KENNESAW STATE UNIVERSITY

College of Science and Mathematics

Department of Chemistry and Biochemistry

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.

Fall 2018

Seminars are held on Tuesdays in CL 1009 (Clendenin Building, Room 1009 on the Kennesaw Campus), 12:30 - 1:30pm, unless otherwise noted with special day/time/location information. All are invited to attend.

Tuesday, September 4, 2018

Dr. Christine He

Postdoctoral Fellow in the labs of Jennifer Doudna and Jill Bansfield, University of California, Berkeley

Investigating the Microbial Dark Matter with Metagenomics and Biochemistry

Microorganisms are the most diverse and abundant cellular life forms on Earth, and the source of many pharmaceuticals. However, our understanding of the microbial world is largely limited to the tiny set of microbes that can be grown alone, in pure culture. We know very little about the vast majority of microbes which cannot yet be cultured: the "microbial dark matter." In the past decade or so, a new set of methods called metagenomics has enabled us to probe the genetics of uncultured microbes. Metagenomics involves the bioinformatic assembly of genomes from total DNA sampled directly from the environment.

In particular, metagenomics studies led by the Banfield lab at UC Berkeley have led to the classification of a vast, previously undefined monophyletic group in Domain Bacteria named the candidate phyla radiation (CPR), composed almost entirely of uncultivated organisms. CPR bacteria are incredibly diverse, comprising >15% of all diversity in Domain Bacteria, and ubiquitous, found in nearly every known environment. All members share unusual features that are divergent from other bacteria, including very small cell sizes, compact genomes, and a lack of many integral biosynthetic abilities.

Currently, almost no biochemical or molecular level characterization of CPR bacteria has been done. However, the few studies that have been performed have already revealed novel, highly compact CRISPR-Cas immunity systems and divergent RubisCO enzymes. CPR bacteria represent a huge, unexplored potential source of novel biochemical tools and pharmaceuticals. The talk will contain the development of methods to detect and characterize CPR bacteria on a molecular level, as well as efforts to cultivate CPR bacteria.

View event on Facebook:

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Tuesday, September 25, 2018
Dr. Abraham Joy, Associate Professor of Polymer Science, The University of Akron
Peptidomimetic Polyesters and Polyurethanes: A Modular Biomaterials Platform with Diverse Applications
Synthetic biomaterials are being designed for an increasing number of clinical applications. Common biomaterials such as poly(lactic acid) and polycaprolactone are useful because of their mechanical and biodegradable properties. These materials have been critical in advancing the field of tissue engineering and drug delivery. However, such biomaterials are incapable of providing signaling and functional cues that would enable their interaction and eventual integration with the cellular environment. On the other hand, natural materials such as proteins provide both structural and functional roles due to their multivalent and self-organizing nature. The current presentation will describe the work of the Joy Lab in bridging this gap between natural materials which are multifunctional but expensive and synthetic materials that can be made in large scales but have poor functionality. The Joy Lab has developed a modular biomaterial platform with the aim of bridging this performance gap. Similar to a Lego building set, multifunctional polyesters or polyurethanes can be designed with a wide diversity of polymer properties. During this presentation, the key features of these polymers will be elucidated and our progress in designing such polymers as antimicrobial polymers, thermoresponsive systems, controlled release matrices, wet adhesives and as viscoelastic polymers for 3D printing will be discussed.
View event on Facebook: https://www.facebook.com/events/247264269315801

Tuesday, October 2, 2018 - Clendenin Building, Room 2010
Mr. Abdelbasset Farahat, Limited Term Assistant Professor, Kennesaw State University
Indole and benzimidazole bichalcophenes: synthesis, DNA binding, and antiparasitic activity
A novel series of indole and benzimidazole bichalcophene diamidine derivatives were prepared to study their antimicrobial activity against the tropical parasites causing African sleeping sickness and malaria. The dicyanoindoles needed to synthesize the target diamidines were obtained through Stille coupling reactions while the bis-cyanobenzimidazoles intermediates were made via condensation/cyclization reactions of different aldehydes with 4-cyano-1,2-diaminobenzene. Different amidine synthesis methodologies namely, lithium bis-trimethylsilylamide (LiN[Si(CH3)3]2) and Pinner methods were used to prepare the diamidines. Both types (indole and benzimidazole) derivatives of the new diamidines bind strongly with the DNA minor groove and generally show excellent in vitro antitrypanosomal activity. The diamidino-indole derivatives also showed excellent in vitro antimalarial activity while their benzimidazole counterparts were generally less active. Compound 7c was highly active in vivo and cured all mice infected with Trypanosoma brucei rhodesiense, a model that mimics the acute stage of African sleeping sickness, at a low dose of 4x 5 mg/kg i.p. and hence 7c is more potent in vivo than pentamidine.
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Tuesday, October 16, 2018 - Clendenin Building, Room 2010

Alma Castaneda, Postdoctoral Researcher, Orlando Lab: *Chemical Origins of Life in Aerosols*

Tyler Roche, Ph. D Student, Hud Lab: *There and Back Again: A Grad Student's Tale*

George Tan, Ph. D Candidate, Stockton Lab: *Characterization of the Dyngjusandur Alluvial Plain in Iceland with an Analog of a Mars Instrumentation Suite*

Join us for presentations by three GT chemistry researchers as well as an informal discussion of research life. Topics covered will include aerosol, analytical, and biochemistry.

Tuesday, October 23, 2018 - Clendenin Building, Room 2010

Dr. Paula Lemons, Associate Professor of Biochemistry and Molecular Biology, The University of Georgia

Nonpolar Groups, Arrows, and End Points: Students' Difficulties in Biochemistry Problem Solving Reveal Targets for Evidence-Based Instruction

Undergraduate students persistently struggle with biochemistry problem solving because they must integrate and apply their knowledge in both biology and chemistry. Yet, biochemistry coursework is a required component of many undergraduate science degree programs and may be a major choice-point for undergraduates as they decide whether to continue in science. To improve student learning in biochemistry, we must identify precise student difficulties and target these difficulties with evidence-based instructional approaches. My group has conducted research to identify difficulties and test instructional approaches for two key concepts in biochemistry: the physical basis of noncovalent interactions and metabolic pathway dynamics and regulation. We have identified a number of critical difficulties in student thinking. Regarding the physical basis of noncovalent interactions, students show limited ability to explain the mechanisms of noncovalent interactions and predict their impact on biological structure. Regarding metabolic pathway dynamics and regulation, students misinterpret features of visual representations and focus on pathway endpoints rather than the entire pathway. We are experimentally assessing the impact of three distinct instructional approaches – worked examples, productive failure, and guided inquiry – on these student difficulties. Our results reveal ways that biochemistry educators can improve teaching and student learning and suggest new avenues of research.

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Tuesday, November 6, 2018

Dr. Gary E. Douberly, Associate Professor, The University of Georgia

Spectroscopy of 'Reactive Intermediates' Trapped in Superfluid Helium Nanodroplets

Born from the marriage of cryogenic matrix isolation and molecular beam technologies, helium nanodroplet isolation has evolved into a versatile technique for molecular spectroscopy. Helium nanodroplets provide a medium for studying at 0.4 Kelvin, the structure and dynamics of novel systems such as biomolecules, free-radicals, metal clusters, and molecular clusters. In this lecture, a brief historical account will be presented that emphasizes several important hallmarks of the method, such as nanoscale superfluidity, nearly free molecular rotation of helium-solvated molecules, and the formation and kinetic trapping of metastable molecular assemblies. The decades old technique of using superfluid He droplets for the spectroscopic study of novel molecular species has only just started to move out of the world of chemical physics and into the realm of physical chemistry. Although the spectroscopy of molecules trapped in He droplets have provided fascinating insights into the physical properties of the droplets, the actual observation of chemistry inside a 0.4 K helium droplet is only just beginning. Here we present some of the most recent advances in using helium droplets to address several important problems in gas-phase atmospheric and combustion chemistry.

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Tuesday, November 27, 2018

Dr. T. Keith Hollis, Associate Professor, Mississippi State University

Designing, Developing and Applying Molecules to Solve Tomorrow's Problems: CCC-NHC Pincer Complexes: Early and Late Transition Metal Complexes – Synthesis & Applications

The Hollis Group designs and develops next-generation organometallic ligands and complexes (CCC-NHC pincers) for many applications, which often requires the development of new synthetic methodologies. Access to new molecules and materials is required to solve many of the technological challenges facing society, such as improving energy-efficiency, direct conversion of solar energy to useful forms, and more cost-effective access to medicines. These goals are reached by developing efficient, scalable syntheses of molecules with interesting properties.

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