

Scenes from SuRPS



2024 SuRPS Keynote Speaker

Exploring the Fast Transient Optical Sky & Developing New Technologies for the Argus Array



Alan Vasquez Soto, Ph.D.
(Department of Physics Class of 2018)
Postdoctoral scholar, UNC Chapel Hill

ABSTRACT

Time-domain surveys like ZTF, ASAS-SN, and PanStarrs have discovered myriad phenomena, such as supernovae evolving on day-to-month timescales. These systems achieve nightly to weekly full-sky cadence by observing individual tiles and periodically revisiting previously observed areas, but they can miss transients evolving at faster rates or occurring outside their field of view (FoV). Reaching these rapid, rare transients requires surveying the entire sky simultaneously. The Evryscope follows this approach, with a northern and southern pair of telescopes surveying the sky above the horizon every two minutes. Moving to the next generation of surveys, the Argus Array is an all-sky system that multiplexes 900 telescopes onto a single mount. With arcsecond-scale sampling, sCMOS detectors, and wide-field optics, Argus can reach extragalactic transients. However, with resolution nearing seeing-limited performance, Argus is physically orders of magnitude larger than the Evryscope. This necessitates a custom mount capable of supporting and tracking 900 telescopes, while maintaining their optics presents a challenge equivalent to servicing every currently operational robotic telescope combined. I present solutions to these challenges, implemented in the Argus Pathfinder Array, which was the central topic of my dissertation work. This scaled prototype demonstrates how to construct and maintain an Argus Array. I detail our new pseudofocal telescope design, reducing the maintenance overheads when operating hundreds of individual telescopes to initial commissioning. I also present scalable motion control systems driving current designs for the Argus Array. We conclude with early performance results from Argus Pathfinder.

BIO

Alan received B.S. and B.A. degrees in physics and computer science from High Point University in 2018. He was a member of the inaugural SuRPS program in 2015 and participated again in 2016, working in Dr. Brad Barlow's lab. Alan completed his Ph.D. in Physics at the University of North Carolina at Chapel Hill in May 2024, focusing on rapid optical transients and developing innovative telescope systems to detect these ultra-fast phenomena across the entire visible sky. His work involved leveraging an optical transients event stream from a pair of all-sky telescopes to discriminate between satellite glints and astrophysical transients. Alan led a team in designing, deploying, and commissioning the Argus Pathfinder Array, a prototype for large-scale, multiplexed telescope systems. Currently a postdoctoral scholar at UNC Chapel Hill, Alan serves as project manager and systems engineer for the \$24M Argus Array project, overseeing organization, scheduling, and systems engineering efforts. Alan's career philosophy emphasizes seeking challenging opportunities that provide lasting experiences and relationships. He advocates for deep understanding of tools and systems, believing that learning through trial and error is crucial for innovation in any scientific field.

SuRPS Final Symposium

(Thursday, July 25, 2024, Culp Planetarium, Wanek School of Natural Sciences)

Posters will be set up in the hall and lobby of the Wanek School of Natural Sciences.

All posters should be set up by 9 am on Thursday for both poster sessions and will be taken down after the symposium completes on Friday after the Keynote Address.

Session I: Oral Presentations: Dr. Brock Miller, Department of Chemistry, Presiding

	8:30 – 9:00		COFFEE, TEA RECEPTION (WSNS Lobby)
	9:00 – 9:05	Dr. Kelsey Kean	Opening Remarks and Announcements
	9:05 – 9:15		Morning Poster Session Elevator Pitch Videos
Th.1	9:15 – 9:35	Miranda Gough	Investigating the mechanism of isopropyl BPZ as a treatment against <i>Toxoplasma gondii</i>
Th.2	9:35 – 9:55	Gracie Vickery	Monitoring presence of the endangered Cape Fear Shiner, <i>Notropis mekistocholas</i> , in the Cape Fear River Basin using eDNA
Th.3	9:55 – 10:15	Chloe Buffalino	Larval Color Plasticity in the Painted Lady Butterfly, <i>Vanessa cardui</i>
Th.4	10:15 – 10:35	Ryland Brady	Enhancement and Optimization of Lithography Processes: Exploring the Heidelberg Instruments μ MLA
Th.5	10:35 – 10:55	Mack Fox & Webb Garrett	Identification and Characterization of α -Carbonic Anhydrases: Insights from RzCA α , HeCA α , and HeCA α 313
Th.6	10:55 – 11:15	Maggy Henkel & Izzie Marshall	Evaluation of Antibiotic Adjuvants on MRSA Pathogenicity and Virulence through RT-qPCR Analysis in EA.hy968 Endothelial Cells
	11:15 – 11:30		BREAK

Session II: Poster Presentations Part A (11:30 am - 12:30 pm) (Wanek School of Natural Sciences Lobby)

- P1. Burton Brewer: "Loratadine Derivatives: Development of Antibiotic Adjuvants to Combat Antibiotic Resistance"
- P2. Chloe Cox: "Evaluating compounds and therapeutics for antibiotic adjuvant activity against a panel of ESKAPE pathogens"
- P3. Skyler Gangestad: "Simulated Uncertainties in The Monte Carlo Fitting Method"
- P4. Madison Kline: "Environmental Effects on Wing Size in the Painted Lady Butterfly, *Vanessa cardui*"
- P5. Dominick Latta: "Development an eDNA Assay to Monitor the Endangered *Moxostoma sp. Carolina* (Carolina Redhorse) in North Carolina Waters"
- P6. Holley Lowe: "Expansion of Surveying for The Eastern Hellbender Across Northwestern North Carolina using eDNA"
- P7. Caroline Paccione: "Exploring the anticancer effects of melittin on HeLa cervical cancer cells"
- P8. Tyler Rogers: "Etching Patterns on Buried Graphene for Nanowire (NW) Fabrication"
- P9. Meredith Russell: "Characterization of HeCA- α from *Hypsibius exemplaris*: Insights into α -Carbonic Anhydrase"
- P10. Caitlyn Wingear: "Textured Polydimethylsiloxane Surfaces: A Promising Approach to Biofilm Prevention"

12:30 – 1:30

LUNCH BREAK

Session III: Oral Presentations: Dr. Jacob Brooks, Department of Physics, Presiding

	1:35 - 1:45		Afternoon Poster Session Elevator Pitch Videos
Th.7	1:45 – 2:05	Holley Lowe	Piloting the HHMI SEA-PHAGES Discovery protocols for implementation in a first-year undergraduate teaching laboratory at High Point University
Th.8	2:05 – 2:25	Helia Osareh	Mechanistic insights into melittin-induced cell death in cervical cancer cells
Th.9	2:25 - 2:45	Carlee Logan	Establishing a Research Lab Focused on the Interactomics of the Circadian Clock
Th.10	2:45 – 3:05	Jack Quintana & Elyse Zeffiro	Defining Extracellular Vesicle Isolation Protocol from Various Cell Sources
Th. 11	3:05 – 3:25	Thomas Owens	Testing the physics of a gas degrader
	3:30 – 3:45		<i>BREAK</i>

Session IV: Poster Presentations Part B (3:45 - 4:45 pm) (Wanek School of Natural Sciences Lobby)

- P11.** Morgan Abrams: “Buried Graphene Analysis for Nanowire (NW) Fabrication”
- P12.** Gracie Bruyere: “Skills Learned Through the Process of Starting a Lab”
- P13.** BriAnna Doll: “Building Blocks of Novel Medications: Methodology Development of Yndiamides”
- P14.** Webb Garrett: “Characterization of a Putative Alpha Carbonic Anhydrase (HeCA α 313) from *Hypsibius exemplaris*: Insights into Enzymatic Properties and Potential Biotechnological Applications”
- P15.** Bella Perez: “Container mosquito oviposition activity as a function of urbanization in Guilford County, NC”
- P16.** Gracie Vickery & Christian Jones: “Monitoring presence of the endangered Cape Fear Shiner, *Notropis mekistocholas*, in the Cape Fear River Basin using eDNA”
- P17.** Lillie Wilson: “*In vitro* and *in vivo* evaluation of antibiotic adjuvants against MRSA”
- P18.** Allyssa Winegar: “Pupal Commitment of the Brain in *Vanessa cardui*”
- P19.** Michael Wright: “Monitoring the Atlantic Pigtoe in North Carolina using eDNA applications”
- P20.** Alina Zimavaya: “Initial Steps in the Construction of Hanging Rock State Park’s Fire History”

SuRPS Final Symposium

(Friday, July 26, 2024, Culp Planetarium, Wanek School of Natural Sciences)

Session V: Oral Presentations: Dr. Daniel Greene, Department of Biology, Presiding

	8:30 – 9:00		COFFEE, TEA RECEPTION (WSNS Lobby)
Fr.1	9:00 – 9:20	Jack Moreland	Developing and manufacturing microfluidic filters
Fr.2	9:20 – 9:40	Caitlin McCray	Building Blocks of Novel Medications: Methodology of Yndiamides
Fr.3	9:40 – 10:00	Emilie Brisco & Ava Salvant	Repurposing Cancer Drugs as Anti-parasitics Against <i>T. gondii</i>
Fr.4	10:00 – 10:30	Morgan Abrams & Tyler Rogers	Buried Graphene Patterning and Analysis For Nanowire (NW) Fabrication
Fr.5	10:30 – 10:50	Tyler Wood	The Initial Development of Hanging Rock State Park's Fire History
Fr.6	10:50 – 11:10	Tyler Wright & Maggie Garr	Epigeal arthropod community dynamics as a function of urbanization in Guilford County, NC
	11:15 – 11:30		BREAK

Keynote Address:

Introduction by Dr. Briana Fiser, Interim Dean of Wanek School of Natural Sciences & Department of Physics

11:30 am –
12:30 pm

Alan Vasquez Soto Ph.D.

(HPU Class of 2018)

Postdoctoral scholar, UNC Chapel Hill

Exploring The Fast Transient Optical Sky & Developing New Technologies for The Argus Array

Lunch at Café / Lab Clean Up

Special Thanks:

Rebecca Smoak, WSNS Administrative Assistant
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 Erin Brady, Culp Planetarium Director
 Pam Haynes, Cinde Ingram, and Lee Adams, HPU Office of Communications
 Dr. Joanne Altman, Director of HPU Undergraduate Research and Creative Works Program

STUDENT ABSTRACTS ORAL PRESENTATIONS:

Note: presenting author(s) is underlined, * denotes faculty advisor(s)

(Fr.4) Buried Graphene Patterning and Analysis For Nanowire (NW) Fabrication

Morgan Abrams, Tyler Rogers, and Sean Johnson*

Department of Electrical Engineering, High Point University

Graphene, characterized by its thermal and electrical conductivity, is a two-dimensional carbon material with vast potential in semiconductor technology. This thin outer layer of graphite has been a hot topic of research since its discovery. Research has searched for ways to introduce a bandgap into graphene's properties for its application in optoelectronics. The goal of this study was to expose a buried graphene layer under SiO₂. The graphene was transferred to a silicon and SiO₂ substrate by chemical vapor deposition (CVD). Another SiO₂ layer was deposited atop the graphene through physical vapor deposition. The substrate was patterned via photolithography and etched by a hydrofluoric acid etching process. Furthermore, analysis was performed to evaluate graphene's properties, including thickness, structure, and purity. Using tools consisting of ellipsometry, Raman spectroscopy, and scanning electron microscopy (SEM) to examine NW hole diameter, thickness of SiO₂ deposition, and graphene characteristics post lithography and etching. This substrate could act as a base for controlled NW fabrication on graphene, with potential application in photodetectors and optoelectronics.

(Th.3) Larval Color Plasticity in the Painted Lady Butterfly, *Vanessa cardui*

Chloe Buffalino, and Kenneth Z. McKenna*

Department of Biology, High Point University

When a ship has a hole in it and is inevitably going to sink, the first order of business is to patch the leak. Putting an environmental stressor on an organism tends to force it to divert all of its attention to fixing the problem before it becomes fatal. Some organisms even have built in tools in the event of a 'leak'. For example, heat shock proteins are chaperone proteins known to keep organisms alive during stressful situations. To test this, we exposed *V. cardui* to abnormally high temperatures during, an essential point of their development, the fourth instar. As a result, we found a plethora of phenotypic anomalies stemming from age of the animal and length of the treatment. When exposed to adverse temperatures the animals turn various shades from a dark brown to white and anywhere in between. It was also found that most of the pigmentation stemmed from the head of the animal, potentially revealing an endocrine signal pathway originating from the brain and dorsal vessel. This may be an ideal model for how heat shock proteins divert energy from pigmentation production to survival tactics. Whether this phenomenon is caused by heat shock proteins or another physiological source, *V. cardui* is a useful way to model observable phenotypic changes under duress at a pivotal point of development. All of this was possible thanks to funding from the Summer Undergraduate Research Program, Natural Science Fellows, and caring staff at High Point University.

(Th.4) Enhancement and Optimization of Lithography Processes: Exploring the Heidelberg Instruments μ MLA

Ryland Brady¹, Caitlyn Wingert², Jack Moreland², Brian Augustine^{*,1}, and Jacob Brooks^{*,2}

¹Department of Chemistry, High Point University

²Department of Physics, High Point University

As one of the only undergraduate research universities worldwide to have a Heidelberg Instruments μ MLA, understanding the capabilities, limitations, and applications of this instrument is crucial to the future utilization of this advanced lithography tool. This study highlights the operational parameters and optimization strategies used to best equip the μ MLA for its use in both binary and grayscale lithography. Throughout various tests with multiple photoresists, the minimal feature size and design capability were explored and characterized. Compared with traditional methods used previously, the μ MLA holds advantages in precision, cost-effectiveness, resolution, and efficiency.

(Fr.3) Repurposing Cancer Drugs as Anti-parasitics Against *T. gondii*

Emilie Brisco, Ava Salvant, Miranda Gough, and Robert Charvat*

Department of Biology, High Point University

Toxoplasma gondii is an exclusively intracellular parasite and the causative agent of toxoplasmosis, which is an infection that damages the brain, eyes, and other organs. *T. gondii* lives asymptomatically in roughly thirty percent of the global population, except for immunodeficient individuals, who exhibit symptoms of toxoplasmosis. Current treatments to combat the parasite are largely unsuccessful as many patients experience substantial adverse effects in comparison to infection symptoms. Therefore, there is a necessity to discover new treatments. An avenue to investigate is anti-cancer drugs, a class of compounds that has previously exhibited anti-parasitic activity. *T. gondii* possesses several kinases critical for survival; therefore, current FDA-approved cyclin-dependent kinase (CDK) inhibitors targeting breast cancer, including Palbociclib HCl, Ribociclib HCl, and Abemaciclib, were examined. To test the efficacy of the CDK inhibitors as a potential treatment, doubling assays of the compounds at varying concentrations were performed. These drugs have shown significant reduction in parasitic growth and replication of *T. gondii* while preserving the viability of the host cell. Fluorescence microscopy was completed to observe the cellular consequences following treatment with the compounds. Two of the three compounds exhibit defects in the tubulin structure of the parasites, indicating possible defects in normal parasite division. Future work will include an analysis of the stages of parasitic replication as well as the specific *T. gondii* protein(s) that these compounds target in hopes of completing structure activity relationship studies, thus increasing the specificity of the compounds to target *T. gondii*.

(Th.5) Identification and Characterization of α -Carbonic Anhydrases: Insights from RzCA α , HeCA α , and HeCA α 313

Mack Fox, Webb Garrett, Meredith Russell, and Kelsey M. Kean*

Department of Chemistry, High Point University

The Kean Lab investigates proteins from extremophiles, organisms that can live under extreme conditions such as high heat and extreme pH. To survive and thrive, their proteins must also be able to function under these conditions. We aim to identify and characterize these extremophile proteins and their potentially useful properties using tardigrades as a source. We've identified three putative α -carbonic anhydrases from tardigrades, one from *Ramazzottius varieornatus* (RzCA) and two from *Hypsibius exemplaris* (HeCA and HeCA-313). Here, we present the successful recombinant expression, purification, and characterization of RzCA, HeCA, and HeCA-313. We utilized colorimetric assays to measure carbonic anhydrase activity and stability. Thus far, we have shown that RzCA, HeCA, and HeCA-313 all function as genuine carbonic anhydrases and further characterization is ongoing. Identifying and characterizing thermostable carbonic anhydrases contributes to our understanding of thermostable enzymes at large, with specific applications for thermostable α -carbonic anhydrases in carbon capture and sequestration. In the future, we propose to further optimize purification conditions and begin structural studies of these α -CAs.

(Th.1) Investigating the mechanism of isopropyl BPZ as a treatment against *Toxoplasma gondii*

Miranda Gough, Ava Salvant, Emilie Brisco, and Robert Charvat*

Department of Biology, High Point University

Toxoplasma gondii is an obligate intracellular parasite that affects roughly one-third of the world's population. It is the second leading cause of death from food-borne illnesses in the United States, after salmonella, which signifies the demand for an effective treatment. As an intracellular parasite, current treatment methods are poorly tolerated by patients, as the drugs tend to destroy healthy cells in the process. Past research from this lab identified novel anti-cancer bisphenol Z (BPZ) derivatives to be effective at targeting and destroying *T. gondii* cells. These drugs inhibit the growth of the parasitic cells and prevent them from replicating. To further this concept, this project aimed to identify the gene targets that allow the most promising BPZ derivative, isopropyl BPZ, to destroy *T. gondii* cells. This was accomplished through the creation of a mutated parasite line that is resistant to the isopropyl BPZ compound. The replication patterns of this mutated strain was analyzed in varying concentrations of the compound, which displayed adequate resistance as compared to that of the wildtype strain. In addition, the mutated strain's genome was extrapolated through RNA and DNA sequencing to determine the genetic markers that allow for gene expression. This information can be used to create custom gene knockout strains using CRISPR-Cas9 technology, which could uncover the mechanisms of drug activity as well as the normal function of the genes. The outcomes of this project have the potential to identify a novel treatment of toxoplasmosis that is more effective than the current treatment methods.

(Th.6) Evaluation of Antibiotic Adjuvants on MRSA Pathogenicity and Virulence through RT-qPCR Analysis in EA.hy968 Endothelial Cells

Maggy Henkel, Izzie Marshall, Heather Miller, and Meghan Blackledge*
Department of Chemistry, High Point University

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a pathogen that has caused hospital- and community-acquired infections, known for its resistance to multiple antibiotics, including methicillin. This makes it a challenging pathogen to treat. Loratadine, an antihistamine commonly used to treat allergies, and RB6, a novel compound under investigation, have shown potential in preliminary studies to affect bacterial virulence and survival mechanisms. Understanding how these drugs influence MRSA pathogenicity could lead to new approaches in managing and mitigating MRSA infections, either as adjunct therapies or as part of a combination treatment regimen.

The primary aim of this experiment was to evaluate the therapeutic effects of loratadine and RB6, on MRSA-infected cells. In this study, EA.hy968 endothelial cells were infected with USA300, USA300 Δ Stk1, and USA300 Δ Sfp. Stk1 and Sfp are a kinase/phosphatase pair that have been implicated in regulation of infection and virulence activities in MRSA. Preliminary studies have shown that loratadine and RB6 may interact with one or both of these enzymes to exert their adjuvant effects. Following the infection process, the cells were treated with loratadine and RB6. RNA was subsequently extracted from both the treated and untreated infected cells, purified, and analyzed using real-time quantitative polymerase chain reaction (RT-qPCR). Our optimized infection assay protocol will be presented along with preliminary transcriptional data.

(Th.9) Establishing a Research Lab Focused on the Interactomics of the Circadian Clock

Carlee Logan and Alexander Mosier*
Department of Biology, High Point University

Our lab's focus is on circadian biology in *Neurospora crassa* and the protein interactions and post-translational modifications tied to the clock. Starting a new lab requires a deep dive into literature and building a solid background of information. We focused on academic article reviews and studies that focused on circadian biology, proteomics, interactomics, quantum biology, and techniques used to perform our research. Using our background knowledge, we also began to outline our grant proposals, which are crucial to helping start and continually fund the lab. Circadian rhythms are tied to the clock and to many biological processes and functions that help to maintain homeostasis. Circadian biology is an expanding discipline that has provided evidence of the effects of a chronically disrupted clock on an organism's system, including a relationship to blood pressure issues, cardiovascular disease, diabetes, psychiatric, autoimmune, and neurodegenerative diseases. Through the application of interactomics, we aim to understand the role of various proteins linked to diseases and their interactions with the clock. To do this, we are using the organism *Neurospora crassa* and analyzing the protein CDC2, using western blotting and post-translational western blotting to analyze and quantify the data and understand the clock-mediated post-translational modifications. To further understand the process of the circadian clock and how it functions, we are simulating and analyzing the quantum mechanics behind the process to understand how coherence is possibly affecting phototransduction and causing and controlling the whole process.

(Th.7) Piloting the HHMI SEA-PHAGES Discovery protocols for implementation in a first-year undergraduate teaching laboratory at High Point University.

Holley A. Lowe¹, Christian K.D. Jones¹, Elijah Sage², and Megan Rudock Bowman^{*,1}

¹Department of Biology, High Point University

²Grekin Labs

Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science (SEA-PHAGES) is a collaborative research initiative among a wide variety of top institutions administered by the Howard Hughes Medical Institute's Science Education division. SEA-PHAGES aims to discover novel bacteriophages and examine their genomes in an undergraduate discovery-based research course. Bacteriophages have a wide array of applications including antibiotic resistance, food safety, and treating infections unresponsive to antimicrobial compounds. Beyond scientific discovery, SEA-PHAGES further aims to enhance undergraduate students' retention and pique their interest in biology, in hopes they will continue valuable genomic research. Integrating SEA-PHAGES into the undergraduate curriculum teaches students with a wide-range of current molecular techniques, such as bacterial cell culture, isolation and purification of phages, techniques to identify novel phages, bioinformatics and genome annotation. Further, students develop a sense of project ownership and have the opportunity for presentation at national symposia and publication of novel findings, gaining valuable experience and connections within the scientific community. Our goal is to evaluate the success of protocols in the SEA-PHAGES Discovery Guide when followed by undergraduate students. Additionally, we have tested slight variations of these protocols using common reagents found in molecular teaching labs. Minor adjustments that decrease the cost, without reducing the success of phage discovery, will allow us to increase course offerings and impact a greater number of students. Ultimately, we aim to adapt the verbiage of the SEA-PHAGES protocols, as well as the timing and reagents, to best incorporate this experience into first-year biology teaching labs here at High Point University.

(Fr.2) Building Blocks of Novel Medications: Methodology of Yndiamides

Caitlin McCray, BriAnna Doll, and Brock Miller*

Department of Chemistry, High Point University

Molecules bearing four, five, and six-membered nitrogen heterocycles are important in pharmaceutically relevant compounds. Nearly 75% of all small molecule FDA-approved drugs contain a nitrogen heterocycle. Further, compounds containing vicinal diamines (1,2-diamines) exhibit similar pharmaceutical relevance with 20% of FDA-approved drugs containing a vicinal diamine. Significant work has been performed on ynamides (1-amidoalkynes) due to their ability to install nitrogen heterocycles in few synthetic operations. Unlike ynamides, yndiamides (1,2-diamidoalkynes) are not well studied. These unique alkynes can serve as versatile building blocks to synthesize complex vicinal diamines for drug discovery. Our group is focused on developing methodologies to synthesize rarely accessed yndiamides (1,2-diamidoalkynes). Installation of the nitrogen on the acetylene is a time-consuming step (up to 7 days). We have begun to explore the potential implementation of using a microwave reactor to speed up this process. This presentation will focus on the progress made towards the synthesis of yndiamides, and future directions of this project.

(Fr.1) Developing and manufacturing microfluidic filters

Jack Moreland¹, Caitlyn Wingear¹, Ryland Brady², Keir Fogarty², Brian Augustine², and Jacob Brooks^{*,1}

¹Department of Physics, High Point University

²Department of Chemistry, High Point University

A significant challenge to microfluidic experimentation is controlling the flow and movement of the fluids predictably and programmatically due to the comparatively high resistance of viscous forces as compared to inertial forces (low Reynolds number) at this size scale. To solve this problem, many biological cells have evolved hair-like structures called cilia, which are able to move asymmetrically and predictably, allowing the cells to create flow in viscous fluids to, for example, remove mucous from surfaces. This summer, we have focused on creating bio-inspired artificial cilia and other fluid control structures. We used CAD software (KLayout) to design micro-scale patterns that would replicate a top-down view of our control structures. This design would then be applied to a photoresist-treated silicon wafer using the new Heidelberg tabletop maskless aligner (μ MLA) photolithography machine, which was used to mold polydimethylsiloxane (PDMS) silicone rubber structures. We produced a herringbone array design (offset perpendicular rectangles) to reduce the amount of strain the structures would experience when moving. In addition to cilia, we also created microfilter structures, which can be used to separate objects of different sizes without any outside input. We used designs based on principles of deterministic lateral displacement (DLD) (arrays designed to create displacement between differing objects) and deliberate filters, where only objects smaller than a certain size are permitted to flow. We are currently working towards incorporating magnetic particles into the actuator structure and designing electromagnets to programmatically control the movement of the structures.

(Th.8) Mechanistic insights into melittin-induced cell death in cervical cancer cells

Helia Osareh and Y. Kevin Suh*

Department of Biology, High Point University

Honeybees, *Apis mellifera*, produce and secrete venom which contain peptides, amino acids, sugars, and pheromones. Melittin is a 26-amino acid long polypeptide and a major component of honeybee venom. Bee venom has been used as a complementary and alternative therapy for thousands of years and has gained attention for its therapeutic potential in cancer treatment. This study investigates the effects of melittin on HeLa cervical cancer cells, a widely used model in cancer research. Our research focuses on melittin's capacity to induce programmed cell death, specifically exploring its impact on cell viability and migration. Utilizing various assays, we observed a significant reduction in HeLa cell viability and an inhibition of cell migration upon melittin treatment. Western blot analysis further revealed alterations in cell signaling pathways such as Erk MAPK, Akt, and mTOR which are known to be involved in cell proliferation and survival. Finally, our data suggest that melittin may induce ferroptosis in HeLa cells.

(Th.11) Testing the physics of a gas degrader

Thomas Owens and Adam Anthony*

Department of Physics, High Point University

One major challenge when studying the kinematics of reactions with heavy nuclei is controlling the kinetic energy of the nuclei entering the reaction. In a previous experiment studying heavy ion fission, thin sheets of iron were used, but the thickness of the sheets varied, leading to overran uncertainty in the kinetic energy. To this end, we tested the possibility of creating a gas-based energy degrader. A gas degrader would feature a tube with two thin films on both sides and a high-density gas on the inside. This setup would allow ions to pass in and out while being slowed down by the gas. Using LISE++ and SRIM-2013 simulations, we tested the viability and required pressures of different high-density gases. Then, we built a replica gas chamber to test the strength of possible films at the needed pressures. Combining these data points, we were able to determine whether the physics behind the construction of a gas degrader would work.

(Th.10) Defining Extracellular Vesicle Isolation Protocol from Various Cell Sources

Jack Quintana^{1,2}, Elyse Zeffiro^{1,2}, David Coltan², Megan Rudock Bowman¹, and Elijah Sage^{*,2}

¹Department of Biology, High Point University

²Grekin Labs

Extracellular vesicles (EVs) are small, cell derived, membrane bound pockets of DNA, RNA, proteins, and other bioactive molecules utilized for intracellular signaling. Along with being easy to store, EVs also act as a natural delivery system without the risk of introducing whole cells into the body. Human stem cell EV research has demonstrated incredible immunomodulatory and regenerative effects in the treatment of dementia and ALS in rodents, as well as completely reversing venous skin ulcers in humans. Even so, the harvest of EVs from stem cells can be quite expensive and ethically ambiguous when sourcing from the umbilical cord or embryonic stem cells. Recent research has shown that EVs from other cell types can interact in the human cell ecosystem as a therapeutic treatment. Our research is therefore focused on defining EV isolation protocols from other sources such as bacteria, milk, carrots, watermelon, and invasive Kudzu to create methodologies to be applied at an industrial scale, increasing availability and lowering treatment cost. Furthermore, we intend to extend EV research towards identifying genetic differences using proteomics and transcriptomics, testing cargo modifications, and starting *in vivo* experiments in rats to study immune system response and wound healing properties with EVs from different sources.

(Th.2) Monitoring presence of the endangered Cape Fear Shiner, *Notropis mekistocholas*, in the Cape Fear River Basin using eDNA

Gracie Vickery¹, Christian Jones¹, Jack Quintana¹, Michael B. Wright¹, Holley A. Lowe¹, Dominick Latta², Sonia Mumford², Brandi Symons², Brenna K. Jones², and Megan Rudock Bowman^{*,1}

¹Department of Biology, High Point University

²Edenton National Fish Hatchery, North Carolina Wildlife Resources Commission

The *Notropis mekistocholas* known as the Cape Fear Shiner (CFS) is an endangered minnow fish native to the Cape Fear River Basin that commonly schools with sympatric species of notropis. CFS are found in fewer waterways than ever before. Monitoring has traditionally used catch and release netting, which is time intensive and potentially harmful to the CFS. Further, CFS are small and low population numbers may lead to false negative results. Instead, environmental DNA (eDNA) can be collected and analyzed using custom assays to identify where the CFS are located with improved cost efficiency and accuracy. Sympatric species were identified in the literature and sequences of all COI genes downloaded. MEGA was used to align DNA sequences and create a phylogenetic tree containing CFS. We collected from the Deep, Haw and Rocky Rivers and then filtered on site. Filter paper was preserved in ethanol and on ice until the DNA could be isolated using Qiagen DNeasy PowerWater kit and DNA quality and concentration was evaluated using a NanoDrop. The DNA was amplified using PCR and analyzed with gel electrophoresis. Analysis thus far suggests successful amplification of product that is the desired size in both unknown and positive control samples. Sequencing of the PCR products is needed to validate the assays and further testing on sympatric species is necessary to rule out false positives.

(Fr.5) The Initial Development of Hanging Rock State Park's Fire History

Tyler Wood, Alina Zimavaya, and Dane Kuppinger^{*}

Department of Biology, High Point University

Fire influences the distribution, composition, and structure of many ecosystems. Although fire plays a limited role in most Piedmont forests, drier forests like those of Hanging Rock State Park (HRSP) contain fire adapted tree species, indicating its influence. Knowing the fire history of the park will improve our understanding of its forests and aid park management efforts. This study builds upon prior work through additional surveys for fire-scarred pines as part of ongoing efforts to build a fire history for HRSP. Vegetation maps were used to pre-select survey sites within Pine-oak heath (POH) habitat. In these surveys, fire-scarred trees geocoordinates were recorded alongside tree health and size. Tracklog data was used to map survey routes and the areas covered. Our surveys covered 2.06 km², 15.6% of it within POH habitat, and identified 212 possible samples. Of these, 86 definitively contained fire scars and 78 were dead. Processing and analysis work continues on 59 previously collected samples. Eight of these have been completely analyzed and dated along with their fire scars. All of the remaining collected samples have had an initial sanding to enable scar identification. These surveys will allow researchers to systematically collect samples and determine where surveys are still needed. The number of definitively scarred trees shows that fire played a significant role in the park's history. Final analysis and dating of current and future samples will eventually enable a fire history for HRSP to be formed.

(Fr.6) Epigeal arthropod community dynamics as a function of urbanization in Guilford County, NC

Tyler Wright, Maggie Garr, Bella Perez, and Daniel Greene*

Department of Biology, High Point University

Urbanization is one of the least reversible forms of anthropogenic action and is a principal driver of species extinctions and habitat loss. Highly urbanized areas can be delineated by large areas of impervious surfaces, lower humidity, and a warmer temperature than more undisturbed and rural areas. To assess the effects of urbanization on arthropod abundance in Guilford County, NC, we conducted weekly (4 weeks) faunal community assessments across 20 sampling sites from 12 June-10 July 2024. We predicted that common epigeal arthropod (i.e., Araneae, Carabidae, Collembola, Formicidae, and Isopoda) abundance would be highest in sites with higher humidity and a low percentage of impervious surfaces and lowest in sites with low humidity and a high percentage of impervious surfaces. Each sampling site featured two covered pitfall traps and belonged to one of two grids (Grid A, 6.71km²; Grid B, 5.62km²) that differed in their level of urbanization. Environmental data (e.g., temperature, humidity, eCO₂, VOC, etc.) was also collected at multiple sampling sites with a BirdWeather Portable Universe Codec (PUC). The number of pitfall-collected Araneae, Carabidae, Collembola, Formicidae, and Isopoda were separately analyzed via generalized linear mixed modeling using land cover and environmental data as predictor variables. The results from our study are important as we seek to enhance ecosystem services as urban expansion continues across the planet. The identification of distinct drivers of arthropod abundance among various taxonomic groups within urban arthropod communities is a critical first step in the modification of anthropogenic habitats to increase their suitability for arthropod occupancy.

STUDENT ABSTRACTS POSTER PRESENTATIONS:

Note: presenting author is underlined, * denotes faculty advisor(s)

THURSDAY, JULY 25 POSTER PRESENTATIONS PART A (11:30 am – 12:30 pm):

(P.1) Loratadine Derivatives: Development of Antibiotic Adjuvants to Combat Antibiotic Resistance

Burton Brewer, and Meghan Blackledge*

Department of Chemistry, High Point University

In 2019, infections caused by *Staphylococcus aureus* killed 1.2 million people globally, posing a serious threat to global health. Methicillin resistant *S. aureus* (MRSA) is a Gram-positive bacterium that has developed antibiotic resistance to beta-lactams and other classes of antibiotics. Finding a way to counteract these resistance mechanisms is essential for treating these infections and lowering the high mortality rate. One method for combatting these infections is creating novel antibiotics. However, due to bacteria's ability to rapidly evolve resistance mechanisms, novel antibiotics quickly lose efficacy. An alternative to developing novel antibiotics is using antibiotic adjuvants in conjunction with existing antibiotics. Adjuvants are small molecules that work to inactivate bacterial resistance mechanisms. This inactivation is not lethal to bacteria, but can be used to enhance the efficacy of antibiotics. Previous work in the Blackledge lab has proven loratadine to be a functional adjuvant against MRSA. Loratadine's tail is not essential for its function as an antihistamine however the tail is crucial for it to be an adjuvant. This tail can be easily cleaved inside the human body which prevents loratadine from deactivating resistance mechanisms in the bacteria. To function as an adjuvant, new tails that are more resistant to cleavage need to be synthesized. A library of loratadine analogs with non-cleavable tails has been synthesized and evaluated for biological activity. These compounds are being assessed for their ability to potentiate beta-lactams and inhibit biofilm formation. Synthetic methodology, biological data, and preliminary structural activity relationships will be presented.

(P.2) Evaluating compounds and therapeutics for antibiotic adjuvant activity against a panel of ESKAPE pathogens

Chloe Cox and Meghan Blackledge*

Department of Chemistry, High Point University

Antibiotic-resistant bacterial infections cause hundreds of thousands of deaths globally each year. In particular, the ESKAPE pathogens (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* spp.), six highly virulent and antibiotic-resistant bacterial pathogens, are the leading cause of hospital-acquired infections across the world. While the push for novel antibiotics is a worthy cause, bacteria retain the ability to rapidly develop resistance. An alternative approach is to combat resistance via antibiotic adjuvants, which work by neutralizing resistance mechanisms as opposed to killing the bacteria. We previously identified several classes of molecules that potentiate antibiotics and inhibit biofilm formation in several strains of *Staphylococcus aureus* (*S. aureus*). These initial studies show promise as novel anti-infectives but would further benefit from expansion into other clinically relevant bacterial strains and antibiotics.

To further explore the breadth and depth of our adjuvants, we expanded repotentialization and biofilm assays into several gram-negative strains of bacteria with variable antibiotic resistance profiles. Interestingly, we discovered certain compounds in our adjuvant library were able to potentiate antibiotics against various ESKAPE pathogens, further proving their utility as therapeutic agents.

(P.3) Simulated Uncertainties In The Monte Carlo Fitting Method

Skyler Gangestad and Adam Anthony*

Department of Physics, High Point University

Fission is a nuclear reaction where a single, heavy nucleus splits into two massive daughter particles. In 2020, an experiment was performed to measure the fission properties of nuclei near ^{196}Pb by fusion-fission with ^4He . Previous work has been done to measure the element number of the fission fragments and the energy of the nucleus just before fission. Both of these tasks were completed using a Monte-Carlo based fitting method. While effective, the method does not allow for the quantification of errors. To better understand these uncertainties, we performed a Monte-Carlo fit on simulated data with a fixed mass-splitting and decay angle; from there, we will vary the decay angle and mass distribution to examine how that changes the uncertainty in the fitting method. Initial results on the uncertainty will be presented.

(P.4) Environmental effects on Wing Size in the Painted Lady Butterfly, *Vanessa cardui*

Madison Kline and Kenneth Z. McKenna*

Department of Biology, High Point University

Environmental factors, such as nutrition and temperature, can affect cell proliferation in the wings of lepidoptera species. These species have homologous patterning, which allows for the development and evolution of their wings to be studied and mapped. For our experiment, we specifically used the painted lady butterfly, known as *Vanessa cardui*. We separated the animals three days into their fifth instar and divided them into four experimental groups: control, starved, heated, and starved & heated. After 48 hours in their respective treatments, they were then returned to control conditions for the remainder of their larval stage. Following pupation, their wings were photographed and analyzed using morphometric software (MorphoJ) to map specific landmarks along the veins. This allowed for any differences or changes in wing development to be calculated and graphed. This study revealed that posterior and anterior wing development occurs earlier than previously thought, in contrast to the typical patterning along various wing axes. Additionally, it highlighted the natural shape plasticity that wings can express. This suggests that starvation can lead to a noticeable decrease in cell proliferation, affecting the shape of the wing. Temporal differences in cell proliferation across the wing may result in altered wing patterns and structures. Our research relates the relationship between environmental factors and developmental biology in the lepidoptera species and how this is a significant model for evolutionary design. We would like to thank Natural Science Fellows, High Point University and its' Summer Research Program (SuRPs) for providing the resources and funding for this research project.

(P.5) Development an eDNA Assay to Monitor the Endangered *Moxostoma sp. Carolina* (Carolina Redhorse) in North Carolina Waters

Dominick Latta, Micheal B. Wright, Gracie L. Vickery, Holley A. Lowe, Christian K.D. Jones, and Megan Rudock Bowman*

Department of Biology, High Point University

Moxostoma sp. Carolina, also known as the Carolina redhorse, is a species of suckerfish local to the Pee Dee and Little rivers and is classified as a threatened species. Current monitoring methods involve catch and release with PIT tagging. These methods are unreliable and stressful for the animal. To better monitor *Moxostoma sp. Carolina*, eDNA tracking is being used. eDNA can be collected from environmental water and used to determine an organism's presence. This method is faster, cheaper, and has much higher throughput than tagging, without the downsides of causing stress and harm to endangered fish. Fishmap was used to identify all sympatric species of *Moxostoma* present in waterways known to be inhabited by the Carolina redhorse. The Cytochrome B gene sequence for each species was downloaded from NCBI blast as a fasta file. MEGA was used to align these sequences and search for differences in their genetic code, identifying areas of unique sequence for primer/probe design. An ideal location for probe design was found to be between base pairs 771 and 899. The cytochrome B gene was then uploaded into IDT PrimerQuest to generate a primer and probe for this location. Samples were collected from the Great Pee Dee and Little rivers, which were filtered before DNA was isolated with a Qiagen DNeasy PowerWater kit. DNA was then analyzed using Real-Time qPCR and PCR to amplify target DNA. A positive result produces DNA fragments of 128 base pairs visible in gel electrophoresis and a positive reading in the qPCR presence/absence analysis.

(P.6) Expansion of Surveying for The Eastern Hellbender Across Northwestern North Carolina using eDNA

Holley A. Lowe, Gracie L. Vickery, Dominick Latta, Michael B. Wright, Christian K.D. Jones, and Megan Rudock Bowman*
Department of Biology, High Point University

The Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*) is an aquatic salamander that is listed as a species of special concern. They are commonly found in rivers and tributaries along the Appalachian Mountains from New York down to Georgia. Hellbenders inhabit microhabitats on the downstream side of rocks where they catch food as it floats by. The Hellbender is remarkably rare and withdrawn making them difficult to spot and assess in the wild. Currently, intensive surveying is used to determine the Hellbender population. However, the utilization of environmental DNA (eDNA) and quantitative PCR (qPCR), could significantly cut down on the time, invasiveness, and cost of these surveys. Our goal is to greatly expand the surveying region in collaboration with an ongoing study by the North Carolina Wildlife Resources Commission (NCWRC). We have collected water samples along the New River and its branches in the northwestern part of North Carolina, in areas suspected to be Hellbender habitats by the NCWRC. Samples are filtered within 24 hrs. DNA is isolated using Qiagen DNeasy PowerWater kit and the concentration and purity analyzed using NanoDrop. The Eastern Hellbender's presence or absence can be determined via qPCR using primers/probes currently used by the NCWRC and Tangled Bank Conservation (TBC). Results from duplicate samples will be validated by TBC. With this knowledge and through these methods it is possible to better monitor population sizes and location of the decreasing number of Eastern Hellbenders across a much larger region of their documented habitat.

(P.7) Exploring the anticancer effects of melittin on HeLa cervical cancer cells

Caroline Paccione and Y. Kevin Suh*
Department of Biology, High Point University

In this study we investigated the anticancer effects of melittin on HeLa cervical cancer cells. Melittin is the principal component of honeybee venom, representing approximately 50% of the honeybee venom. Utilizing the proliferation assay, we determined the number of viable cells upon melittin treatment. The results demonstrated a dose-dependent decrease in cell viability, highlighting melittin's potent cytotoxic effect. To determine whether melittin induces apoptotic cell death, we used Hoechst 33342 dye. Staining the cells with this cell-permeant blue nuclear stain reveals morphological changes consistent with apoptosis, such as chromatin condensation and nuclear fragmentation. These changes were evident in cells treated with etoposide, a known inducer of apoptosis, but were not as pronounced in those treated with melittin. These data suggest that melittin may induce non-apoptotic programmed cell death.

(P.8) Etching Patterns On Buried Graphene for Nanowire (NW) Fabrication

Tyler Rogers, Morgan Abrams, and Sean Johnson*
Department of Electrical Engineering, High Point University

Graphene is a two-dimensional carbon allotrope with high thermal and electrical conductivity properties, making it a great material to be used in semiconductor applications. Due to its characteristics, it can find a wide range of uses in electronics. In this study, we attempted to expose graphene buried under a silicon dioxide layer. The experiment started on a premade substrate consisting of silicon, SiO₂, and graphene created using chemical vapor deposition (CVD). A second SiO₂ layer was deposited atop the graphene by physical vapor deposition, patterned through maskless photolithography, and etched via hydrofluoric acid etching. This method shows a new way to create patterns in a mask over a graphene layer. The patterned substrate serves as a base for controlled NW growth using the modified graphene as an electrode. This system could find use in photodetectors and optoelectronics.

(P.9) Expression, Purification, and Characterization of a Novel Carbonic Anhydrase from *Hypsibius exemplaris* (HeCA)

Meredith Russell, Mack Fox, Webb Garrett, and Kelsey M. Kean*
Department of Chemistry, High Point University

α -Carbonic Anhydrases are metalloenzymes that catalyze the reversible hydration of carbon dioxide (CO₂) to bicarbonate (HCO₃⁻) and protons (H⁺). The hydration and dehydration of CO₂ and HCO₃⁻ ions are involved in many different metabolic pathways, indicating that α -CAs play a crucial physiological role in all organisms where they are present. This study primarily seeks to further characterize and investigate the activity of a putative α -carbonic anhydrase from the tardigrade *Hypsibius exemplaris* (HeCA- α). Here, the successful cloning, recombinant protein expression, purification, and characterization of HeCA- α are presented. Colorimetric CO₂ hydration and PNPA assays confirmed carbonic anhydrase activity of HeCA- α . Ongoing research is focused on the further characterization and exploration of HeCA- α , including its stability under high heat and metal binding. A more comprehensive understanding and knowledge of the breadth of α -carbonic anhydrases, especially with enhanced stability, may be useful for industrial and biomedical applications such as carbon sequestration and artificial lungs.

(P.10) Textured Polydimethylsiloxane Surfaces: A Promising Approach to Biofilm Prevention

Caitlyn Wingeart¹, Ryland Brady², Jack Moreland¹, Brian Augustine², Meghan Blackledge², Briana Fiser¹, and Jacob Brooks^{*,1}

¹Department of Physics, High Point University

²Department of Chemistry, High Point University

Infections resulting from bacterial and fungal biofilm proliferation pose a multitude of challenges in the realm of medicine, including increased patient morbidity and healthcare costs. One of the emerging ways to prevent these biofilms has been through the use of textured surfaces. There has been mild success with laser-textured surfaces in controlling biofilm formations. This summer, I textured silicon surfaces for polydimethylsiloxane (PDMS) molds, specifically, I used Sylgard 184 and 186. Sylgard Elastomers are widely used for cellular research because they allow for cell proliferation. Two main designs were used, the “sharklet” and the “flower.” The “sharklet” consists of a repeating diamond pattern, and the “flower” pattern is a repeating triangular pattern with circles to break up extra space. These stamps were then treated with MRSA media and incubated overnight, which were then fixed and critically point dried, and imaged in the scanning electron microscope for analysis. In future projects, I hope to use the movement from magnetically artificial cilia (MAC) to prevent biofilm formation. Previous studies have shown that MAC can be used to move microscopic particles and that their movements can remove microparticles from a surface. Other studies use artificial cilia as a basis for fabricating biofilm sensors. Using this, it may be possible to use MAC to reduce the amount of biofilm buildup on the surfaces of implants. Another future application would also be to fabricate a “smart” biosensor that would also treat the biofilms.

THURSDAY, JULY 25 POSTER PRESENTATIONS PART B (3:45 – 4:45 pm):**(P.11) Buried Graphene Analysis for Nanowire (NW) Fabrication)**

Morgan Abrams, Tyler Rogers, and Sean Johnson*

Department of Electrical Engineering, High Point University

Graphene is a two-dimensional carbon allotrope comprised of tightly bound carbon atoms in a hexagonal honeycomb lattice. It serves a variety of purposes from thermoelectric to light-sensing and contains properties such as high thermal and electrical conductivity that make it a great semiconductor material. However, its use in research and nanowire (NW) fabrication is still a relatively new area. Literature and data analysis are conducted to examine graphene’s properties such as thickness, structure, and purity. Tools consisting of the atomic force microscopy (AFM), Raman spectroscopy and Ellipsometry examine thickness of silicon dioxide deposition (SiO₂), NW hole diameter, and graphene characterization post lithography and etching. This analysis of buried graphene shows a potential solution for another method of patterned NW fabrication.

(P.12) Skills Learned Through the Process of Starting a Lab

Gracie Bruyere and Alexander Mosier*

Department of Biology, High Point University

Starting a new research lab is a long and strenuous process that can take months to establish. Background research was conducted, developing the critical analysis skills required for comprehending scientific research papers and developing experimental procedures. Writing grant proposals is another life skill that was learned through the process of starting a new lab. In order to receive funding, researchers must write proposals introducing a topics relevance, describing intended experimental designs, and verifying a need for the requested funds. The circadian clock is a molecular time keeping system that controls many biological and physiological aspects in all organisms over a 24-hour period. This internal clock is what allows us to adapt to environmental changes. The filamentous fungi, *Neurospora crassa* is one of the most studied organisms in circadian biology because the architecture of the core clock is similar to that of humans and other mammals. Cell Division Control protein 2 (CDC2) is G1/S phase transition inducer and a G2/M cyclin-CDK. The purpose of this research is to identify the effect that frequency (FRQ) has on post translational modifications (PTMs) on CDC2. To test this, western blot analysis of CDC2 with or without FRQ was conducted, and PTM sites were identified with phos tag gel and phos tag antibody. Additional research will incorporate the use of python to create quantum biology simulations to test theories such as electron tunneling and superpositions.

(P.13) Building Blocks of Novel Medications: Methodology Development of Yndiamides

BriAnna Doll, Caitlin McCray, and Brock Miller*

Department of Chemistry, High Point University

Molecules bearing four, five, and six-membered nitrogen heterocycles are important in pharmaceutically relevant compounds. Nearly 75% of all small molecule FDA-approved drugs contain a nitrogen heterocycle. Further, compounds containing vicinal diamines (1,2-diamines) exhibit similar pharmaceutical relevance with 20% of FDA-approved drugs containing a vicinal diamine. Significant work has been performed on ynamides (1-amidoalkynes) due to their ability to install nitrogen heterocycles in few synthetic operations. Unlike ynamides, yndiamides (1,2-diamidoalkynes) are not well studied. These unique alkynes can serve as versatile building blocks to synthesize complex vicinal diamines for drug discovery. Our group is focused on developing methodologies to synthesize rarely accessed yndiamides (1,2-diamidoalkynes). Installation of the nitrogen on the acetylene is a time-consuming step (up to 7 days). We have begun to explore the potential implementation of using a microwave reactor to speed up this process. This presentation will focus on the progress made towards the synthesis of yndiamides, and future directions of this project.

(P.14) Characterization of a Putative Alpha Carbonic Anhydrase (HeCA α 313) from *Hypsibius exemplaris*: Insights into Enzymatic Properties and Potential Biotechnological Applications

Webb Garrett, Mack Fox, Meredith Russell, and Kelsey M. Kean*

Department of Chemistry, High Point University

Studying alpha carbonic anhydrases (α -CAs) in extremophiles such as tardigrades offers insights into their unique biochemical adaptations. I focused on a putative α -CA from *Hypsibius exemplaris* (HeCA α 313). We aim to express and characterize this enzyme to understand its functional properties. We successfully cloned and expressed HeCA α 313 using recombinant DNA technology in *E. coli*. We purified the enzyme using affinity chromatography to try to ensure high yield and purity. Subsequent characterization was performed using spectroscopic methods and enzymatic activity assays. Preliminary results indicate that HeCA α 313 exhibits catalytic properties of an α -CA. This research enhances our understanding of α -CAs in extremophiles and paves the way for biotechnological applications requiring robust enzymes.

(P.15) Container mosquito oviposition activity as a function of urbanization in Guilford County, NC

Bella Perez, Maggie Garr, Tyler Wright, and Daniel Greene*

Department of Biology, High Point University

Mosquitoes such as *Aedes aegypti* (Linnaeus) and *Ae. Albopictus* (Skuse) breed in containers, and an increased amount of refuse associated with increased urbanization has been associated with the creation of novel oviposition habitats for container-breeding mosquitoes. To assess the effect of urbanization on mosquito oviposition activity in Guilford County, NC, we conducted weekly (4 weeks) oviposition sampling events across 20 sampling sites from 12 June-10 July 2024. Each sampling site featured two 473 ml black 'ovicups' (one at 1 m in height, one at 0 m in height [ground level]) and belonged to one of two grids (Grid A, 6.71km²; Grid B, 5.62km²) that differed in their level of urbanization. Ovicups were filled with water and lined with germination paper ("ovistrip") to provide an oviposition substrate for mosquitoes. During each sampling event, ovistrips were removed and replaced in each ovicup, and ovicups were refilled with water. The number of viable, desiccated, and hatched eggs were then counted under a stereomicroscope. Environmental data (e.g., temperature, humidity, eCO₂, VOC, etc.) was also collected at multiple sampling sites with a BirdWeather Portable Universe Codec (PUC). The number of viable and desiccated eggs were separately analyzed via generalized linear mixed modeling using land cover, environmental data, and ovicup trap height as predictor variables. As human expansion continues to increase, the identification of environmental and land-use variables associated with increased mosquito activity/abundance is of paramount importance as we seek to reduce the transmission of mosquito-borne diseases.

(P.16) Monitoring presence of the endangered Cape Fear Shiner, *Notropis mekistocholas*, in the Cape Fear River Basin using eDNA

Gracie Vickery¹, Christian Jones¹, Jack Quintana¹, Michael B. Wright¹, Holley A. Lowe¹, Dominick Latta², Sonia Mumford², Brandi Symons², Brena K. Jones², and Megan Rudock Bowman^{*,1}

¹Department of Biology, High Point University

²Edenton National Fish Hatchery, North Carolina Wildlife Resources Commission

The *Notropis mekistocholas* known as the Cape Fear Shiner (CFS) is an endangered minnow fish native to the Cape Fear River Basin that commonly schools with sympatric species of notropis. CFS are found in fewer waterways than ever before. Monitoring has traditionally used catch and release netting, which is time intensive and potentially harmful to the CFS. Further, CFS are small and low population numbers may lead to false negative results. Instead, environmental DNA (eDNA) can be collected and analyzed using custom assays to identify where the CFS are located with improved cost efficiency and accuracy. Sympatric species were identified in the literature and sequences of all COI genes downloaded. MEGA was used to align DNA sequences and create a phylogenetic tree containing CFS. We collected from the Deep, Haw and Rocky Rivers and then filtered on site. Filter paper was preserved in ethanol and on ice until the DNA could be isolated using Qiagen DNeasy PowerWater kit and DNA quality and concentration was evaluated using a NanoDrop. The DNA was amplified using PCR and analyzed with gel electrophoresis. Analysis thus far suggests successful amplification of product that is the desired size in both unknown and positive control samples. Sequencing of the PCR products is needed to validate the assays and further testing on sympatric species is necessary to rule out false positives.

(P.17) *In vitro* and *in vivo* evaluation of antibiotic adjuvants against MRSA

Lillie Wilson and Meghan Blackledge*

Department of Chemistry, High Point University

Methicillin resistant *Staphylococcus aureus* (MRSA) is a specific set of *S. aureus* bacteria that are resistant to methicillin. MRSA often causes life-threatening infections; due to MRSA's antibiotic resistance, these infections are very difficult to treat. The research we are conducting intends to combat MRSA through the use of compounds known as adjuvants, which enhance antibiotic activity by blocking resistance or enhancing the host's response to infection. The advantage of using adjuvants, rather than new antibiotics, are their ability to target bacteria's resistance mechanisms to make antibiotics useful again. We assessed various compounds to enhance the effectiveness of antibiotics against MRSA both *in vitro* and *in vivo*, aiming to identify compounds with therapeutic potential for further development. Our research has expanded, as we are testing additional strains of MRSA and new potential adjuvants. The growth of our research enhances the potential of determining productive treatment options for MRSA infections.

(P.18) Pupal Commitment of the Brain in *Vanessa cardui*

Allyssa Winegar and Kenneth Z. McKenna*

Department of Biology, High Point University

Animals' progression through developmental stages poses a fundamental question in biology. In insects, the decision to metamorphose from larva to pupa involves significant changes in brain physiology and organogenesis. While direct neural signals driving pupal commitment are understood in model systems, mechanisms for stage assessment and metamorphosis timing remain poorly understood. Here, we investigated pupal commitment in the painted lady butterfly, *Vanessa cardui*, via restricting nutrition and application of a Juvenile Hormone analog. Fifth instar larvae, harvested within 0-6 days post-molting, were divided into four groups: fed (control), starved, DMSO (control), and methoprene (JH analog). Fed larvae received an artificial diet, while starved larvae received a mock diet (agarose + DI water). Methoprene-treated larvae received a diet injected with 5 μ l of a 10 μ g/ μ l methoprene stock solution in DMSO, compared to DMSO control larvae receiving 5 μ l of DMSO alone. Pupation time and pupal weight were recorded to elucidate factors influencing pupal commitment. Our findings propose a specific instar day when larvae are capable of molting and indicate a potential "bailout" mechanism. Future research will delve into the developmental significance of day 3 larvae, focusing on neural mechanisms driving pupation during this critical stage. Acknowledgments to High Point University's Summer Research Program and Natural Science Fellows for their support of this work.

(P.19) Monitoring the Atlantic Pigtoe in North Carolina using eDNA applications

Michael Wright, Gracie L. Vickery, Holley A. Lowe, Dominick Latta, Christian K. D. Jones, and Megan Rudock Bowman*
Department of Biology, High Point University

The Atlantic Pigtoe, *Fusconaia masoni*, is a freshwater mussel designated as threatened by the US Fish & Wildlife Service. The Pigtoe plays an important role in maintaining North Carolina's unique and diverse river systems. They are also a direct measure of the river system's health, warranting strong conservation efforts. The Pigtoe mussel population is currently being surveyed by traditional catch and release methods which can be time consuming, highly inaccurate, and even harmful. The use of environmental DNA (eDNA) may provide a more efficient and cost-effective method for monitoring this species. eDNA is DNA shed into the water by the Pigtoe that can be collected and analyzed using custom-made assays. To create an effective primer set specific for the Atlantic Pigtoe, we used BLAST to find sequences of all sympatric species, MEGA to create a phylogenetic tree and a DNA alignment of those species, and IDT PrimerQuest to create the primers and probe. Water samples from the Tar River were collected and filtered on site. In the lab, DNA was collected using a Qiagen PowerWater Pro DNA Isolation kit and analyzed for quality and quantity using the NanoDrop. PCR, qPCR and gel electrophoresis were used to determine the presence of Pigtoe DNA in each sample. Our results thus far suggest that our assay is successful in amplifying target sequences. Further evaluation in the presence of positive control samples and assay validation by sequencing will be needed to confirm the accuracy of this assay.

(P.20) Initial Steps in the Construction of Hanging Rock State Park's Fire History

Alina Zimavaya, Tyler Wood, and Dane Kuppinger*
Department of Biology, High Point University

Forest fires play a critical role in some forest ecosystems by influencing vegetation dynamics and species distributions. However, research on their impact in the Piedmont remains limited. This study continued work building a fire history for Hanging Rock State Park to enhance our understanding of the historic role of fire in this ecosystem. To this end, we identified fire-scarred pines within Pine-oak heath habitat areas which may retain indications of past fire events. Potential survey locations were chosen using vegetation maps of the park. Field surveys were conducted to pinpoint fire scarred trees and tracklog data was used to assess survey effectiveness. To date, field surveys have covered 54.93% (2.59km²) of Pine-oak heath habitat within the park. A total of 212 potential samples were identified and of these, 86 were definitively scarred. This work will allow a thorough sample collection and has enabled us to identify areas of the park that still need to be surveyed. We also continued processing and analyzing samples collected in previous years: sanding them to increase ring clarity, measuring ring widths, and dating the scars contained in some of them. Initial analysis of the 59 collected samples, found that 52 contained fire scars. Sadly, 9 of the 59 samples were too rotten to be dateable. Eight of the good samples have been fully processed and dated, and initial sanding has been done on the remaining 42. Our findings established a foundation for elucidating the role of fire in this ecosystem.

2024 SuRPS Faculty Participation and Projects

Department of Biology

Dr. Megan Rudock
Bowman
(Conservation Genetics
and Ecology)

*"Investigation of
Cannabinoid-mediated
Neuroprotection"*

In collaboration with the North Carolina Wildlife Resource Commission, the Bowman lab aims to develop assays for high throughput monitoring of endangered species. Many aquatic species are monitored by netting, careful identification and counting, which is a labor-intensive practice. Second, the organisms must be plentiful enough to collect and identify. We hypothesize that this surveillance method may be missing organisms that exist in low population areas. We believe that monitoring using environmental DNA may be more successful in identifying the presence of endangered species in areas of low population density. Our SuRPS research project this summer will involve the continued development and validation of PCR assays for 3 species: the endangered Cape Fear Shiner (*Notropis mekistocholas*), the Atlantic Pigtoe Mussel (*Fusconaia masoni*) and the Carolina Redhorse (*Moxostoma Carolina*). We will collect water samples from rivers and streams where these species have been previously found and areas of unknown presence. Field work may include hiking, kayaking and river walking. In addition, we will be collecting and testing samples to contribute to a larger project monitoring the Eastern Hellbender.

Students will have the opportunity to do field work, DNA isolation, PCR, qPCR, and use bioinformatics for assay design and sequence analysis.

Dr. Robert Charvat
(Molecular Parasitology)

*Investigating the
mechanism of action of
novel antiparasitic
compounds*

The Charvat lab studies *Toxoplasma gondii*, a parasite found around the world infecting approximately one-third of the human population. Toxoplasmosis, the disease caused by infection with *T. gondii*, is the second leading cause of death from food-borne illness in the United States, and for which there are currently no efficacious treatments. As a result, our group is broadly interested in novel drug discovery and understanding the mechanism of action of those compounds as well as others with intriguing effects on normal parasite biology. Project(s) will focus on understanding the mechanism of action for novel compounds, including several derivatives of bisphenol Z, against the parasite *T. gondii*. Students will investigate the cellular consequences of the compounds for normal parasite replication as well as organellar biogenesis. Students will develop skill sets that encompass basic tissue culture techniques, fluorescence microscopy, immuno-staining, and other applicable molecular biology tools.

Dr. Daniel Greene
(Community Ecology)

*The Abundance and
Diversity of Arthropod
Functional Groups in
Managed and
Unmanaged Urban
Habitats in North
Carolina*

Urbanization is a primary factor in the decline of arthropod populations, and arthropods from numerous functional groups (e.g., pollinators, soil invertebrates, natural enemies, and saproxylic insects) have been shown to be impacted by urbanization factors such as fragmentation, pollution, and the 'urban heat island' effect. As urban populations are predicted to reach 6.7 billion by 2050, the identification of the drivers of urban arthropod distributions across different habitats and levels of urbanization is vital to the conservation and enhancement of biodiversity and ecosystem services provided by these organisms. Therefore, the effects of urbanization and fragmentation will be assessed through the collection and analysis of arthropod diversity, abundance, and functional trait data in managed (e.g., gardens, parks) and unmanaged (e.g., vacant lots, fallow fields) urban habitats in the High Point, NC area. Additionally, an understanding of how urban arthropod distributions are associated with environmental variables (e.g., soil moisture, humidity, plant density) could serve to guide urban planning towards designs that do not inhibit arthropod establishment. Students will collaborate with landowners and managers and participate directly in habitat characterization, arthropod sampling, environmental data collection, arthropod identification and curation, and community-wide data analysis using the R statistical program.

Dr. Dane Kuppinger
(Ecosystem Ecology)

Fire history and fire effects in the Sauratown Mountains of North Carolina

The southeastern United States contains isolated forest communities that are dependent upon fire to maintain their structure and species composition. Fire effects are dependent upon fire frequency, seasonality, and intensity, so the local fire history significantly influences community composition. Luckily this history is preserved by scars present within annual growth rings of some of the surviving trees. Pilot Mountain and Hanging Rock are both within the Sauratown mountains just north of HPU and both contain fire dependent plant species, yet the abundance of fire adapted species differs between them.

This research is focused on understanding how the fire history of these areas differs, whether this explains differences in each areas' vegetation, and assessing how human's have impacted each location's fire history. Recent work in this lab established Pilot Mountain's fire history and began sample collection at Hanging Rock. This summer's work will build on this through primary areas of research. Each student will choose one to focus on but the fieldwork will be done as a lab group for safety and efficiency reasons.

The first research area is the development of a fire history for Hanging Rock. Although one smaller section of the park has been thoroughly sampled, many areas remain un-surveyed and un-sampled, and few of the collected samples have been processed or analyzed. The second area will establish survey plots at both locations to allow vegetation differences to be quantitatively assessed and fire history effects to be separated from other environmental effects.

Dr. Ken McKenna
(Evolutionary Developmental Biology)

Testing a putative reaction-diffusion mechanism regulating butterfly color pattern formation

The McKenna lab studies how developmental patterning mechanisms create magnificent color patterns on butterfly wings. Recently, my lab discovered a putative mechanism for the regulation of the size and spacing of color pattern elements at the onset of the pupal stage. We have found that two antagonistic pathways, Wnt and Dkk, are required for pattern elements to form properly. Both proteins are secreted from cells and act as paracrine signals to regulate gene expression of neighboring and distant cells. We believe Wnt acts as a short-range activator while Dkk acts as a long-range inhibitor.

The first project will determine if the expression of Wnt and Dkk are colocalized to the same population cells (in phase) or if they are expressed in neighboring cells (out of phase). This work will use immunohistochemical techniques to visualize where Wnt and Dkk signals are being received as well as in situ hybridization techniques to visualize where cells transcribing Wnt and Dkk. Students will learn pupal wing dissection and staining techniques, requiring fine motor skill dexterity and attention to detail.

The second project will determine the necessity of Dkk in two butterfly species using CRISPR-Cas9 mutagenesis. Students will learn CRISPR project design and will conduct embryonic injections to induce loss of function mutations in different Dkk genes in the butterfly genome.

Dr. Alexander Mosier
(Circadian Biology)

Regulation of Downstream Cellular Processes by the Circadian Clock in Neurospora crassa

The circadian clock is a molecular mechanism that aids most living creatures to anticipate the Earth's 24-hour light/dark cycle. By being proactive rather than reactive, organisms have heightened survival rates as well as energy conservation. The circadian clock is led by a transcriptional/ translational negative-feedback loop. While much work has been done into defining how and what the positive arm of the clock transcriptionally activates, there is a gap in our understanding as to translational and post-translational level regulation. We aim to fill this gap by studying the protein interactomics centered around core clock proteins across the circadian day and how their post-translational modifications may be regulated by these interactions. We are also beginning work into studying how quantum mechanics may be regulating or influencing the core clock itself in a novel blending of circadian, quantum, and computational biology.

Dr. Y. Kevin Suh
(Cellular and Molecular Biology)

Identifying novel anticancer compounds and their targets in human cancer cells

Cancer is the second leading cause of death and a major public health issue. In the US, it is known that 1 in 3 women and 1 in 2 men will develop cancer in their lifetime. Prostate cancer is the most commonly diagnosed cancer and second leading cause of cancer-related death in men in the US. In women, breast cancer is very common and triple-negative breast cancer is considered an aggressive subtype of breast cancer as they do not express any of the receptors that are commonly found in breast cancer making them harder to treat. In recent years, we found several compounds that induce cell death in human prostate, cervical, and triple-negative breast cancer cells. These compounds include fisetin, albendazole, and melittin. Fisetin is a plant flavonol found in many vegetables and fruits. Albendazole is an anthelmintic drug used for the treatment of a variety of parasitic worm infestations by targeting microtubules which play an important role in cell division. Melittin is a polypeptide and a major component of honeybee venom. SuRPS projects will involve identifying novel anticancer compounds and the targets of these compounds in human cancer cells. The projects would use techniques such as mammalian cell culture, cell viability assay, DNA and protein gel electrophoresis, immunoblot analysis, real time quantitative reverse transcription PCR, RNA sequencing, colony formation assay, migration assay, immunocytochemistry, and enzyme-linked immunosorbent assay.

Department of Chemistry

Dr. Brian Augustine
(Materials Science)

*Fabrication and
characterization of metal-
coated polymer
nanoporous thin films*

Polymer thin films can be produced with novel micro/nanostructures when they are deposited from solutions under specific deposition conditions. A complicated plate-like structure with large open pores can be created by spin-casting poly methylmethacrylate (PMMA) films from tetrahydrofuran (THF) solutions. The same structure does not form when deposited from other solvents such as chloroform and toluene. These solvents result in much more uniform, smooth films. The microstructure of the THF-deposited films reveal pores on the order of 1 - 10 μm , and the remaining PMMA structures are on the order of 50 - 500 nm. Atomic force microscopy (AFM) has been used to confirm a layered plate-like morphology. The microstructure suggests that nanoporous membranes can be fabricated which can be used in a variety of applications such as filtration, chromatography, battery membranes, catalysis, biosensors or many applications that require a high surface area material. Combining the film structures with electroless Ni, a novel nanostructured polymer could result in not only a high surface area material, but a material that could be metal coated or a metallic nanostructure with a high surface area which are extremely difficult to fabricate using conventional microfabrication technologies. SuRPS students will learn microfabrication, surface characterization using AFM, and metal deposition techniques applicable to biomedical devices.

Dr. Meghan Blackledge
(Bioorganic Chemistry)

*Developing Small
Molecules to Combat
Bacterial Infections*

The Blackledge lab is interested in developing novel therapeutics to combat bacterial infections. Specifically, we use chemical synthesis to make and modify compounds that we test in various medically relevant strains of bacteria. Students can choose to focus on either chemical synthesis or microbiology or participate in both aspects of the project.

Synthetic projects: Students in the synthesis lab will be making derivatives of the antihistamine Claritin. We have found that claritin reverses antibiotic resistance in MRSA and lowers its infectivity in an infection model. We want to make novel derivatives to test their function and understand which structural modifications improve its therapeutic activity.

Biological projects: Students in the microbiology lab will be testing various compounds for the ability to reverse antibiotic resistance and inhibit biofilm formation in the following medically relevant strains: MRSA, *Enterococcus faecalis*, *E. coli*, *Pseudomonas aeruginosa*, and *Acinetobacter baumannii*.

Dr. Kelsey Kean
(Biochemistry)

*Studying extreme
proteins from extreme
organisms*

Proteins are among the most abundant and functionally diverse biomolecules with the ability to carry out unique and specific functions and chemistries. In the Kean Lab, we are interested in understanding how proteins evolve and are able to carry out their unique and specific chemistries. A key piece to understanding how proteins work – when working correctly, when behaving aberrantly, or when being engineered for a new function – comes from exploring and understanding protein structure and function on a molecular level. One area of interest in our group is understanding proteins from extremophiles, organisms that can survive extreme conditions such as pH, temperature, and even the vacuum of space. In order to survive, these organisms must have very stable proteins. We are curious to know how these proteins work and what makes them so stable. Student researchers in the Kean Lab will have the opportunity to learn techniques in molecular biology, biochemistry, and structural biology.

Dr. Brock Miller
(Organic Synthesis)

*Design and synthesis of
novel organic molecules
from yndiamides*

Research in the Miller Laboratory will investigate the synthesis of rarely studied yndiamides. These substrates can produce highly functionalized vicinal diamines that are common building blocks in the pharmaceutical and drug discovery industries. Most of this summer project will involve developing methodologies to produce a variety of electron-rich and electron-deficient alkynes. We are interested in investigating the reactivity profile to better understand the versatility of these substrates. Initial reactivity screenings will involve electron-rich and electron-deficient olefins as well as invoke Nobel-Prize winning click chemistry. Further studies will involve synthesis of “push-pull” acetylenes. In collaboration with the Eukaryotic Pathogens Innovation Center at Clemson University, our novel molecules will undergo preliminary biological evaluations against Neglected Tropical Diseases (NTDs). Students in the Miller lab will gain expertise in techniques related to classical organic synthesis such as column chromatography, advanced NMR, and methodology development.

Department of Physics

Dr. Adam Anthony
(Nuclear Physics)

*Exploring fission with a
Time Projection Chamber*

My group's work focuses on studying nuclear reactions with a class of detector called a Time Projection Chamber (TPC). TPCs are gas filled detectors that act like a camera, allowing us to take 3 dimensional "images" of individual nuclear reactions where the nuclei are typically moving at more than 20% the speed of light. By measuring where and how the nuclei interact with the gas we can deduce both the path nuclei take through the detector, as well as their speed. All of this information combines to allow us to calculate the kinematics (or momentum of each particle) on an event-by-event basis.

This project will focus on analyzing TPC data from an experiment measuring the fission properties of nuclei with a mass and charge similar to lead. Fission is the process through which an excited heavy nucleus splits into two fragments with roughly equal mass. Our goal is to identify the mass distribution of these fission fragments. An initial analysis of the mass distribution has been completed for the nucleus ^{204}At . This project will extend that analysis to other nuclei measured in the experiment. The project will be primarily computational in nature, adapting and extending existing analysis codes to new nuclei. In July (assuming the tentative schedule holds), we will travel to the Facility for Rare Isotope Beams (FRIB) in Michigan to participate in an experiment using a TPC. This will provide some hands-on experience working on a nuclear physics experiment at one of the world-leading rare isotope accelerators.

Dr. Jacob Brooks
(Biophysics, Micro/
nanoengineering))

*Micro-actuator design,
fabrication, and
application*

Bio-inspired systems are the basis for many technologies we use today. A classic example is the development of Velcro based on observations of burrs hanging on clothes after being outdoors. This project draws its inspiration from biological lung cilia, which beat (or actuate) back and forth to help move mucus up and out of the airway. The scale of these microscopic structures and the physical properties of the fluid conspire to form what is known as a low Reynolds number environment. Fluid transport and other phenomena (such as locomotion through a fluid, or swimming) are no longer intuitively understood, as familiar reciprocal beating patterns cannot produce fluid transport. This low Reynolds number environment introduces unique challenges to the design of a practical and robust artificial micro-actuator platform to perform fluid transport studies in a microfluidic space. We are working to develop such a platform by taking advantage of fabrication techniques such as photolithography and ion etching to create regular arrays of high-aspect ratio, elastomeric (flexible), and magnetically responsive micropillars. Students will learn these techniques to design and pattern silicon substrates to be used for replica molding of such micro-pillars. Once fabricated, the micropillars will be used to study phenomena such as low Reynolds number fluid transport. Students will develop a magnetic actuation system for the pillars and learn fabrication of microfluidic channels. Furthermore, the micro-actuator platform will be used as the basis for the development of active soft substrates to study cellular motility and response to dynamic stiffness changes.

Department of Electrical Engineering

Dr. Sean Johnson
(Semiconductor Materials
and Device
Characterization)

*Optoelectronic
characterization of 1D
and 2D nanostructures
on Silicon and Graphene*

1D and 2D nanostructures have shown considerable advantages in optoelectronic characterization metrics such as responsivity, detectivity, and low dark current, in comparison with bulk structures. Surface interactions with these structures and the growth substrate can affect the quality of the desired metrics. Though silicon is the substrate of choice, the gapless material graphene has demonstrated valuable attributes suitable to the advancement of photonics and optoelectronics. 1D and 2D semiconductor photodetectors on various substrates are to be studied, modeled via Matlab and COMSOL, and characterized. III-V nanowire-based photodetectors, which were fabricated in conjunction with the Joint School of Nanoscience and Nanoengineering (JSNN) in Greensboro, NC, and the Shared Materials Instrumentation Facility at Duke University in Durham, NC are also analyzed.

SuRPS 2024 Seminar Series

(Fridays at Noon, Wanek School of Natural Sciences)

Date	Name	Affiliation	Seminar Title
Friday, June 7	Dr. Emily Derbyshire Associate Professor	Departments of Chemistry, Molecular Genetics and Microbiology, and Cell Biology Duke University Durham, NC	<i>Interdisciplinary approaches to reveal parasite vulnerabilities</i>
Friday, June 14	Dr. Brad Barlow Associate Professor	Department of Physics University of North Carolina at Chapel Hill Chapel Hill, NC	<i>The Galactic Fast & Furious: A Tale of Hypervelocity Stars, Binary Brawls, and Explosions</i>
Friday, June 21	Dr. Huong Kratochvil Assistant Professor	Department of Chemistry University of North Carolina at Chapel Hill Chapel Hill, NC	<i>On the Design of Functional Membrane Proteins</i>
Friday, June 28	Dr. En Yang Assistant Professor	Department of Biology University of North Carolina at Chapel Hill Chapel Hill, NC	<i>Brain-wide Plasticity: a holistic understanding of learning and memory</i>
Friday, July 12	Dr. Jessica Cooke Bailey Associate Professor	Department of Pharmacology and Toxicology East Carolina University Greenville, NC	<i>SIGHT: Studies Integrating Glaucoma, Health disparities, and Translation</i>
Friday, July 19	Dr. Emily Gentry Assistant Professor	Department of Chemistry Virginia Tech Blacksburg, VA	<i>Exploring (Bio)chemical space using Synthesis and Mass spectrometry</i>

Past SuRPS Keynote Speakers

Year	Speaker	Title
2015	Rachael Parker, Ph.D. HPU Chemistry 2011 Virginia Tech	<i>Statistical and combinatorial approaches to designing repeat proteins as recognition elements in microbial sensors</i>
2016	Sarah Craven Seaton, Ph.D. HPU Chemistry/Biology 2004 UNC Asheville Biology	<i>Soirées in the Soil: Bacterial Communication, Cooperation, and Competition in the Rhizosphere</i>
2017	Laura Lee, Ph.D. HPU Biochemistry/Physics 2012 North Carolina State University	<i>Boiling Bugs Break Biomass: An Investigation Into High Temperature, Cellulolytic Microorganisms</i>
2018	Gavid Coombs, Ph.D. HPU Biochemistry 2014 Yale University	<i>A Journey Through Research: Peptide-Catalyzed Atroposelective Coupling of Arenes and Quinones</i>
2021	Hailey Parry, Ph.D. HPU Exercise Science/Chemistry 2017 National Institutes of Health	<i>Key to Success – A Note to Future Graduates</i>
2022	Elizabeth Reardon HPU Biology 2017 Emmes Company, LLC	<i>Planting Seeds: A Perspective on Alternative Paths</i>
2023	Calla Telzrow, Ph.D. HPU Biology 2016 RFI at PPD	<i>Underappreciated & Underestimated: Implications of Human Fungal Pathogens and Genetic Approaches to Understanding Them</i>

Notes

SuRPS 2024 Was Partially Supported By The Following Organizations:





2024 SciQuest Spectacular

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