex and time-consuming. Herein, we demonstrate a relatively simple and scalable approach to fabricate chemically resistant PCs from two cheap commercially available materials, poly(vinylidene fluoride-co-chlorotrifluoroethylene) (PVDF-CTFE) and phenolic resin (resol), which naturally have a high refractive index difference ($\Delta n \approx 0.3$). The Bragg peak of the PCs is controlled across the spectrum of visible light by simply adjusting the substrate moving velocity during dip-coating. These PCs can exhibit high stability when exposed to various organic solvents, acid, and base aqueous solutions. Moreover, different hydrophobicity between the layers offers an easy-to-pattern approach for these PCs by using a PDMS pad to spatially control the wettability of PVDF-CTFE and direct the casting of the resol layer during sequential depositions. We believe this work provides a facile approach to fabricate patterned PCs with customizable reflecting behavior and excellent chemical stability.

10:10 **Crosslinked Conductive Polymer Thin Film Electrode for Microbial Bioelectronics**

Chia-Ping Tseng, Rice University

Microbial bioelectrochemical systems (BESs) play crucial roles in vast applications including electricity generation, chemical synthesis, and health monitoring. Electrodes within the BESs bridge the biology and electronic worlds and govern biotic-abiotic communication and device performance. Conductive polymers, especially poly(3,4-ethylenedioxythiophene)-poly(styrenesulfonate) (PEDOT:PSS), have been applied as electrodes in diverse bioelectronics such as wearable device, implantable device, and brain-machine interface. Due to its great conductivity, mechanical property, and biocompatibility, recent studies have employed PEDOT:PSS to interface with and encapsulate living microbes to achieve high current density, but prior work did not fully study the microbe-material interaction and biofilm formation on PEDOT electrodes. Here, we developed a photocrosslinking method to create PEDOT thin films for the growth and immobilization of exoelectrogenic microbes. The thin-film electrode was prepared by mixing and crosslinking PEDOT:PSS with 2-hydroxyethyl acrylate under UV light. The crosslinked film was a conductive, water-insoluble, swellable network that allowed for the adhesion of *Shewanella oneidensis*. Microbe viability and attachment to the coated electrodes were excellent, and the thin film greatly enhanced current density when compared to plain electrodes. Our work shows an approach for studying the microbe immobilization and biofilm formation on polymer thin-film electrode.

10:30 **Exploring Degradation as a Viable End-of-Life Process for Thermoset Polymers**

Minjie Shen, University of Houston

There is a great need to recycle polymers to minimize their environmental impact, as the majority of produced polymers end up in landfills after their useful lifetime. Thermoset polymers normally require harsh degradation conditions due to their highly crosslinked structures. We have explored the incorporation of cleavable hydrolytic linkages into the crosslinked network, to determine if thermoset polymers can be also degraded under benign conditions. Epoxy resins are thermoset polymers widely used in composites, coatings and adhesives. The standard precursor to epoxy resins, the diglycidyl ether of bisphenol A (DGEBA), is derived from petroleum and lacks functional groups that can promote degradation under benign conditions. Epoxidized vegetable oils and vanillic acid containing ester linkages, were investigated as sustainable sources to produce degradable epoxy resins. The vanillic acid-based epoxy resins exhibited comparable thermal and mechanical properties to DGEBA-based epoxy resins. The accelerated hydrolytic degradation behavior of the ester-containing epoxy resins was explored, through monitoring of the polymer mass loss after exposure to both basic and acidic solutions at moderate temperatures. Various factors which affected the degradation rates were discussed. Two degradation models were proposed to describe the degradation behavior and the mechanism was surface erosion and bulk erosion through ester hydrolysis in basic media and acidic media, respectively.

Oral Presentations

Student Talks II.A

Nov 7 – 9:20 to 10:50 AM CST @ Presentation Room 1 (or [HERE](#))

09:20

A facile approach to prepare polymers with reversible linear-cyclic topologies using an anthracene-functionalized RAFT agent
Alexander Fortenberry, University of Southern Mississippi

Cyclic polymers exhibit unique properties when compared to their linear counterparts, like reduced hydrodynamic volumes, and different glass transition temperatures. However, the preparation of cyclic polymers can involve multiple synthetic and purification steps, which is potentially complex. Herein, we develop an easy approach for preparing cyclic polymers. A commercial chain transfer agent for reversible-addition fragmentation chain transfer polymerization is first functionalized with anthracene groups, and is then used to prepare polymers with terminal anthracene groups. This method is demonstrated by using polystyrene and poly(methyl acrylate) as model systems, whereby the polymers can be cyclized in their crude reaction solutions (after dilution) via intramolecular dimerization of anthracene end groups through UV irradiation. The cyclization of polymer chains are confirmed by gel permeation chromatography, UV-vis and nuclear magnetic resonance spectroscopy. Furthermore, we demonstrate that cyclic block copolymers can be prepared using this method by cyclization of linear block copolymers. Finally, these polymers exhibit a reversible nature between cyclic and linear states, which can be triggered by light or heat. We believe this approach can be generalized as an easy way to prepare polymers that are capable of altering their chain topology and material properties upon exposure to light or heat.

09:40

Difunctional polyvinylmethylsiloxane (PVMS) synthesis via anionic polymerization
Md Fakar Uddin, Tulane University

Two anionic synthesis schemes for preparing difunctional PVMS were investigated. In the first scheme, α,ω -bromo-PVMS was initiated by lithiated-diphenylsilane and terminated with 4-bromobutyldimethylchlorosilane (bromo-silane). Limited solubility of lithiated-diphenylsilane in tetrahydrofuran (THF) resulted in a mixture of difunctional and monofunctional PVMS. Switching to a benzene/THF cosolvent improved solubility and resulted in pure α,ω -bromo-PVMS (PDI<1.30, 25% yield) as assessed by ¹H-NMR. In the second scheme, trimethylsilane-protected α -alkyne- ω -bromo-PVMS (TMS-alkyne-PVMS-Br) was initiated by trimethylsilylethynylphenyllithium and terminated with bromo-silane. Lithiation in THF resulted in mostly t-BuLi initiated PVMS, but switching to benzene yielded TMS-alkyne-PVMS-Br (85% purity, PDI<1.13, 60% yield). However, TMS deprotection degraded the polymer.

10:00 **Forcing single-chain nanoparticle collapse through hydrophobic solvent interactions in comb copolymers**

Logan D. Dugas, University of Southern Mississippi

Single-chain nanoparticles (SCNPs) are a subclass of functional polymeric materials that exhibit great potential as protein mimetics and multifunctional nanoreactors. We present a novel synthetic strategy by which comb copolymers with aliphatic side chains exhibited a forced collapse into SCNPs under ultraviolet (UV) irradiation. Ring-opening metathesis polymerization (ROMP) of oxanorbornene-terminated polyisobutylene (oNBMIPIB) macromonomer and norbornene anthracene (NB-An) monomer provided access to PNB-An-co-PoNBMIPIB comb copolymers loaded with 12 and 32 mol % anthracene. Comonomers were selected due to disparate solvophilicity of oNBMIPIB and NB-An in n-hexane. Upon sequential photodimerization of comb copolymers, first in THF and then in THF/n-hexane 50/50 (v/v), selective solvophobicity of the small molecule comonomer drove intrachain crosslinking which corresponded to a substantial decrease in the hydrodynamic radius (RH). By modulation of the THF/n-hexane solvent ratio, the total conversion of anthracene dimerization was driven to ca. 75% and 86% over two irradiations, respectively. This work highlights the drastic effects preferential solvation has in driving the formation of SCNPs, further expanding the synthetic toolbox by which multicompartmental and multifunctional nanoreactors might be realized.

10:20 **Polymer Dispersity Affects Conformation of Brushes Grafted on Nanoparticles**

Tzu-Han Li, University of Houston

The efficacy of polymer brushes in applications such as drug delivery, reinforced composites, and water filtration membrane, depends, in part, on brush conformation. Although the parameters to control brush conformation such as grafting density and brush length have been well-studied, the effect of dispersity \mathcal{D} (i.e. the breadth of the molecular weight distribution) on brush conformation remains underexplored. Here, we show that the effect of \mathcal{D} on brush conformation and pH-responsive behavior on brush length depends on brush molecular weight. We synthesized poly(tert-butyl acrylate) PtBA grafted silica nanoparticles with variation in \mathcal{D} by atom transfer radical polymerization in the presence of a chain terminating agent. The brush lengths (as assessed by using dynamic light scattering) as a function of weight-average degree of polymerization could be collapsed onto a master curve with varying \mathcal{D} , for brushes of length greater than 27 nm. By contrast, for shorter brushes, the high- \mathcal{D} brushes were up to twice as thick as the low- \mathcal{D} brushes. We also demonstrated that the pH-responsive behavior in lengths of long poly(acrylic acid) PAA brushes was similar and independent of \mathcal{D} , but, for shorter PAA brushes, the pH-responses of brush length were dependent on \mathcal{D} . Variation in brush length, originated from changes of brush conformation, and in stimuli-responsive behavior as controlled by \mathcal{D} can be leveraged to improve dispersion in the complex media.

Oral Presentations

Student Talks II.B

Nov 7 – 9:20 to 10:50 AM CST @ Presentation Room 2 (or [HERE](#))

09:20

High-speed retraction behavior in a bioinspired stretchable hydrogel

Rosa Maria Badani Prado, Mississippi State University

Hydrogels have a wide range of applications, including in drug-delivery, biomedical field, and soft-robotics. Bioinspired hydrogels are an interesting class of hydrogels, and we have synthesized a gel inspired by resilin, an elastomeric biopolymer responsible for power amplified activities in biological species. These biological species utilize such power amplification for locomotion, feeding, and defense. Our gel is synthesized by a simple free-radical polymerization reaction-scheme and consists of polymerized hydrophilic acrylic acid and methacrylamide and hydrophobic poly(propylene glycol) diacrylate. We have obtained a gel with elastic modulus as high as 100 kPa, stretchability of 8.6, and resilience of 98%. When released from a stretched state, the gel achieves a high retraction velocity of 16 m/s with an acceleration of 4×10^3 m/s². By tuning the balance between hydrophilic and hydrophobic components, we obtain velocity and acceleration values comparable to those observed in many biological species during the power amplification process. By taking benefits of these gels' high resilience and stretchability, we have been able to launch projectiles over a long distance. Since the gels are stable in a saline environment, many applications can be envisioned, for example, developing undersea soft-robotics, prosthetics, and engineered devices where power amplification is desired.

09:40

Dynamics of Semiflexible Colloidal Filaments in Eccentric Time-Varying Magnetic Fields

Aldo Stefano Spatafora Salazar, Rice University

Chains of linked superparamagnetic particles actuated by time-varying magnetic fields exhibit diverse dynamical behaviors that depend on the field parameters and filament length. Their motion serves for the microscopic manipulation of fluids and as model systems of active polymers. These dynamics can be described by the competition between viscous and magnetic forces during chain actuation, represented by the dimensionless Mason number. However, current literature has focused mostly on actuation under symmetric (circular) time-varying fields of constant strength. Here, we explore novel filament dynamics by applying asymmetric (eccentric) time-varying fields, characterized by a nonconstant field strength. Under such circumstances the chains bend and stretch repeatedly because the relative importance between magnetic and viscous forces varies within a field period. During a period of eccentric field rotation, the chain dynamics showcase four distinct regimes of motion characterized by distinct morphological configurations of the chains. These regimes are described in terms of the Mason number, the phase lag angle between the chain and the instantaneous field direction, the Magnetoelastic number, and the total bending energy of the chain to elucidate the mechanism governing the configurational changes in the filaments. The extent of buckling in the bent configurations of the chains is affected by chain length, field frequency, and field ellipticity.

10:00

Endowing Polymer Thin Film Surfaces with Bactericidal and Antireflective Properties by the Protrusive Nanostructure

Ruwen Tan, University of Florida

Bacterial adhesion on the polymers leads to contamination and many infectious diseases, which is one of growing global concerns. Inspired by the natural, bactericidal nanostructure on the cicada wing, we have developed a series of protrusive nanopillars on silicon (Si) substrates and polyethylene glycol diacrylate (PEGDA) films using colloidal lithography and soft pattern transfer technique, respectively. We demonstrated that the bactericidal efficacy increased with decreasing nanopillar number density, which occurred when the average interpillar distance was smaller than the cell size. The bactericidal efficacy decreases when the average interpillar distance becomes larger than the comparable size of bacteria. We then designed PEGDA thin films with optimized bactericidal nanopillar density to improve their antibacterial and antireflective performance. The results show that surface nanostructures play an important role in determining antibacterial properties, regardless of the material type. This work would provide insights into the understanding of the bacterium-nanostructure interaction as well as practical solutions for the design of antimicrobial polymer surfaces used for medical and optical devices.

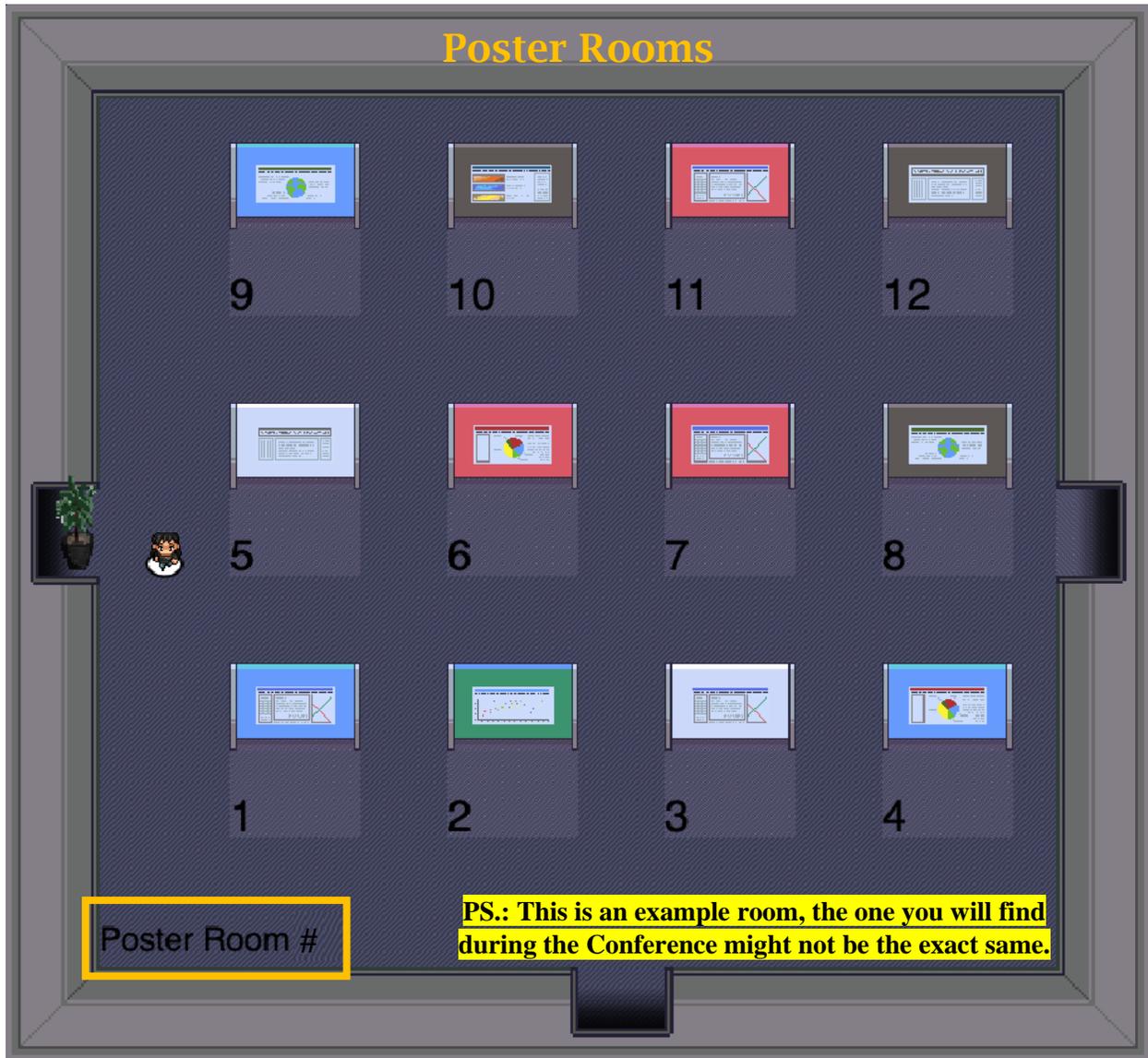
10:20

Investigation of Solution Structure for Ionic Polypeptoid Block Copolymers

Meng Zhang, Louisiana State University

Ionic block copolymers (BCPs) bearing a charged hydrophilic segment and a hydrophobic non-charged segment can self-assemble into aggregates with varying morphologies in solution. The aggregate morphology is influenced by several factors, such as the polymer composition, pH and, ionic strength. Polypeptoids are structural mimics of polypeptides. They are largely free of hydrogen bonding and have a flexible backbone whose conformation is determined by the molecular characteristic of N-substituent via steric and stereoelectronic interactions. These attributes make polypeptoids a suitable model system to study the effects of the sequence-encoded electrostatic interactions on the aggregate structures. The hypothesis of this study is that the electrostatic interactions encoded in the block sequence of the polypeptoid BCP chains will influence their equilibrium aggregate structures. Understanding of whether and how charge pattern of amphiphilic BCPs encoded in the block sequence influence their equilibrium aggregate structure in solution are limited. In this study, a series of amphiphilic ionic polypeptoid BCPs with different chain length and block sequence were synthesized by controlled ring-opening polymerization. Small-angle neutron scattering (SANS) and cryogenic transmission electron microscopic (cryo-TEM) analysis revealed notable difference in the aggregate structures of ionic polypeptoid BCPs with different block sequences.

Student Posters



Poster Room #	Posters #
1	1 - 11
2	12 - 18
3	19 - 25
4	26 - 37
5	38 - 49

Student Posters

Poster Session I

Nov 6 – 11 AM to 12 PM CST @ Poster Rooms 1 – 3 (Posters #1 - #25)

- #1 **Effects of trace water on the self-assembly kinetics and nanoscale structure of sulfonated block copolymers during solution processing**
Karthika Madathil, University of Tennessee
- #2 **Structure-Property Relationships in Ion Containing Sustainable Thermoplastic Elastomers**
Josiah Hanson, University of Houston
- #3 **Development of hydrolytically labile poly(thioether ketal) thermoplastics**
Reese Keeling Sloan, University of Southern Mississippi
- #4 **Computational Studies of Order-Disorder Transition in Block Copolymer Topological Blends**
Rahul Kumar, Tulane University
- #5 **Extraction of Chitin using Ionic Liquids**
Anto Jean Xavier, McNeese State University
- #6 **Differential Dynamic Microscopy of Synthetic Polymer Microgel Particles**
Sahitya Movva, Georgia Institute of Technology
- #7 **Furfural-Based Random Copoly(Acetal-Triazole)s**
Guery Saenz, Mississippi State University
- #8 **Synthesis and Temperature Response of Star Polymers: Role of Molecular Architecture and a Small Molecule Competitor**
Raman Hlushko, Texas A&M University
- #9 **Hydrolytically degradable thiol-ene thermosets: incorporating hydrolyzable ketal crosslinks to achieve tunable network degradation**
Benjamin Alameda, University of Southern Mississippi
- #10 **Developing a new design strategy to synthesize xanthene based NIR I dyes**
Ishanka Nirmani Rajapaksha, Mississippi State University
- #11 **Command-destruct thermosets via photoinduced thiol-catalyzed β -scission of acyclic benzyldene acetals**
William Walker, University of Southern Mississippi
- #12 **Advanced Infrared Nanospectroscopy for Polymer Blend Characterization**
Nathaniel Prine, University of Southern Mississippi

- #13 **AFM Analysis of Rq and Ra Values of Polyimide Film**
Taylor Grace Chambers, Troy University
- #14 **Fourier Transform Infrared Spectroscopy Investigation of Water Microenvironments in Polyelectrolyte Multilayers at Varying Temperatures**
Chikaodinaka Eneh, Texas A&M University
- #15 **Probing ion diffusion in chemically amplified resists through experiments and atomistic simulations**
Christopher Bottoms, University of Tennessee-Knoxville
- #16 **Dendrimer Approach toward High Permittivity Polymer Dielectrics for Electrical Energy Storage**
Beibei Chen, University of Southern Mississippi
- #17 **Understanding Density Gradients in Thin Polymer Films**
Yixuan Han, Emory University
- #18 **Investigating Correlations Between Local Glass Transition and Physical Aging Behavior Within Rubbery-Glassy Bilayer Films by Fluorescence and Ellipsometry**
James H. Merrill, Emory University
- #19 **Functionalized Polymeric Coatings for Selective Ion Removal**
Njideka (Syndi) Nnorom, Rice University
- #20 **Tailored Photopolymerizable CO₂-Philic Thiol-Ene Network Membranes for CO₂ Separation: Effect of PEG Content and Placement on Gas Transport Properties**
Moustafa Zagho, University of Southern Mississippi
- #21 **A Comparative Study of Hydrogen Bond Organization between Hyperbranched Polymers and Dendrimers based on bis-MPA**
Samantha Daymon, University of Southern Mississippi
- #22 **Unlayered Crystals from Rapid Cooling of Long-Spaced Aliphatic Polyesters**
Stephanie Marxsen, Florida State University
- #23 **Mimicking Polyaniline based on Phenoxazine and Carbazole Derivatives, Synthesis and Characterization**
Mohammed Noifa Almtiri, Mississippi State University
- #24 **Thermal transition behavior of thermoplastics after exposing to high temperature**
Soumitra Ganguly, Troy University
- #25 **Polyrhodamine: A pH-responsive redox stable conducting polyelectrolyte**
Ranganath Wijesinghe Wahalathantrige Don, Mississippi State University

Student Posters

Poster Session II

Nov 7 – 8:10 to 9:10 AM CST @ Poster Rooms 4 – 5 (Posters #26 - #49)

#26 High-density polyethylene reinforced by low loadings of electrochemically exfoliated graphene via melt recirculation approach
Pawan Verma, Texas A&M University

#27 Thickness and Crystallinity Dependent Swelling of Poly(ethylene oxide)/Poly(methyl methacrylate) Blend Films
Shiping Wang, Tulane University

#28 Investigating the Structure-Property Relationships of Phosphonium-Based Solid Polymer Electrolytes for Lithium Ion Batteries
Kayla Strong, Xavier University of Louisiana

#29 Depolymerization of Waste Plastics by Induction Heating
Bernard Whajah, Louisiana State University

#30 Infrared Characterization of a Lithium-ion Polymer Gel Electrolyte Particles
Jeramie Rushing, Louisiana State University

#31 Understanding the thermodynamics and kinetics for water-splitting in micropatterned bipolar membranes
Subarna Kole, Louisiana State University

#32 Co-transport behavior of methanol and acetate in crosslinked PEGDA-AMPS-PEGMA cation exchange membranes
Jung Min (Luca) Kim, Auburn University

#33 Synthesis and Evaluation of Polyisobutylene-grafted Graphene Oxide Nanocomposite Films with Improved Oxygen Barrier Properties
Dana Pinson, University of Southern Mississippi

#34 Local Glass Transition Temperature $T_g(z)$ Within Polystyrene Strongly Impacted by Modulus of Neighboring PDMS Domain
Yannic J. Gagnon, Emory University

#36 Design optimization of a 3D printed compliant translational joint
Charisma Clarke, Florida Polytechnic University

#37 Rheological and Dielectric Properties of Polyethersulfone/POSS Nanocomposites
Rahul Shankar, University of Southern Mississippi

#38 Improved Photocatalysts for Grafting-From Proteins: shining light on a new catalyst that is removable, recyclable, and pretty in pink
Rebecca Olson, University of Florida

- #39 Fabrication of Polydopamine Nanotubes for Chemo-Photothermal Therapy**
Yuzhe Sun, Auburn University
- #40 PEGylation of monodisperse bisMPA nanomaterials for drug delivery applications**
Gregory Isaac Hodge, Xavier University of Louisiana
- #41 Generating Biomaterials from Biopolymers Using Ionic Liquids**
Juan Fierro, Mcneese State University
- #42 Assessing the Effects of an Alternating Field Electrospun Nanofibrous Biomaterial's Parameters on its Mechanical Properties and Degradation Rate**
Olivia Shivers, University of Alabama
- #43 Synthesis of Branching-Controlled Comb Polymers via Thiol-yne "Click" Chemistry**
Brennan Curole, Tulane University
- #44 Ultrahigh Molecular Weight Macrocyclic Bottlebrushes via Post-Polymerization Modification of a Cyclic Polymer**
Digvijayee Pal, University of Florida
- #45 Tailoring adhesion and wettability of thin polymer films with surface-active bottlebrush polymer additives**
Travis Laws, University of Tennessee-Knoxville
- #46 Synthesis of asymmetric xanthene probes for biological applications**
Chathuranga Rathnamalala, Mississippi State University
- #47 Chemoselective conjugation of lignin into engineered composites to attenuate fibrotic markers of patient-derived dermal fibroblasts**
Jorge Alfonso Belgodere, Louisiana State University
- #48 Viscosity Measurement of Polyvinyl Alcohol Solutions in Various Solvents**
Aliyah Dalier, Southeastern Louisiana University
- #49 Investigating solvent effects on thiol-ene network formation**
Jacob Schekman, University of Southern Mississippi

Career Panel

Nov 7 - 11 AM to 12 PM (CST) @ Keynote Room (or [HERE](#))

❖ Industry



Michael Drenski

Co-founder and CTO
Fluence Analytics (New Orleans, LA)

Michael Drenski is co-founder and CTO of Fluence Analytics, a manufacturer of systems that produce continuous data streams enabling realtime optimization of manufacturing and R&D processes. Prior to founding Fluence Analytics, Michael worked as the Director for Instrumentation at Tulane-PolyRMC, an R&D center which is active in fundamental and applied polymer research. In 2012 Michael co-founded Advanced Polymer Monitoring Technologies (APMT) to commercialize technologies he helped develop at Tulane-PolyRMC. He possesses unparalleled expertise in the hardware, software, data analytics and technical understanding of Fluence Analytics' proprietary technologies. APMT became Fluence Analytics in 2017 to emphasize its focus on continuous process analytics and better reflect the company's vision for the future of polymer and biopharmaceutical manufacturing. As the CTO of Fluence Analytics, Michael leads the technology vision and roadmap, both setting and executing the company's product development priorities. Michael is listed as inventor on several patents and has authored and co-authored numerous scientific papers. He holds a B.S. in Physics from Youngstown State University and an M.S. in Physics from Tulane University.

Wayne Pertuit

Intralox (New Orleans, LA)

Wayne Pertuit manages a team of engineers in the New Product Development Department at Intralox. During his twenty-seven year career with Intralox, he has been responsible for the execution and management of several aspects of their modular plastic conveyor belt product development work including injection mold design and fabrication as well as product design, analysis, and testing. His product design efforts have produced seven patented inventions. Wayne has a bachelor's degree from Tulane University in Mechanical Engineering. He currently serves on the Tulane Physics and Engineering Physics Advisory Board and the Tulane Engineering Forum Planning Committee and mentors participants in the Tulane Novel Tech Challenge.



Anne Marie Sweeney-Jones

Production Engineer

BASF

After obtaining my B.S. in chemistry from Canisius College, I worked in a variety of industrial positions where I learned the ins and outs of the manufacturing process for hair care products, how to design and analyze toner particles, and the complex process for developing medical devices. While working full-time, I started to pursue an M.S. in chemistry part-time at Rochester Institute of Technology. After finishing my masters, I decided to pursue a Ph.D. in chemistry at Georgia Institute of Technology. My Ph.D. research involved identifying and characterizing marine natural products from organisms collected in Fiji and the Solomon Islands with activity against human pathogens. After graduating this past August, I joined BASF's Ph.D. leadership development program and am currently working in Gordon, GA as a production engineer for my 1st rotation.



❖ Academia



Dr. Karen Wooley

Professor of Chemistry

Texas A&M

Karen L. Wooley holds the W. T. Doherty-Welch Chair in Chemistry, and is a University Distinguished Professor and Presidential Impact Fellow at Texas A&M University, with appointments in the Departments of Chemistry, Chemical Engineering and Materials Science & Engineering. She also serves as Director of the Laboratory for Synthetic-Biologic Interactions. Her academic training included undergraduate study at Oregon State University (B.S., 1988) and graduate study under the direction of Professor Jean M. J. Fréchet at Cornell University (Ph.D., 1993). She began an academic career as an Assistant Professor of Chemistry at Washington University in St. Louis, Missouri, was promoted in 1999 to Full Professor with tenure, was installed in 2006 as a James S. McDonnell Distinguished University Professor in Arts & Sciences, and in 2007 received an appointment in the School of Medicine, Department of Radiology. Karen relocated to Texas A&M University in July 2009. Research interests include the synthesis and characterization of degradable polymers derived from natural products, unique macromolecular architectures and complex polymer assemblies, and the design and development of well-defined nanostructured materials. She has designed synthetic strategies to harness the rich compositional, regiochemical and stereochemical complexity of natural products for the construction of hydrolytically-degradable polymers, which have impact toward sustainability, reduction of reliance on petrochemicals, and production of biologically-beneficial and environmentally-benign natural products upon degradation - these materials are expected to impact the global issue of plastic pollution. The development of novel synthetic strategies, fundamental study of physicochemical and mechanical properties, and investigation

of the functional performance of her materials in the diagnosis and treatment of disease, as superabsorbent hydrogels to address global challenges associated with excessive liquid water, as non-toxic anti-biofouling or anti-icing coatings, as materials for microelectronics device applications, and as environmental remediation systems are particular foci of her research activities. Recent awards include the American Chemical Society Award in Polymer Chemistry (2014), the Royal Society of Chemistry Centenary Prize (2014), and election as a Fellow of the American Academy of Arts and Sciences (2015), the National Academy of Inventors (2019), the American Institute for Medical and Biological Engineering (2020) and the National Academy of Sciences (2020). Karen has served on the technical advisory boards and served in consulting capacities for several companies, from Fortune 500 companies to start-ups, and law firms. She is the co-founder and President of Sugar Plastics, LLC, and Chief Technology Officer of Teysha Technologies, LTD. Karen currently serves as an Associate Editor for the Journal of the American Chemical Society, among many other advisory roles within the broader scientific community.

Dr. Stassi DiMaggio

Professor at Xavier
Xavier University of Louisiana

Dr. DiMaggio received a B.S. in Biochemistry from Tulane University in 1998 and a Ph.D. in Organic Chemistry from the University of New Orleans in 2003. Her dissertation research involved designing and synthesizing biologically active molecules based on natural products as well as natural product synthesis. She also enjoyed an appointment as a Visiting Professor at the University of Michigan, Ann Arbor (2005-2006) where she focused on synthesizing functionalized nanomaterials to be used in basic studies as potential drug delivery systems. She gladly joined the Xavier Chemistry Department in 2003 where she has been at home ever since and conducts research on drug delivery and gene delivery systems using modified nanomaterials. She is currently serving on the Executive Board of the Louisiana Local Section of the American Chemical Society, of which she has been an active member since 1998. She is a member of the ACS Organic and Polymer Divisions and the Louisiana Cancer Research Consortium. She serves as the Phi Lambda Upsilon Chemistry Honor Society advisor. She is also the recipient of the 2012 Norman C. Francis Excellence in Teaching Award, the Alan Berman Research Publication Award from the Naval Research Laboratory, and the Kellogg II Endowed Professor of Teaching award.



❖ Government



H. N. Cheng

Research Chemist
USDA NOLA

H. N. Cheng is currently President-Elect of the American Chemical Society (ACS) and will be ACS President in 2021. He has served on and chaired a variety of ACS committees and task forces at national levels, as well as being active at various capacities in local sections and technical divisions. He obtained his B.S. from UCLA and his Ph.D. from the University of Illinois at Urbana-Champaign. He currently works at USDA Southern Regional Research Center in New Orleans. Over the years, he has been involved with the use of agro-based materials, biocatalysis, green processing, and green methodology. He has also contributed to polymerization theory and polymer NMR. He has authored or co-authored 280 papers and 26 patent publications. He has organized 40 symposia at national meetings since 2000 and edited 21 books. He was selected as a Fellow of the ACS (2009), a Fellow of the ACS Polymer Chemistry Division (2010), and a Fellow of the ACS Agricultural and Food Chemistry Division (2018), among other recognition and awards.

Dr. Dawanne Poree

Program Manager, Polymer Chemistry
US Army Research Laboratory, Army Research Office

Dr. Dawanne Poree currently serves as the Program Manager for the Polymer Chemistry program at the U.S. Army Research Laboratory-Army Research Office (ARL-ARO). In this position, she executes and manages a diverse research portfolio of ~60 projects, totaling more than \$15M in annual research investments while also identifying and guiding novel scientific opportunities to address fundamental basic research gaps to achieve scientific breakthroughs and discoveries leading to critical new technologies and capabilities for the U.S. Army.

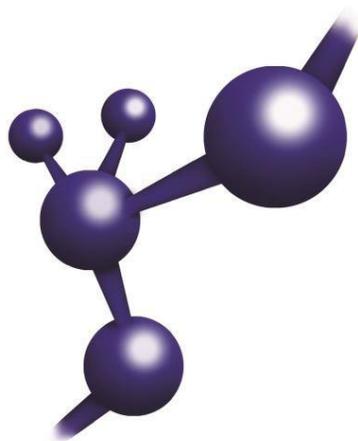
Dr. Poree received her BS in Chemistry from Nicholls State University and a PhD in Chemistry from Tulane University.



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