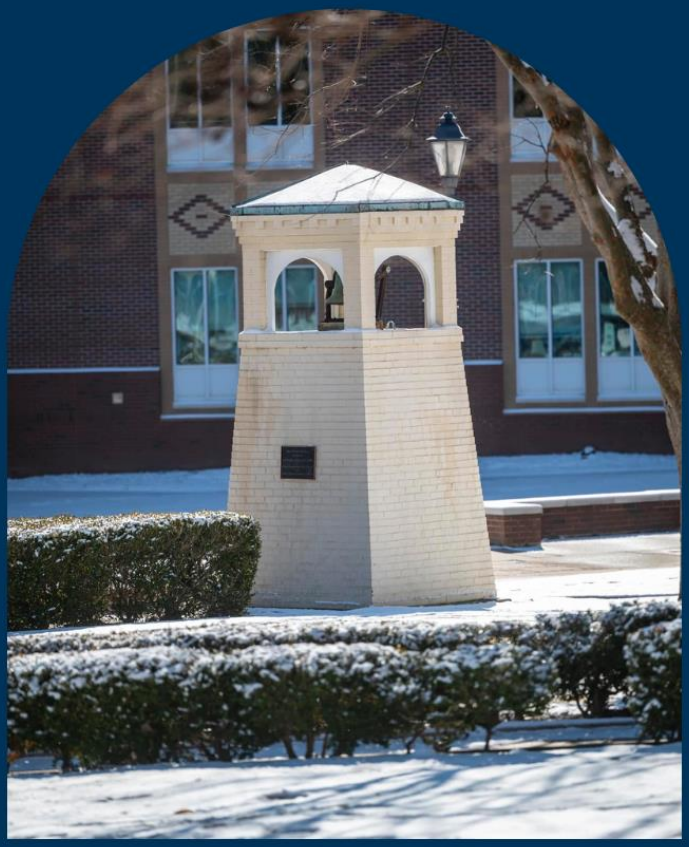
THE ARSENAL

EST. 2016



AUGUSTA UNIVERSITY'S UNDERGRADAUTE RESEARCH JOURNAL

VOLUME 8, NO.1

Special Issue: 2025 Undergraduate Research and Fine Arts Conference Proceedings

About *The Arsenal*

The Arsenal: The Undergraduate Research Journal of Augusta University (ISSN 2380-5064) is a peer-reviewed, open-access, interdisciplinary journal for undergraduate research conducted at Augusta University. This journal is a collaboration between the Center for Undergraduate Research and Scholarship (CURS), University Libraries, and the CURS student Ambassadors.

The Arsenal was launched by the undergraduate research student organization named On the Shoulder of Giants in Fall 2016. The journal represents and highlights undergraduate research of academic and scholarly value from various disciplines at Augusta University. Each article undergoes a peer-review process facilitated by the journal's Editorial Review Board and must be approved by an appointed faculty reviewer in the article's respective discipline. More information can be found at augusta.edu/arsenal-home.php.

Editorial Board

Preface

The Center for Undergraduate Research and Scholarship (CURS) proudly presents the proceedings for the 26th annual Undergraduate Research and Fine Arts (URFA) Conference on April 2, 2025. This annual conference is supported by the CURS, the AU Chapter of Phi Kappa Phi, and the Office of Interdisciplinary Research. The proceedings consist of the program for the 26th annual conference, along with the scholarly abstract of each undergraduate presenter's original work.

This year we host 72 undergraduate student presenters majoring in Art, Biochemistry, Biology, Business Administration, Economics, Cell and Molecular Biology, Chemistry, Communications, Computer Science, Cybersecurity, Cybersecurity Engineering, Dental Hygiene, Ecology, English, Health, Society & Policy, Kinesiology, Mathematics, Neuroscience, Physics, and Psychology.

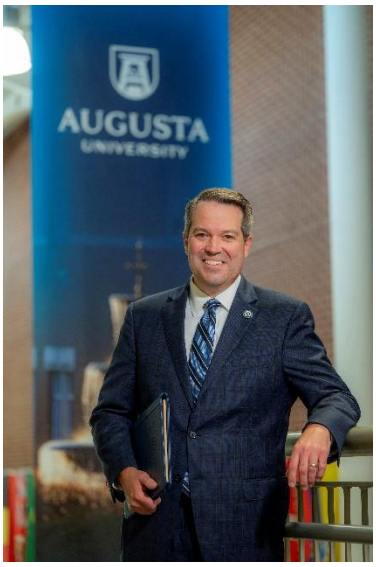
We are pleased to have 41 Faculty Mentors from the departments of Art and Design, Biochemistry and Molecular Biology, Biological Sciences, Biomedical Research, Business, Cardiology, Cellular Biology and Anatomy, Chemistry & Biochemistry, Communications, Community and Behavioral Health Sciences, English and World Languages, Gastroenterology, History, Anthropology & Philosophy, Immunology Center for Georgia, Mathematics, Medicine, Neurology, Neuroscience and Regenerative Medicine, Neurosurgery, Nursing, Oral Biology and Diagnostics, Physics & Biophysics, Physiology, and Psychological Sciences are represented at this year's conference.

We would like to express our gratitude to all the speakers, presenters, participants, and volunteers for their contributions. In particular, we would like to thank our generous sponsors for their financial support to the 26th URFA Conference. Without the support of the Provost's Office, the Vice Provost for Instruction, and the Phi Kappa Phi Honor Society, we would not be able to provide such an impactful event for our students. We hope that the proceedings and conference grant the most beneficial and fruitful experience to all those involved.

Dr. Quentin Davis, Co-Chair URFA Conference
Ms. Elizabeth Eisner, Co-Chair URFA Conference

Table of Contents

President's Welcome



It is an honor to welcome you all to Augusta University's 26th annual Undergraduate Research and Fine Arts Conference (URFA). This unique opportunity is a special chance to showcase the discoveries, innovations, and achievements of the many talented scholars pursuing their degree at AU.

The URFA conference is hosted by the Center for Undergraduate Research and Scholarship (CURS) with support from the AU Chapter of Phi Kappa Phi and the Office of Interdisciplinary Research. CURS, established in 2008, has a mission of supporting undergraduates in the pursuit of discovering new information, investigating factors of influence, and innovating research under the collaborative guidance of a faculty mentor. Since 1897, Phi Kappa Phi – the nation's oldest, largest, and most selective all-discipline honor society – has displayed an integrated approach to both academic and personal excellence.

I believe the most impactful research stems from collaboration, which is why I'm especially proud that this conference highlights partnerships that bridge all our different colleges and campuses, fostering connections and integration across research groups.

At Augusta University, our goal is to achieve excellence by staying committed to the most effective teaching and interactive, engaged learning methods. Providing access to research experiences for our undergraduate students helps us accomplish many important goals – teaching our students to become critical thinkers and problem solvers, while also enhancing the experience they have while they are with us at AU.

Through scholarly engagement, we can truly bring innovation and education to life, which has a lasting impact on students' outcomes and success.

I encourage you to engage and participate in the comprehensive and dynamic presentations developed by our students. I am deeply appreciative of the dedication and commitment of the volunteers, staff, students, and faculty whose hard work made this conference possible.

Congratulations to you all,

Russell T. Keen

President of Augusta University

Conference Agenda

Opening Ceremony	12:00 pm -12:50 pm	
	Welcome	Dr. Quentin Davis, Center for Undergraduate Research and Scholarship
	Opening remarks	Dr. Zach Kelehear, Vice Provost for Instruction
	Phi Kappa Phi Welcome	Dr. Kevin Frazier, VP Phi Kappa Phi Chapter 324
	Navigating the Conference	Ms. Elizabeth Eisner, Center for Undergraduate Research and Scholarship
Oral & Poster Sessions	1:00 pm – 5:00 pm	
	Oral and Poster sessions	See summary schedule
	4x4 Showdown	Research Pitch Competition
Awards Ceremony & Reception	5:00 pm – 6:00 pm	
	Conference Awards	Center for Undergraduate Research and Scholarship, Phi Kappa Phi
	Distinctions in Research	Center for Undergraduate Research and Scholarship
	Closing Remarks	Dr. Jennifer Sullivan, Interim Provost
	Acknowledgments	Dr. Quentin Davis, Center for Undergraduate Research and Scholarship

Summary Schedule of Events

Welcome & Kickoff
12:00 – 12:50

Poster Sessions
Session A 1:00 – 2:00 Session B 2:30 – 3:30

Health and the Human Experience
Session 1:00 – 2:30

Physics Applications
Session 1:00 – 2:30

Medical Chemistry
Session 1:00-2:40

Genetics & Cellular Biology
Session 2:40 – 4:00

Neurobiology & Cognition
Session 2:40 – 3:40

Health, Society & Technology
Session 3:00-4:00

Art & Literature
Session 4:00 – 4:40

4x4 Showdown Research Pitch Competition
Session 4:00 – 5:00

Awards Ceremony & Reception
light refreshments served
5:30 – 7:00

Navigation

TIME	BUTLER (40) Rm 227	COFFEEHOUSE (100) Rm 235	BALLROOM (300) Rm 155	HARDY (50) Rm 232
11:00 - 12:00			Presenter Check-in; Poster A Set up	
12:00 - 12:50			**Welcome & Keynote**	
12:50-1:00			Break	
1:00 - 2:30	Health and the Human Experience	Physics Applications	Poster Session A 1:00-2:00	Medicinal Chemistry 1:00 - 2:45
			Poster B Set up	
2:30 - 2:40	Break	Break	Poster Session B 2:30 -3:30	
2:40 - 4:00	Genetics & Cellular Biology	Neurobiology & Cognition 2:40 - 3:40		Break
				Health Society & Technology 3:00 - 4:00
		Break		
4:00 - 5:00		Art & Literature 4:00 - 4:40	4x4 Showdown 4:00 - 5:00	
5:00 - 5:30		Break	Break	
5:30 - 7:00			**Closing: Awards Ceremony & Reception**	

1:00 – 2:30 Butler, Room 227

Health and the Human Experience

Moderator: Emily Harris

Folasade Logan-Batista, Biology **1:00 – 1:15**
THE CULTURAL IMPACT OF BEAUTY STANDARDS
Mentor: Dr. Angela Bratton

Paige Sheppard, Nursing **1:15 – 1:30**
INFLUENCE OF OCCUPATIONAL PHYSICAL ACTIVITY ON HISPANIC AGRICULTURAL WORKERS' DIABETES RISK
Mentor: Dr. Lynn Glenn

Maivy Huynh, Health, Society, and Policy **1:30 – 1:45**
THE ILLNESS EXPERIENCE OF ORGAN TRANSPLANT RECIPIENTS
Mentor: Dr. Angela Bratton

Julianna McGahee, Communication **1:45 – 2:00**
THE ILLNESS EXPERIENCE OF ORGAN TRANSPLANT RECIPIENTS
Mentor: Dr. Taylor Walker

Francess Pujeh, Health, Society, and Policy **2:00 – 2:15**
THE ILLNESS EXPERIENCE OF ORGAN TRANSPLANT RECIPIENTS
Mentor: Dr. Andrew Goss

1:00 – 2:30 Coffeehouse, Room 235

Physics Applications

Moderator: Tonya Doroty

Brody Brogdon, Physics **1:00 – 1:15**
LATTICE VIBRATION OF CHROMIUM HALIDES
Mentor: Dr. Trinanjan Datta

Kathryn Dunstan, Physics **1:15 – 1:30**
LOW-COST REMOTE EATER LEVEL MEASUREMENT USING ARDUINO
Mentor: Dr. Andrew Hauger

Patrick Rimbey, Cybersecurity Engineering **1:30 – 1:45**
REAL-TIME WASTE MONITORING USING LOW-COST CELLULAR CAPABLE MICROCONTROLLERS
Mentor: Dr. Andrew Hauger

Kaylee O'Steen, Cybersecurity **1:45 – 2:00**
GO WITH THE FLOW: BUILDING LOW-COST WATER VELOCITY SENSOR
Mentor: Dr. Andrew Hauger

Victoria Makowski, Ecology & Emma Herndon, Ecology **2:00 – 2:15**
DOpTC: A LOW-COST WATER QUALITY MONITORING SYSTEM
Mentor: Dr. Andrew Hauger

Wesley Cooke, Physics/ Computer Science **2:15 – 2:30**
PATH DEVIATION OF AN AUTONOMOUS SURFACE VEHICLE
Mentor: Dr. Andrew Hauger

1:00 – 2:45 Hardy, Room 232

Medicinal Chemistry

Mentor: Dr. Siva Panda

Moderator: Allison Toney

Holden Dinkins, Medicinal Chemistry **1:00 - 1:15**
ADVANCING CANCER TREATMENT WITH DIARYLPIPIDONNE-DERIVED HYBRID MOLECULES

Brianna Lynn, Forensic Chemistry **1:15 - 1:30**
ADVANCING ANTIMICROBIAL DRUG DESIGN: FLUOROQUINOLONE HYBRIDS WITH DUAL-ACTION POTENTIAL

Iris Truong, Medicinal Chemistry **1:30 – 1:45**
IBUPROFEN-DERIVED HYBRID MOLECULES: UNLOCKING NEW THERAPEUTIC POTENTIAL

Sophia Ying & Nihal Amineni, Cell and Molecular Biology **1:45 - 2:00**
URSOLIC ACID-BASED HYBRID CONJUGATES: A NEW AVENUE FOR CANCER THERAPY

Katherine Conkright, Medicinal Chemistry **2:00 - 2:15**
CURCUMIN MIMICS: A PATH TO NOVEL ANTICANCER AGENTS

Nathan Ramaswamy, Cell and Molecular Biology **2:15 - 2:30**
IN SILICO EVALUATION OF PIPERINE AS A PROMISING ANTICANCER AGENT

Josh Melton & Andrew Perez-Manso, Medicinal Chemistry **2:30 - 2:45**
EXPLORING MODIFIED PIPERINES FOR CANCER THERAPY: A COMPUTATIONAL APPROACH

2:40 – 4:00 Butler, Room 227

Genetics and Cellular Biology

Moderator: Natalee Reese

Corbin Lane, Cell and Molecular Biology **2:40 – 2:55**
INVESTIGATING ADHESION FORCES IN T-CELL MEDIATED CANCER KILLING
Mentor: Dr. Abdul Malmi-Kakkada

Sophia Tang, Cell and Molecular Biology **2:56 – 3:11**
MAPPING OF ORAL TISSUE EXTRACELLULAR VESICLES IN HEALTH AND DISEASE
Mentor: Dr. Ranya El Sayed

Tanvi Patil, Cell and Molecular Biology **3:12 – 3:27**
LOSS OF PKG2 CONTRIBUTES TO CONSTIPATION IN ELDERLY MICE
Mentor: Dr. Darren Browning

Sriram Budim, Cell and Molecular Biology **3:28 – 3:43**
TOLL-LIKE RECEPTOR 4 IN TRAUMATIC BRAIN INJURY-INDUCED BEHAVIORAL DEFICITS
Mentor: Dr. Kumar Vaibhav

Isaac Bloom, Neuroscience **3:44 – 3:59**
JMJD1C DIRECTS OLIGODENDROCYTE MATURATION FOLLOWING DEVELOPMENTAL BRAIN INJURY
Mentor: Dr. Evan Goldstein

2:40 - 3:40 Coffeehouse, Room 235

Neurobiology and Cognition

Moderator: Melissa Johnson

Calvin Puch, Physics **2:40 – 2:55**
ELECTROMAGNETIC FREQUENCY RESPONSE OF DAMAGED NERVES
Mentor: Dr. Trinanjan Datta

Tej Murudkar, Cell and Molecular Biology **3:00 – 3:15**
NLRP3 DELETION IMPROVES CBF AND FUNCTIONAL OUTCOMES IN VCID MODELS
Mentor: Dr. Mohammad B. Khan

Madden Jones, Cell and Molecular Biology **3:20 – 3:35**
SEX DIFFERENCES IN COGNITION POST-TREATMENT OF EMOTIONAL TRAUMA
Mentor: Dr. Almira Vazdarjanova

3:00 – 4:00 Hardy, Room 232

Health, Society, & Technology

Moderator: Jennifer Davis

Taylor Grace Yancey, Nursing **3:00 – 3:15**
GUIDELINES FOR PATIENTS TO FIND SCIENTIFICALLY ACCURATE MEDICAL INFORMATION
Mentor: Dr. Andrew Balas

Madina Afzali, Kinesiology **3:15 – 3:30**
VALIDATION AND ASSESSMENT OF ELECTRONIC GAS AND BLOATING DIARY
Mentor: Dr. Satish Rao

Radha Garikipati, Cell and Molecular Biology **3:30 – 3:45**
SINGLE AND DUAL-TASK MOBILITY MEASURES TO DISTINGUISH FALLERS FROM NON-FALLERS
Mentors: Dr. Deborah Jehu

Kaamya Mehra **3:45 – 4:00**
ALABAMA COVID-19 VACCINATION RATES: IMPACT OF SITE AVAILABILITY PER CAPITA
Mentor: Dr. Roger MacArthur

4:00 – 5:00 Coffeehouse, Room 235

Art and Literature

Moderator: Kathy Davies

Danielle Denton, English **4:00 – 4:15**
AILING: AN ABJECT HORROR STORY

Mentor: Dr. Spencer Wise

Cheo Saromines, Nursing **4:15 – 4:30**
THE PERCY THAT COULD HAVE BEEN: DEVALUING UNDERDOGS IN THE LIGHTNING THIEF

Mentor: Dr. Lee Anna Maynard

Andrew Vincent III, Art **4:30 – 4:45**
PHOTO SERIES, HARRISBURG AND THE WHITE HOUSE TRACT TODAY, 2024

Mentor: Prof. Randy Pace

4:00 – 5:00 Ballroom, Room 155

4x4 Showdown

Moderator: Soma Mukhopadhyay

Shawn Macon, Physics
COMPUTATIONAL MODELING TO UNDERSTAND HOW CONTACT LENGTH AFFECTS SYNNOTCH OUTPUT

Mentor: Dr. Abdul Malmi-Kakkada

Tzipporah Israel, Biochemistry
MEMORY CD4 T CELL ENRICH CD8 T CELLS VIA CROSSTALK

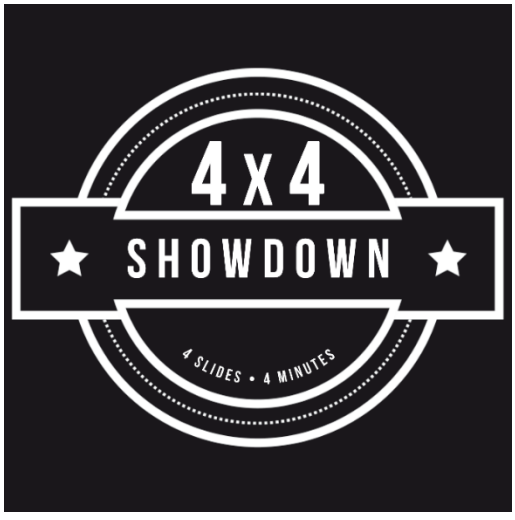
Mentor: Dr. Hossam Abdelsamed

Grace Neiswender, Cell and Molecular Biology
INVESTIGATING THE ROLE OF BICD2 IN NUCLEAR IMPORT

Mentor: Dr. Graydon Gonsalvez

Riya Patel, Psychology
IMPACT OF BLOOD PRESSURE VARIABILITY ON CEREBROVASCULAR FUNCTION IN MICE

Mentor: Dr. Jessica Filosa



1:00 – 2:00 Ballroom, Room 155

Poster Session A

1. **Gavin Feinberg, Cell and Molecular Biology**
   SIZE DEPENDENT ENDOCYTOSIS OF PERIPHERAL MEMBRANE PROTEINS
   Mentor: Dr. Nevin Lambert

2. **Amanda Wolbert, Psychology**
   NRF2 INHIBITOR PEPTIDES AS NEW THERAPEUTIC FOR RESISTANT CANCERS
   Mentor: Dr. Matteo Borgini

3. **Kacey Axon, Business Economics**
   DOES GROWING INCOME INEQUALITY IN GEORGIA'S COUNTRIES THREATEN GROWTH?
   Mentor: Dr. Simon Medcalfe

4. **Brandon Day, Business Administration**
   EFFECTS OF TARIFF POLICY ON MANUFACTURING EMPLOYMENT IN GEORGIA
   Mentor: Dr. Simon Medcalfe

5. **Matthew Kededa, Cell and Molecular Biology**
   LEVERAGING ADENOVIRUS-ASSOCIATED VECTORS TO INDUCE SAMHD1 DEGRADATION AND OVERCOME THERAPY RESISTANCE IN GLIOBLASTOMA
   Mentor: Dr. Waaqo Daddacha

6. **Victoria Makowski, Ecology**
   CHLOROPLAST FROM THE PAST: DIGITIZING AUGUSTA UNIVERSITY'S HERBARIUM
   Mentor: Dr. Stacy Bennetts

7. **Neha Thomas, Cell and Molecular Biology**
   IMMUNOLOGY AND THERAPUTIC INTEVENTION OF OVARIAN CANCER
   Mentor: Dr. Evila da Dilva Lopes Salles

8. **Emily Harmon, Ecology**
   TRAFFIC NOISE IMPACTS ON INTERSPECIFIC ALARM CALL RESPONSE IN BIRDS
   Mentor: Dr. Robert Cromer

9. **Emilie Barenghien, Biology**
   THE EFFECTS OF TURBIDITY ON FEEDING BEHAVIOR OF POMOXIS ANNULARIS
   Mentor: Dr. Randy Singer

10. **Aniyah Stevenson, Biology**
    DETERMINANTS OF RACIAL DISPARITIES IN INFANT MORTALITY IN GEORGIA
    Mentor: Dr. Simon Medcalfe

11. **Mariya Saju, Biology**
    DEPLETION NEUTROPHIL MOBILIZATION TO PREVENT STROKE DETERIORATION AND AID RECOVERY
    Mentor: Dr. Ali Arbab

12. **Namita Gupta Gonugunta, Cell and Molecular Biology**
    EXOSOME DELIVERY OF PROTEINS FOR STROKE RECOVERY
    Mentor: Dr. Ali Arbab

13. **Ruth Germann, Biology**
    PHYSIOLOGICAL INSIGHT: INVESTIGATING BIOMARKERS OF ENVIRONMENTAL STRESS IN SPARTINA ALTERNIFLORA
    Mentor: Dr. Robert Cromer

2:30 – 3:30 Ballroom, Room 155

Poster Session B

1. **Ja'Miah Johnson, Mathematics**
   STATISTICAL AND MACHINE LEARNING APPROACH TO ANALYZE HEART ATTACK DATA
   Mentor: Dr. Durga Kutal

2. **Beyza Koseoglu, Computer Science**
   BREAST CANCER DATA ANALYSIS USING SUPERVISED MACHINE LEARNING ALGORITHMS
   Mentor: Dr. Durga Kutal

3. **Osarume Ogala, Cell and Molecular Biology**
   CHARACTERIZATION OF A NEW MOUSE MODEL FOR COVID-19
   Mentor: Dr. Joseph Miano

4. **Priscilla Xiong, Biology**
   CANNABIDIOL AND ITS EFFECTS ON BRAIN METASTASIS FROM BREAST CANCER
   Mentor: Dr. Evila da Dilva Lopes Salles

5. **Gabriel Brunkow-Schnell, Dental Hygiene**
   ALTERNATION IN AUTOPHAGY AND MITOPHAGY GENES IN SKELETAL OF AGED MICE
   Mentor: Dr. Sadanand Fulzele

6. **Samantha Kendrick, Cell and Molecular Biology**
   IMPACT OF KIF1A MUTATIONS ON INTRACELLULAR TRANSPORT IN NEURONAL GLIOBLASTOMA
   Mentor: Dr. Stephen Tymanskyj

7. **Maksim Diakov, Cell and Molecular Biology**
   HISTAMINE REGULATES CELL FUNCTION IN THE KIDNEY
   Mentor: Dr. Daria Ilatovskaya

8. **Avneesh Prabakar, Cell and Molecular Biology**
   THE ROLE OF BICD2 IN CILIOGENESIS
   Mentor: Dr. Kumar Vaibhav

9. **Arilyn Williams, Biology**
   THE ROLE OF DNTPS IN THERAPY-RESISTANT GLIOBLASTOMA
   Mentor: Dr. Waaqo Daddacha

10. **Vanessa Browning, Psychology**
    OPIODS' EFFECTS OF PAIN-RELATED DISRUPTION OF BEHAVIOR IN MICE
    Mentor: Dr. Laurence Miller

11. **Febin John, Biology**
    MEASURING TURTLE TERRITORIES IN AUGUSTA GA INSIGHT INTO ECOSYSTEM PRESENCE
    Mentor: Dr. Robert Cromer

12. **Elizabeth Nelson-Twakor, Cell and Molecular Biology**
    COGNITION PREDICTS SLEEP ISSUES IN OLDER ADULTS WITH MOBILITY IMPAIRMENTS
    Mentor: Dr. Deborah Jehu

13. **Abraham Raji, Chemistry**
    INFLAMMATORY RESPONSE TO PYRIDOSTIGMINE BROMIDE AND PERMETHRIN IN MICE
    Mentor: Dr. Raghavan Pillai Raju

14. **Aditi Yellu, Cell and Molecular Biology**
    AGE-RELATED LIPID DROPLET ACCUMULATION IN THE BRAIN
    Mentor: Dr. Xin-Yun Lu

15. **Emma Herndon, Ecology**
    LOOKING FOR SUCCESS: MONITORING MULTI-LEVEL RESTORATION EFFECTS OF NOYES CUT
    Mentor: Dr. Stacy Bennetts

Special Thanks

Conference Committee and Planning Team

Ms. Jennifer Davis, *University Libraries*
Dr. Quentin Davis, *Center for Undergraduate Research and Scholarship*
Ms. Janice DeLoach, *IT Customer Experience*
Dr. JoAnn Edmond, *Classroom and Event Scheduling*
Ms. Elizabeth Eisner, *Center for Undergraduate Research and Scholarship*
Mr. Zach Griffin, *Center for Undergraduate Research and Scholarship*
Ms. Emma Gomez Lopez, *Center for Undergraduate Research and Scholarship*
Dr. Josefa Guerrero-Milan, *Department of Chemistry and Physics*
Ms. Jen Lask, *Brand Communications*
Mr. Michael Holahan, *University Communications Photographer*
Mr. Jorden Crawford, *JSAC Coordinator of Student Involvement*
Ms. Arijana Reese, *IT Customer Experience*
Ms. Whitney Russell, *University Libraries*
Ms. Dora Walden, *Classroom and Event Scheduling*

Recognition of Financial Contributions and Support

Phi Kappa Phi Chapter 324
Dr. Zach Kelehear, *Vice Provost for Instruction*
Dr. Jennifer Sullivan, Interim Provost

CURS Ambassadors

Karthik Aurora, *Undergraduate Conference Committee*
Dat Dang, *Undergraduate Conference Committee*
Zeal Dobariya, *Undergraduate Conference Committee*
Alexis Edge, *Undergraduate Conference Committee*
Grace Neiswender, *Undergraduate Conference Committee*

Special Thanks

Oral Session Moderators

Ms. Jennifer Davis, University Libraries
Ms. Emily Harris, University Libraries
Ms. Tonya Doroty, University Libraries
Dr. Allison Toney, Philanthropy and Alumni Engagement
Ms. Natalee Reese, University Libraries
Dr. Melissa Johnson, University Libraries
Ms. Kathy Davies, University Libraries
Dr. Soma Mukhopadhyay, Biological Sciences

Session Judges

Oral

Mrs. Emily Burns-Ray, Physiology
Dr. Heather Chiero, History, Anthropology, and Philosophy
Ms. Ashley Christman, Allied Health Professions
Ms. Elizabeth Crain, Information Technology
Dr. Cassandra Groth, Psychiatry and Health Behavior
Ms. Katherine Hatcher, Institute of Public and Preventative Health
Dr. Pamela Hayward, Communication
Dr. Seungwoo Kang, Pharmacology and Toxicology
Mr. Adam Kraft, Chemistry & Biochemistry
Ms. Heather Lewis, Institutional Effectiveness
Ms. Aspasia Luster, University Libraries
Dr. Anobel Maghsoodpour, Radiology and Imaging
Ms. Paula S. Owens, Academic Success Center
Dr. Gregory Passmore, Allied Health Professions
Ms. Rachel Patterson, Physiology
Ms. Erin Prentiss, University Libraries
Dr. Tim Sadenwasser, Honors Program
Ms. Asia Thomas, Research, Counseling & Curriculum
Dr. Nick Toussaint, Obstetrics and Gynecology
Dr. Kumar Vaibhav, Neurosurgery
Dr. Thomas Weeks, University Libraries
Dr. Christina Wilson, Biological Science
Ms. Heather Wilson, IRB Office
Dr. Nathan Yanasak, Radiology & Imaging

Poster

Mr. Francis Anazodo, Biochemistry & Molecular Biology
Ms. Jessica Burkhalter, Audit, Compliance, Ethics, and Risk Management
Ms. Liesl De Sevilla, Environmental Health and Safety
Ms. Angelica Hill, First & Second Year Experiences
Dr. Todd Hoffman, English & World Languages
Dr. Ellen LeMosy, Cellular Biology and Anatomy
Dr. Henry Moon, Pediatrics/ OAA
Dr. Andrew Moore, Kinesiology
Ms. Neea Rusch, Computer and Cyber Security
Dr. Catherine Slade, Hull Collage of Business
Dr. Douglas Taylor, Physiology
Dr. Jason Williams, Information Systems and Security

This page intentionally left blank.

Abstracts

Validation and Assessment of Electronic Gas and Bloating Diary

Author(s): Madina Afzali, Danielle Long, Yun Yan, Amanda Tyra, Amalesh Sanku, Satish S.C. Rao

Faculty Sponsor(s): Dr. Satish S.C. Rao

Affiliation(s): WellStar MCG Health Augusta University, Augusta, GA, USA

ABSTRACT

Background: Accurate tracking of chronic gastrointestinal (GI) symptoms such as gas, bloating, and abdominal pain is essential for effective patient care and research. However, patients often struggle with recall bias when reporting these symptoms. While a paper diary has been previously validated for tracking gas and bloating, the accuracy and reliability of a digital app for symptom tracking remain unknown.

AIM: To determine the clinical utility and accuracy of an electronic gas/bloating app by comparing this with a paper diary in symptomatic patients.

Methods: In this crossover study, patients with persistent gas and bloating (>6 months) were randomly assigned to track their daily symptoms using either the GasBloating app or a paper diary for two weeks before switching to the alternate method. Participants recorded ten GI symptoms (bloating, gas, nausea, belching, abdominal distention, abdominal pain, constipation, indigestion, vomiting, and diarrhea), documenting their frequency (0–3 scale), duration (0–3 scale), and severity (0–10 scale). An overall symptom index score was calculated using the formula: (Frequency + Duration) × Severity (range: 0 = none to 60 = severe). Additionally, a gas, bloating, and distension index score was created by averaging these three symptom scores. At the end of the study, participants completed a feedback questionnaire assessing user experience, ease of use, and overall satisfaction. Symptom tracking consistency between the two methods was analyzed using intraclass correlation coefficients (ICC) to determine reliability.

Results: A total of 34 patients (22 females, 12 males; mean age = 48 years) completed the study. The cohort included 59% Caucasians, 31% African Americans, 8% East Asians, and 2% Hispanics. The app demonstrated strong accuracy, as symptom data recorded by the GasBloating app and the paper diary showed similar distributions. Both tracking methods exhibited high test-retest reliability and reproducibility, as indicated by strong ICC values. Patients overwhelmingly preferred the app over the paper diary, reporting significantly higher ease of use, greater satisfaction, and increased convenience ($p < 0.01$). Additionally, participants noted that the app required less time for symptom tracking, making it a more efficient tool for daily use.

Conclusions: The GasBloating electronic app appears to accurately and reliably capture the symptoms of gas, bloating, and distension with good reproducibility. Further, most patients overwhelmingly preferred the mobile phone app to a paper diary and rated this as easy, convenient and user-friendly. App based prospective symptom assessments may improve our ability to accurately diagnose and manage patients with chronic GI symptoms.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Madina Afzali, Augusta University, 1120 15th St. Augusta, GA 30912, mafzali@augusta.edu

Does Growing Income Inequality in Georgia's Counties Threaten Growth?

Authors: Kacey Axon and Simon Medcalfe

Faculty Sponsor: Simon Medcalfe, PhD

Affiliation: Hull College of Business, Augusta University

ABSTRACT

Income inequality is the unequal distribution of income among individuals in a population. Evidence from country analysis suggests that the gap between the rich and the poor continues to reduce economic growth and macroeconomic stability. High levels of income inequality bring about large social costs, especially for the poor and middle class. This research examines whether this relationship holds true for counties in Georgia. Do Georgia counties with greater income inequality experience slower growth over time? Data is collected for the years 2011 through 2020 from the County Health Rankings and Roadmaps which provides estimates for income inequality as well as population and education data by county in Georgia. The U.S. Bureau of Economic Analysis provides data for the level of Gross Domestic Product (GDP) and personal income per county. This data is used to determine if the economic growth (GDP) of counties in Georgia has a positive or negative relationship with income inequality. The data is analyzed using regression analysis. Preliminary results suggest that higher income inequality is associated with lower GDP for counties in Georgia while a more educated population increases GDP.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Kacey Axon, Augusta University, 1120 15th St. Augusta, GA 30912, kaxon@augusta.edu

The Effects of Turbidity on the Feeding Behavior of Pomoxis annularis

Author: Emilie Barenghien

Faculty Sponsor: Dr. Randal Singer

Affiliation: Department of Biological Sciences, Augusta University

ABSTRACT

As urbanization grows and the human population expands, construction and other efforts are causing an unnatural increase in sedimentation and turbidity of nearby waterwats. Sedimentation is merely sediment entering bodies of water, whereas turbidity is the amount of sediment suspended in water. Studies show that varying levels of turbidity can impact various fishes and their behaviors in many ways, which can pose some questions about the implications of turbidity on overall aquatic ecosystems and fish survivorship. For example, turbidity can be helpful to prey fish for hiding, and unhelpful for predatory fish for hunting. Simple alterations to fish behaviors could impact a freshwater ecosystem in the long-run and cause unbalanced fish diversity, and an unbalanced ecosystem. This thesis aims to explore the impacts of various turbidity gradients on the feeding behavior of *Pomoxis annularis*, otherwise known as the white crappie fish. *P. annularis* is known for its unique hunting behavior of using saltatory scanning for prey and has also been shown to survive in clear and turbid water, being more active at night. *P. annularis* is also a vision-based hunter, making it an interesting case to study in regard to turbidity and low-light conditions. As a piscivorous fish, *P. annularis* has some ecological impact, controlling some abundant populations of species in Augusta, such as the mosquitofish. Using the aquarium in Science Hall, sediment from Augusta lakes/rivers will be used to create various degrees of turbidity in different fish tanks, *P. annularis* specimens will be kept in these tanks, and their feeding behavior on feeder fish will be observed over a period of time. The fish kept in turbid environments will be compared to those kept in clearer water. The results of this thesis will contribute to the expanding wealth of research on turbidity's impact on fish behavior, and ultimately, freshwater ecosystems.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Emilie Barenghien, Augusta University, 1120 15th St. Augusta, GA 30912, ebarenghien@augusta.edu

JMJD1C directs Oligodendrocyte Maturation Following Developmental Brain Injury

Authors: Isaac Bloom, Dr. Evan Goldstein

Faculty Sponsor: Dr. Evan Goldstein

Affiliation: Department of Biological Sciences, Augusta University

ABSTRACT

Over ten percent of babies are born preterm. Often, the lungs of preterm infants are not fully developed, leading to brain hypoxia. This causes white matter injury (WMI) in the brain characterized by aberrant axonal myelination. Previous research using a hypoxic mouse model of developmental WMI demonstrated that recovery in an enriched environment (EE) promotes generation of oligodendrocytes (OLs), the myelinating cells in the brain, myelination, and locomotor recovery. To explore mechanisms of this EE-induced recovery, OL-specific RNA sequencing was performed. One particularly interesting differently expressed gene is Jumanji Domain Containing 1C (JMJD1C), a histone demethylase that promotes lipogenesis, a critical process for myelination. JMJD1C is downregulated after hypoxic injury but upregulated during EE-induced recovery. We hypothesize that JMJD1C directs enrichment-induced effects on following hypoxia. To determine the role of JMJD1C in OLs after hypoxic injury, JMJD1C was conditionally knocked-out of OL precursors. Transgenic mice were housed in hypoxia (10.5% O_2) from postnatal day (P) 3 through P11. Mice recovered in either a standard cage or an enriched environment, until P45. OL dynamics were assessed in the subcortical white matter using immunohistochemistry and fluorescent confocal microscopy. Our data suggests that OL-specific knockout of JMJD1C diminishes the oligodendrogenic response present during enrichment-induced recovery from hypoxia due to an accumulation of post-mitotic pre-myelinating OLs. More work will be done to elucidate the role of JMJD1C in myelination and functional recovery. This work has the potential to identify a therapeutic target for preterm infants with white matter injury.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Isaac Bloom, Augusta University, 1120 15th St. Augusta, GA 30912, Ibloom@augusta.edu

Lattice Vibrations of Chromium Halides

Authors: Brody Brogdon, Trinanjan Datta

Faculty Sponsor: Trinanjan Datta, PhD

Affiliation: Department of Physics and Biophysics, Augusta University

ABSTRACT

Semiconductors are the backbone of our computer technology industry. In this context, chromium based mixed halides (CrSX, X = Cl, Br, and I) are a promising class of magnetic semiconductors which can assist with developing devices than can manipulate information efficiently and allow high-capacity data storage. Since computers operate at room temperature, all the atoms in a material will vibrate. Thus, it is important to understand how lattice vibrations (also called phonon oscillations) can affect the controllability and tunability of information processing. To investigate the potential consequences of phonon (lattice) modes in a semiconductor we perform ab-initio quantum material simulation using Quantum Espresso to compute the electronic energy states (also called a bandstructure diagram) and the phonon energy-momentum (dispersion) relation. The result of our calculation suggests that the chromium halides possess phonon energy bands that coexist with electronic excitations (as found in x-ray scattering experiments). This finding allows us to conclude that chromium mixed halides offer a multi-functional material platform where several pathways of information processing (charge and lattice) can be simultaneously manipulated. Thus, the chromium mixed halides could potentially be utilized in novel electronic device applications.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Brody Brogdon, Augusta University, 1120 15th St. Augusta, GA 30912, bbrogdon@augsta.edu

Opioids' Effects of Pain-related Disruption of Behavior in Mice

Authors: Vanessa Browning, Jamani Garner, Kelly Roen, Gabrielle Pollard, Laurence Miller, PhD

Faculty Sponsor: Laurence Miller, PhD

Affiliation: Department of Psychological Sciences, Augusta University

ABSTRACT

Some estimates suggest that as many as 20% of adults in the U.S. experience chronic pain (Dahlhamer, 2018). One goal in clinical treatment of pain is restoration of behaviors that are disrupted by pain (Gereau, 2014). In support of this goal, pain researchers have developed new pre-clinical models of pain-depressed behaviors such as climbing, locomotion, and nesting behaviors (Garner et al., 2021; Negus et al., 2024; Santos et al., 2023). Recent investigations have found that low efficacy opioids provide the largest window of opportunity to assess effective analgesia in pain-depressed behavior (Santos et al., 2023). The purpose of the current study is to assess the efficacy of three opioid analgesics in restoring behavior in the presence of a noxious stimulus and assess the validity of a Nestlet shredding model of pain-related behavioral depression in mice. Our subjects were 10-week-old male and female ICR mice that weighed 23 - 45g upon arrival in the laboratory. Separate groups of mice were used to test each drug. The target behavior assessed was shredding of nesting material (a "Nestlet") that had been suspended from the top of the home cage. Lactic acid (0.18%) was administered via intraperitoneal injection immediately before the start of experimental sessions. Morphine, methadone, and buprenorphine were administered via subcutaneous injection 30 minutes prior to the start of the experimental sessions. We hypothesized that methadone and buprenorphine would restore pain-related depression of shredding similar to what had previously been observed with morphine. Our data revealed that morphine and methadone blocked acid-induced depression of shredding, however, buprenorphine did not. Our data supports the validity of the nestlet shredding procedure for the study of the expression and treatment of pain-related depression of behavior and suggests that the efficacy requirement to block acid-induced depression of shredding is greater than the requirement for depressing shredding in the absence of acid.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Vanessa Browning, Augusta University, 1120 15th St. Augusta, GA 30912, vbrowning@augusta.edu

Alteration in Autophagy and Mitophagy Genes in Skeletal of Aged Mice

Authors: Gabriel Brunkow-Schnell and Sadanand Fulzele

Faculty Sponsor: Sadanand Fulzele, PhD

Affiliation: Department of Medicine, Medical College of Georgia

ABSTRACT

Aging is characterized by a progressive decline in cellular function, largely influenced by mitochondrial dysfunction. This research investigates how alterations in autophagy and mitophagy genes impact aging in mice, particularly in muscular and skeletal cells. Autophagy is essential for removing dysfunctional organelles, while mitophagy specifically targets damaged mitochondria to maintain cellular homeostasis. Mitochondrial deterioration contributes to reduced ATP production, metabolic inefficiency, and age-related diseases, exacerbated by the accumulation of free radicals. To analyze the effects of mitophagy and autophagy in aging, this study examines RNA expression levels in skeletal muscle and tibial bone tissues from male and female mice aged 12 and 21 months. Tibial bone samples were crushed, and RNA was extracted for gene expression analysis. Muscle tissue samples underwent RNA isolation, cDNA synthesis, and quantitative real-time PCR (qRT-PCR) to assess differential expression of mitophagy and autophagy-related genes. The study measured mRNA levels for key genes involved in mitochondrial and autophagic processes, using GAP and 18S as control primers. Data analysis focused on comparative CT values to determine gene expression changes associated with aging. Findings from this study aim to elucidate the relationship between autophagy, mitophagy, and skeletal muscle atrophy. Preliminary results suggest that mitophagy-related proteins are less prevalent in aged mice, correlating with reduced muscle mass and strength. It is important to study these mechanisms in order to provide insights into potential therapeutic interventions targeting mitochondrial maintenance to mitigate age-related decline in muscle and skeletal health.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Gabriel Brunkow-Schnell, Augusta University, 1120 15th St. Augusta, GA 30912, wbrunkowschnell@augua.edu

Toll-Like Receptor 4 in Traumatic Brain Injury-Induced Behavioral Deficits

Authors: Sriram Budim, Tajman Randhawa, Manuela G. Zabala, Shreya Sunil, Mayuri Gulhane, Tabitha Royal Grace, Fernando L Vale, Kumar Vaibhav

Faculty Sponsor: Dr. Kumar Vaibhav

Affiliations: Department of Biological Sciences, College of Science and Mathematics, Department of Kinesiology, College of Education, Augusta University; Neurosurgery, Medical College of Georgia

ABSTRACT

Traumatic brain injury (TBI) is a leading cause of accidental disability and mortality globally. TBI patients suffer from severe health problems even months after the injury. Initial neurovascular injury leads to sustained neuroinflammation and activation of pattern recognition receptors (PRRs) like Toll-like receptor 4 (TLR4). TLR4, found on immune cells such as macrophages, plays a key role in maintaining inflammation after TBI.

We have hypothesized that TLR4 as a macrophage receptor leads to inflammation and edema post-TBI. We used the moderate to severe cortical impact (CCI) model of TBI in mice as frequently published by our lab. We observed that TLR4 is highly expressed in macrophages as TLR4+ cells accumulate in the traumatic brain. It is known that TBI leads to chronic pathology and behavior deficits, but the role of TLR4 in chronic deficits is still vaguely known. We have generated a macrophage-specific TLR4 knockout (myTLR4 KO) and evaluated the injured mice for pathology and behavioral deficits. Preliminary results have shown TLR4 deletion leads to reduced edema but did not have significant changes in cerebral blood flow and ventricular volume as imaged by MRI. Macrophage-specific deletion of TLR4 showed improvement in behavioral tests measuring movement and coordination, such as the Open Field and Narrow Beam tests. We, therefore, conclude that TLR4 on macrophages contributes significantly to inflammation and chronic deficits seen after TBI. However, more specific experiments are needed to further evaluate the role of TLR4 in neurological function.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Sriram Budim, Augusta University, 1120 15th St. Augusta, GA 30912, SBUDIM@augusta.edu

Molecular Hybridization of Dienone Curcumin Mimics: A Path to Novel Anticancer Agents

Author: Katherine Conkright

Faculty Sponsor: Dr. Siva S. Panda

Affiliation: Department of Chemistry and Biochemistry, Augusta University

ABSTRACT

Cancer remains a major health concern worldwide, ranking as the second leading cause of death in the United States, following heart disease. Breast cancer is the most frequently diagnosed cancer among women globally. Despite ongoing research efforts, there remains a pressing need for innovative treatments to combat breast cancer effectively. Curcumin, a natural substance, exhibits a range of biological activities that may contribute to cancer therapy. However, its low bioavailability limits its effectiveness as a viable drug candidate. To enhance its efficacy within the body, researchers have employed a molecular hybridization approach to modify curcumin active sites, resulting in more potent drug candidates for breast cancer. A range of curcumin analogs has been produced by reacting 3,5-di(E)-benzylidene-piperidine-4-ones with different amino acids and a side chain with antiproliferative properties. Positive *in vitro* results indicate that these compounds have notable anticancer activity against MCF7 and MB231 breast cancer cell lines while showing low toxicity to normal MCF10 breast cells.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Katherine Conkright, Augusta University, 1120 15th St. Augusta, GA 30912, katconkright@augusta.edu

Path Deviation of an Autonomous Surface Vehicle

Authors: Wesley Cooke, Brycen Havens, Wes Byne, Oscar Flite, Joseph Hauger

Faculty Sponsor: Dr. Joseph Hauger

Affiliations: Department of Physics and Biophysics, School of Computer and Cyber Sciences, City of Augusta Utilities Department

ABSTRACT

We have designed and tested an autonomous surface vehicle (ASV) that is deployed to monitor water quality in the local water system. The ASV is a modified kayak propelled by two brushless electric motors, controlled by a microcontroller fixed to the hull. We use a dual-band Global Navigation Satellite System with a nine-axis absolute orientation sensor to acquire the position and heading information used to navigate a predetermined path. To characterize the path deviation, we deploy the ASV into a local waterway to navigate a set course. Initial testing was performed using a square path with sides approximately 25 meters long and corners defined by four waypoints. The actual position of the ASV is compared to the ideal position along the straight-line path between predetermined waypoints. We have written a custom Python script to analyze the collected data in order to quantify the deviation between ideal and actual positions. To date our testing shows a maximum deviation of 2.0 meters and root-mean-square deviation of 0.7 meters from the ideal path. We present details of the operation of the ASV and our analysis of the path deviation data.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Wesley Cooke, Augusta University, 1120 15th St. Augusta, GA 30912, wcooke@augusta.edu

Effects of Tariff Policy on Manufacturing Employment in Georgia

Author: Brandon Day

Faculty Sponsor: Dr. Simon Medcalfe

Affiliation: Hull College of Business, Augusta University

ABSTRACT

Understanding the impacts of policy decisions is important for us as future advisors to policymakers, business leaders, or future leaders ourselves. We need to understand the effects a change in policy has, not just on our intended topic, but in the economy overall. An increase in tariffs doesn't simply impact the price of goods but has effects upon other economic variables, such as employment. I'm looking at the relationship between changes in tariff rates on manufacturing employment within Georgia's Metropolitan Statistical Areas (MSAs). I collected data from eight MSAs within Georgia, covering the period from 1990 – 2023. The employment data is sourced from the Federal Reserve Economic Data (FRED) and The United States Census Bureau. The tariff information is from the United States International Trade Commission (USITC) and the World Trade Organization (WTO). They provide information on how those tariffs were applied to the goods the United States imported within a given year. I hypothesize there is a positive relationship between tariffs and manufacturing employment in Georgia MSAs, so as tariffs increase, so will manufacturing employment within Georgia's MSAs. Using panel regression analysis, and allowing for general employment trends within MSAs, I find initial evaluations of the data show that there is a positive relationship, with strong confidence, between tariffs and employment manufacturing.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Brandon Day, Augusta University, 1120 15th St. Augusta, GA 30912, braday@augusta.edu

Ailing: An Abject Horror Story

Author: Danielle Denton

Faculty Sponsors: Dr. Spencer Wise, PhD and Dr. Blaire Zeiders, PhD

Affiliations: Department of English and World Languages, Honors Program, Augusta University

ABSTRACT

My thesis project is a horror story written using Julia Kristeva's *Powers of Horror* and the theory of the abject. The abject is our revulsion of things inside us. It is the fear of the inside, the fear of losing our identity because we cannot accept what has come from our own bodies. The abject is the identity break that happens when we cannot separate these things that come from our bodies from ourselves. The purpose of this project was to expand my writing skills and to truly understand what makes horror work as a genre. My story also helped me learn how to write three-dimensional, human characters. Using Kristeva's work and others, I learned employment of the abject makes for a truly horrific story because of how human it is, not just because there is a body or a carcass. My horror story is human because as humans we reject parts of us that we find disgusting, but that does not make those parts of us any less part of us. For example, vomit. We detest vomit, but it came from us. Thus, it can become difficult for one to separate the object from us. It is almost impossible to separate the object from the subject. There is a sense of discomfort and confusion regarding our identity, and that is horrifying. Having our identity broken in any form is uncomfortable and scary. Another aspect of the abject that is reflected in *Ailing* is mortality. The use of corpses and bodies forces us to face the fact that some day we will have to die. The abject, however, forces us and the main character of the story to look into the face of death. My story examines themes of bullying, disease and identity breaking, as well as the impacts of alcoholism and the refusal to accept things we do not understand and why this is horrifying. My aim for this story was to be terrifying, not only through the use of gore, but also through connecting the reader to their own humanity, death.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Danielle Denton, Augusta University, 1120 15th St. Augusta, GA 30912, dadenton@augusta.edu

Histamine Regulates Cell Function in the Kidney

Authors: Maksim Diakov, Alena Cherezova, Anastasia V. Sudarikova, Daria V. Ilatovskaya

Faculty Sponsor: Daria V. Ilatovskaya, PhD

Affiliation: Department of Physiology, Augusta University, Medical College of Georgia

ABSTRACT

Histamine is a nitrogenous molecule involved in allergic reactions and immune responses, but emerging research suggests it also plays a role in kidney diseases such as nephrotic syndrome, chronic kidney disease and diabetic nephropathy. The kidney contains multiple histamine receptors (HR1, HR2, HR3, HR4), which regulate various cellular functions, including calcium signaling. However, the specific effects of histamine on calcium levels and cytoskeletal organization in kidney collecting duct cells remain poorly understood. In this study, we explored how histamine influences intracellular calcium levels and actin cytoskeleton dynamics in these cells. Using live confocal imaging, we found that histamine increases intracellular calcium concentrations by activating HR1, HR3, and HR4. This calcium influx primarily comes from outside the cell rather than being released from internal stores. To investigate whether histamine affects cell structure, we treated kidney collecting duct cells (mpkCCD) with histamine (100 µM) for four hours and observed significant changes in the actin cytoskeleton. Specifically, stress fibers—bundles of F-actin—formed beneath the cell membrane, suggesting that histamine plays a role in cytoskeletal remodeling. To determine how histamine triggers these changes, we examined three key signaling pathways involved in actin regulation: RhoA, Rac1, and CDC42. We hypothesized that the RhoA pathway is responsible for stress fiber formation. Using Western blot analysis, we measured the relative abundance of proteins associated with these pathways in control cells and cells exposed to histamine, with receptor blockers: loratadine (5uM), ranitidine (10 uM), iodophenpropit (500 nM), and A943931 (100 nM) for each receptor HR1-4. Our results suggest that histamine-mediated actin remodeling is primarily driven by the RhoA pathway. These findings provide new insights into the relationship between histamine, calcium regulation, and cytoskeletal dynamics in kidney cells. Understanding this mechanism may help identify new therapeutic strategies for kidney diseases linked to histamine signaling, offering potential new strategies for future treatments.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Maksim Diakov, Augusta University, 1120 15th St. Augusta, GA 30912, mdiakov@augusta.edu

Advancing Cancer Treatment with Diarylpiperidinone-Derived Hybrid Molecules

Author: Holden Dinkins

Faculty Sponsor: Dr. Siva S. Panda

Affiliation: Department of Chemistry and Biochemistry, Augusta University

ABSTRACT

Cancer arises from uncontrolled cell division due to genetic or epigenetic changes and presents a significant health challenge. Breast cancer (BC) is the most common type among women, with an expected 310,720 new cases and 42,250 deaths in 2024, highlighting the need for improved treatments. Tumor heterogeneity quickly limits the effectiveness of current BC therapies. Natural products have emerged as promising alternatives for cancer treatments and have been vital sources for drug development over the past four decades. Our research focuses on the diarylpiperidinone scaffold derived from curcumin, the active compound in turmeric, as a potential anticancer agent. However, curcumin's low bioavailability and solubility issues reduce its therapeutic potential. Identifying pharmacological targets continues to be a challenge in drug development. We utilized one-pot molecular hybridization (MH) synthesis to create compounds with synergistic properties, using biotin as a tracer for difficult-to-track substances like curcumin. This approach led to the synthesis of biotinylated diarylpiperidinone derivatives, which improved signal detection and identified curcumin's target molecules. Additionally, we evaluated the anticancer efficacy of diarylpiperidinone derivatives combined with ibuprofen, a non-selective COX-1 and COX-2 inhibitor. COX-2 is associated with tumor growth, whereas COX-1 plays a role in normal functions. The proposed hybrids may selectively inhibit COX-2 while preserving COX-1 functionality, warranting further investigation. The effectiveness of these conjugates was assessed in BC cell lines and confirmed for purity through spectral analyses.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Holden Dinkins, Augusta University, 1120 15th St. Augusta, GA 30912, hodinkins@augusta.edu

Low-Cost Remote Water Level Measurement Using Arduino

Authors: Kathryn Dunstan, Wes Byne, Oscar Flite, Joseph Hauger

Faculty Sponsor: Dr. Joseph Hauger

Affiliations: Department of Physics and Biophysics, Augusta University; City of Augusta, Utilities Department

ABSTRACT

Remote water depth measurements are critical for municipal water resource management. Continuous water level monitoring, for example, is used to develop models for rainfall runoff and to provide early warning for possible flooding events. To enhance the spatial resolution and data quality of these measurements, we have developed a low-cost, high precision water level sensor. The sensor determines water depth by measuring the buoyant force on a submerged, hollow, sealed PVC tube held in place by a two-point calibrated load cell. The load cell is interfaced through an HX711 amplifier to the microcontroller. Our device has been tested using an indoor water bath in which the water level was varied over a range of 30 cm and was able to achieve sub-centimeter accuracy. Data is transmitted wirelessly through long-range, low-power radio communication (LoRa), enabling real-time continuous monitoring of water level. Powered by an integrated solar panel, the device is designed for indefinite deployment in remote environments. Our discussion will detail the sensor's design, calibration methods, field performance, and potential for transforming how municipalities monitor and respond to water resource challenges.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Kathryn Dunstan, Augusta University, 1120 15th St. Augusta, GA 30912, kdunstan@augusta.edu

Size Dependent Endocytosis of Peripheral Membrane Proteins

Authors: Gavin L. Feinberg[1], Wonjo Jang[1], Kanishka Senarath[1], Sumin Lu[1], Nevin A. Lambert[1]

Faculty Sponsor: Dr. Nevin Lambert

Affiliation: [1]Department of Pharmacology and Toxicology, Medical College of Georgia, Augusta University

ABSTRACT

Heterotrimeric G proteins are an important family of peripheral membrane proteins (PMPs) responsible for intracellular signaling on the inner leaflet of the plasma membrane (PM). Previous studies in our laboratory have shown that G proteins undergo endocytosis inefficiently, such that G protein density on endocytic vesicles is only 20-30% of the density on the plasma membrane. We hypothesized that this may reflect size-dependent steric occlusion of PMPs from coated endocytic vesicles. To test the impact of size on endocytosis we studied internalization of a smaller model PMP, mNeongreen-HRas ct (mNG-HRas ct). The plasma membrane and newly formed endocytic vesicles were stained with the styryl dye FM4-64 in HEK 293 cells expressing mNG-HRas, and spontaneous endocytosis was allowed to proceed for 15 minutes. Confocal imaging was used to measure mNG-Hras ct and FM4-64 fluorescence at the plasma membrane and endocytic vesicles. FM4-64 fluorescence was used to normalize the mNG fluorescence for the amount of membrane sampled by the imaging volume. We found that mNG-HRas ct density on endocytic vesicles was 64 ± 17% of its density on the PM. This result suggests that PMPs may generally be excluded from endocytic vesicles and is consistent with the hypothesis that size plays an important role in the endocytosis of PMPs.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Gavin Feinberg, Augusta University, 1120 15th St. Augusta, GA 30912, gfeinberg@augusta.edu

Single and Dual-Task Mobility Measures to Distinguish Fallers from Non-Fallers

Authors: Radha Garikipati, Albert P Okrah, Anitnett Ampiah, Katherine L Hsieh, Deborah A Jehu

Faculty Sponsor: Dr. Deborah A Jehu

Affiliation: Department of Community & Behavioral Health Sciences, Augusta University

ABSTRACT

Falls are a leading cause of injury among older adults. They are often associated with declines in mobility due to decreased muscle strength and sensorimotor coordination. Gait is an individual's walking pattern while dual-tasking involves performing two tasks simultaneously. Dual task gait assessments are presumed to be more sensitive in identifying gait abnormalities than single task assessments. This study aimed to investigate whether dual-task gait assessments can better differentiate fallers from non-fallers than single-task assessments. Eighty-five participants aged 65 years or older (79.81±8.25 years) were recruited from assisted living facilities (63.5%), nursing homes (2.4%), and the community (34.1%). Participants completed a health questionnaire to obtain demographic information, such as age, race, sex (17.19% female fallers, 12.42% female non-fallers), ethnicity, height, weight, education level, and fall history. Participants completed the Montreal Cognitive Assessment (MOCA) to detect cognitive impairment. Inclusion criteria required that participants stand unassisted for 30 seconds, self-report gait impairments, and demonstrate English proficiency. Exclusion criteria included cognitive impairment, high physical activity, a MOCA score ≤ 18 points, or musculoskeletal/neurological conditions. Participants completed mobility tasks such as the Timed Up and Go (TUG) test. Participants were instructed to rise from a chair, walk 3 meters forward, turn, walk back, and sit. The dual-task version included counting backward by 3s while walking. Participants completed an 8-meter gait speed test at normal and fast paces. In the dual-task version, participants listed words starting with "S" and "A". Mobility was measured using Ambulatory Parkinson's Disease Monitoring (APDM) inertial sensors, with data analyzed via Mobility Lab 2 software. Older adults with and without a history of falls were analyzed on how they perform in different walking conditions — single and dual task conditions. Results showed that there was a significant interaction between group (either faller or non-faller), condition (single or dual task), and measures (TUG or gait task) for TUG test ($p= 0.02$) but not for gait tasks ($p=0.2$). Fallers tended to have a smaller turn angle and velocity ($p=0.06$, $p=0.07$) compared to non-fallers. It was concluded that dual tasking was not more sensitive than single tasking to differentiate fallers from non-fallers. Duration of TUG tests, a common clinical metric, failed to distinguish between the groups. However, precise inertial sensors measurements like turn angle and velocity detected subtle differences. These findings highlight the importance of using objective motion analysis over traditional clinical tests to assess mobility impairments in older adults.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Radha Garikipati, Augusta University, 1120 15th St., Augusta, GA 30912, rgarikipati@augusta.edu

Physiological Insights: Investigating Biomarkers of Environmental Stress in Spartina alterniflora

Author: Ruth Germann

Faculty Sponsor: Dr. Robert Cromer

Affiliation: Department of Biological Sciences, Augusta University

ABSTRACT

Spartina alterniflora is a vital species in southeastern U.S. coastal salt marshes, contributing to ecosystem stability and resilience. This research investigates its tolerance to environmental stressors, focusing on salinity gradients. By analyzing patterns in rhizome and leaf tissues, the study aims to assess physiological and biochemical responses indicative of the plant's adaptive capacity.

Many biological mechanisms enable species like S. alterniflora to respond to environmental changes. Samples of S. alterniflora will be extracted along a salinity gradient and be profiled to determine the extent of physiological stress and their correlation with environmental factors. To evaluate stress-induced patterns, the samples will undergo various physiological assessments. The results of these tests will provide insights into the species' resilience or vulnerability. Understanding these dynamics will help determine the resilience of local S. alterniflora populations, providing useful data for conservation strategies to protect coastal ecosystems.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Ruth Germann, Augusta University, 1120 15th St. Augusta, GA 30912, rgermann@augusta.edu

Exosome Delivery of Proteins for Stroke Recovery

Authors: Namita Gupta Gonugunta, Nayonikaa Chakrabarty

Faculty Sponsor: Dr. Ali Arbab, PhD, MD

Affiliation: Department of Biochemistry and Molecular Biology, Department of Georgia Cancer Center, Medical Colleg of Georgia

ABSTRACT

A stroke occurs when blood flow to part of the brain is interrupted, either by a blockage or a rupture in a blood vessel. According to the World Health Organization, stroke is the second leading cause of death globally, with approximately 15 million people affected each year. White matter in the brain plays a crucial role in transmitting signals between different regions, and its disruption is commonly observed in stroked patients. The loss of blood flow during a stroke can lead to damage or degeneration of white matter, particularly in areas responsible for motor control, cognition, and coordination. Exosomes have emerged as a promising tool for targeted protein delivery to the brain, overcoming the challenge posed by the bloodbrain barrier (BBB). Unlike many therapeutic molecules that cannot cross the BBB, exosomes possess natural transport mechanisms that enable them to reach the brain, making them ideal candidates for delivering neuroprotective proteins. This study harnesses engineered exosomes for targeted protein delivery following ischemic stroke. Using a combination of bacterial and viral vectors, we created plasmids encoding target proteins for transfection into TN 293 cells, producing specialized exosomes. These were administered to stroke-induced models shortly after onset. We grouped the models to receive either control HEK exosomes or those modified to express specific proteins like rabies virus glycoprotein (RVG), neuroglobin (NGB), or both, with variations in their membrane association. Brain recovery was monitored through MRI on days 3, 14, and 28 post-stroke. Our specific role in the study involved analyzing Day 28 MRI data. Preliminary MRI data shows changes in white matter integrity as measured by diffusion tensor imaging (DTI). While no statistically significant differences were found, trends suggest variable impacts on fractional anisotropy among the groups, with potential improvements noted in the dual protein-expressing exosomes. Additional immunohistochemical analysis is underway to correlate these imaging findings with physical changes in brain tissue, specifically looking at myelin and astrocyte activation. This exploration into exosome-mediated protein delivery opens potential pathways for enhancing recovery from cerebral ischemic events by facilitating protein delivery across the blood-brain barrier, highlighting a promising frontier in neuroprotective strategies.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Namita Gupta Gonugunta, Augusta University, 1120 15th St. Augusta, GA 30912, nguptagonugunta@augusta.edu

Traffic Noise Impacts on Interspecific Alarm Call Responses in Birds

Authors: Emily Harmon, PeytonLee Allen, Rashaun McWhinney, Febin John, Anila Kankipati

Faculty Sponsor: Dr. Robert Cromer

Affiliation: Department of Biological Sciences, Augusta University

ABSTRACT

Anthropogenic noise pollution has been shown to interfere with avian acoustic communication, potentially disrupting survival-related alarm calls. Previous research has demonstrated that traffic noise can mask or cognitively distract birds from responding to alarm calls, leading to increased predation risk and reduced biodiversity near roadways. Alarm calls play a crucial role in avian survival by warning nearby individuals of potential threats, allowing them to take evasive action. In this study, we examined the effect of varying traffic noise levels on interspecific alarm call responses to determine whether noise pollution differentially affects avian communication. We hypothesized that interspecific communication would deteriorate as traffic noise increased. To test this, we broadcasted tufted titmouse (Baeolophus bicolor) alarm calls at multiple locations locally with different baseline noise levels, recording the number of species that vocalized and characterizing their calls. Major species detected included the northern cardinal (Cardinalis cardinalis), Carolina chickadee (Poecile carolinensis), and blue jay (Cyanocitta cristata). The locations tested were Lick Fork Lake (Francis Marion and Sumter National Forests), GA visitor's center (I-20), SC visitor's center (I-20), and the North Augusta Greenway. Background noise levels were measured for five minutes prior to playback and analyzed using audio processing software to determine site-specific decibel levels. Our results showed that there was no significant difference in species diversity or rates of interspecific communication in response to alarm calls. While this suggests that traffic noise may not universally disrupt avian communication networks, further research is needed to determine its broader ecological impact. This study highlights the complexity of noise pollution effects and confirms the need for additional investigations to inform conservation strategies and traffic regulation policies.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Emily Harmon, Augusta University, 1120 15th St. Augusta, GA 30912, duharmon@augusta.edu

Looking for Success: Monitoring multi-level restoration effects of Noyes Cut

Author: Emma Herndon

Faculty Sponsor: Dr. Stacy Bennetts

Affiliation: Department of Biological Sciences, Augusta University

ABSTRACT

The Satilla River is the largest blackwater system in Georgia; it drains nearly 4,000 square miles of coastal plain habitat and empties into St. Andrew Sound behind Jekyll Island. In the early 1900s multiple cuts were made through the salt marsh near Umbrella and Dover Creeks by the US Army Corps of Engineers (USACE) as part of constructing the Atlantic Intracoastal Waterway. Noyes Cut, which is no longer used for timber harvesting or as a navigational channel, has been a cause for concern. The Dover Bluff community was integral in reporting the first signs of altered flow and the resulting sedimentation to the USACE Savannah District, which prompted a follow-up investigation of water flow, sedimentation, as well as other water quality properties. In 1988, USACE deemed Noyes Cut an important driver of the altered water flow and sedimentation in Umbrella and Dover Creeks. Past sampling has identified spatial and temporal changes in bottom-up parameters (Mathews et al. unpubl. data) and top-down forces (Reichmuth et al. unpubl data). Dover and Umbrella Creeks show the most altered flow and salinity; past data says that salinity was higher in these creeks than expected due to the bi-directional tidal flow through the man-made cuts. (Mathews et al. unpubl. data). The changes in water chemistry negatively affect mobile organisms because salinity is a navigational cue for fish and important invertebrates (white shrimp and blue crab). At Piney Bluff Node, a site downstream from Noyes Cut, fish and plant species diversity are low. occurred in early 2023, with the closure of Noyes Cut to be completed later this year (2025). The purpose of this investigation is to compare pre-closure salt marsh plant diversity and fish assemblage diversity to environmental parameters, such as salinity, to post-closure salt marsh plat diversity and fish diversity.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Emma Herndon, Augusta University, 1120 15th St. Augusta, GA 30912, emherndon@augusta.edu

The Culture Surrounding Vietnamese Holistic Medicine Versus Biomedical Medicine

Author: Maivy Huynh

Faculty Sponsor: Angela Bratton, PhD

Affiliation: Department of History, Anthropology, and Philosophy, Augusta University

ABSTRACT

Medicine is a universal healing experience that enables society to recover from external and internal afflictions. However, medicine can be interpreted in various ways due to cultural factors in a society such as religion and power. Holistic medicine embodies the whole body regarding traditional treatment embedded within their cultural practices, herbal remedies, and spirituality. The various factors of how Vietnamese natural medicine treats patients and how it has been beneficial or not to one's life dictates their moral principles and ancestral workings. Vietnamese medicine is an essential topic to analyze in order to understand how traditional healers receive their skills and heal patients. I interviewed seven participants with a Vietnamese background who now live in US/Canada. The majority of participants concluded that the environment in which one was raised, influenced their views around traditional treatment. Moreover, today most do not rely on holistic approaches but find Western medicine reliable due to its credibility, reliability, and accessibility.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Maivy Huynh, Augusta University, 1120 15th St. Augusta, GA 30912, mahuynh@augusta.edu

Memory CD4 T Cells EnrichCD8 T Cells via Crosstalk

Authors: Tzipporah Israel[5], Mohamed Al-Moussawy[1], Anuj Sharma[2], Srivatsa Bellamkonda[1], Austin W.T. Chiang[2,3], Hossam Abdelsamed[2,4]

Faculty Sponsors: Austin W.T. Chiang, Hossam Abdelsamed

Affiliations: [1]Department of Surgery, Starzl Transplantation Institute (STI), School of Medicine, University of Pittsburgh, Pittsburgh, Pennsylvania, [2]Immunology Center of Georgia (IMMCG), Medical College of Georgia (MCG) [3]Department of Medicine, [4]Department of Physiology, Augusta University, Augusta, Georgia. [5]Department of Chemistry & Biochemistry Augusta University

ABSTRACT

Cells within biological systems often communicate with each other, a process crucial for behavioral coordination such as maintaining cell number, function, and specificity. The vertebrate immune system exemplifies this through intricate cell interactions among diverse array of innate and adaptive immune cells. For instance, the first step in T cell priming is the complex intermingling between antigen presenting dendritic cells and T cells in the lymphoid tissue, which results in effector T cell differentiation. Further, B cells and CD4 T follicular helper cells interact to drive B cell proliferation and differentiation into antibody-secreting plasma cells. Despite the considerable work to understand immune cell-cell interactions, the role of T-T cell crosstalk in immune responses and disease development requires further investigations. Here, we found that CD8 naïve T cells acquired an activated-memory phenotype (CCR7+/- CD45RO+) in the presence of polyclonal activated memory CD4 T cells. Following TCR stimulation in vitro, these cells expressed effector cytokines, including IFN-γ, TNF-α, and IL-2, compared to unstimulated controls. Using HLA-A*02:01 restricted tetramers loaded with six Type I diabetes (T1D) peptides, we observed that approximately 5% of naïve cells that acquired an activated/memory phenotype were beta islet cell-specific CD8 T cells. These findings suggest a mechanism where activated memory CD4 T cells communicate with CD8 naïve cells to enrich for auto-reactive T cells, potentially implicating autoimmunity following vaccination and transplantation. Finally, using scRNA-Seq approach we observed a diverse array of CD8 T cell states within this population. In conclusion, our study underscores the importance of T-T cell crosstalk in immune responses and highlights potential areas for therapeutic intervention.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Tzipporah Israel, Augusta University, 1120 15th St. Augusta, GA 30912, tisrael@augusta.edu

Measuring Turtle Territories in Augusta GA: Insights into Ecosystem Presence

Authors: Febin John, Anila Kankipati, Rashaun McWhinney

Faculty Sponsor: Dr. Robert Cromer

Affiliation: Department of Biological Sciences, Augusta University

ABSTRACT

Freshwater turtles play a major role in the ecosystem by scavenging and eating excess algae, which indicates local water quality. Their presence has a positive effect on local fish populations. The turtles of Reed Creek, Augusta GA were of particular interest to the project since it is an easily accessible body of water and can serve as a representation of the activity to be expected if someone were to test turtles in other parts of the region. Part of the investigation into the lifestyles of these turtles included taking measurements of a given turtle's territory to see how large of a presence an individual turtle had in the area. To test this, four turtles were lured and captured using sardine bait. The subjects included three Yellow Bellied Sliders (YBS, or Trachemys scripta scripta) indicated by transmitters #182, 122, & 101 and one Mud Turtle (Kinosternon subrubrum) indicated by transmitter #142. Their shell length was measured, as well as width and overall mass, before attaching radio antennae to their shells with glue. They were then released back into Reed Creek. GPS points of their locations were collected over the next few weeks and then these points were plotted onto a map. This map showed the square area each of the subjects spent their time in. Each of these areas were identified as the turtle's territory. Generally, the turtle territories seemed to be very small aside from YBS #122 whose territory was massive in comparison. These findings seem to suggest that turtles prefer to have small areas in which to live across species. However, the extreme outlier of YBS #122 means that making such a conclusion would be premature. In conclusion, further testing is needed with a greater variety of turtle species to test whether YBS #122 was an outlier or if there is a variety of preferences turtles have in the size of their territories. An example of this research's real-world application would be using the numbers of turtles as a test of water quality and indicator of health for the local environment.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Febin John, Augusta University, 1120 15th St. Augusta, GA 30912, fjohn@augusta.edu

Statistical and Machine Learning Approach to Analyze Heart Attack Data

Author: Ja'Miah Johnson

Faculty Sponsor: Dr. Durga Kutal

Affiliation: Department of Mathematics, Augusta University

ABSTRACT

In this project, we analyze heart attack data to identify key risk factors and predictive models. The data set was accessed from Kaggle.com and the data set contains 1888 observations and 14 attributes. Heart attacks are the most dangerous chronic life-threatening disease in the medical field. The medical field has benefited from both statistical analysis and machine learning algorithms. We perform logistic regression, classification, chi-squared, decision tree and a random forest to evaluate heart attack data. Logistic regression model is one of the effective models for predicting heart attacks. Since some of the factors have a heavier effect towards having a heart attack, not all the factors given from the data will be used. We found that chest pain, thalassemia, cholesterol, sex, number of major vessels (caa), resting electrocardiographic results (restecg), and exercise-induced angina (exang) are statistically significant risk attributes. The area under curve (AUC) value is 0.8223 and the model accuracy value is 0.631, these values indicate how well logistic regression model predict the heart attack. Using three of the categorical values for chi-square test of independence: chest pain, restecg, and gender, we have concluded both gender and chest pain are statistically significant in having an effect towards being a risk of a heart attack, but not restecg. According to the decision tree, chest pain has the most effect on the risk of having a heart attack. Using random forest algorithm, we obtained chest pain, thalassemia, number of major vessels (caa), age, cholesterol, oldpeak, resting blood pressure (trestbp), and slope of peak exercise (slope) are the most important variables to predict heart attack analysis.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Ja'Miah Johnson, Augusta University, 1120 15th St. Augusta, GA 30912, jjohnson36@augusta.edu

Sex Difference in Cognition Post-Treatment of Emotional Trauma

Author: Madden Jones

Faculty Sponsors: Dr. Almira Vazdarjanova and Khadijah Shanazz

Affiliation: Department of Pharmacology and Toxicology, Medical College of Georgia

ABSTRACT

Post-traumatic stress disorder is a debilitating psychiatric condition that affects cognitive functions such as memory, learning, and executive processing. While effective treatments like Prolonged Exposure (PE) therapy exist, little research has examined how cognition is affected between males and females' post-treatment of their trauma. This study utilized a rodent model to investigate sex-specific cognitive differences following PTSD treatment. Using Contextual Fear Conditioning to induce trauma and a PE-based fear extinction model, we assessed fear behavior, spatial learning, and memory performance in both male and female rats. Cognitive function was evaluated through behavioral tasks while immediate early gene, Arc and Homer1a, expression analysis in the hippocampus and prefrontal cortex provided insight into underlying neural mechanisms causing this difference in behavior. In my presentation, I will show how this project's findings suggest that males and females exhibit cognitive differences following treatment, particularly in spatial memory retention and gene expression in the brain regions discussed. These results highlight the significant importance of considering sex as a variable in PTSD research.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Madden Jones, Augusta University, 1120 15th St. Augusta, GA 30912, madjones@augusta.edu

Leveraging Adenovirus-Associated Vectors to Induce SAMHD1 Degradation and Overcome Therapy Resistance in Glioblastoma

Authors: Matthew Kededa, Arilyn Williams, Ramsha Khanam, Aman Kalsi, Dominique Monroe, Edidiong Usoro, Waaqo Daddacha

Faculty Sponsor: Waaqo Daddacha, PhD

Affiliations: Department of Biochemistry & Molecular Biology, Medical College of Georgia
Department of Biological Sciences, Augusta University

ABSTRACT

Glioblastoma (GBM) is a deadly primary tumor of the brain, accounting for almost half of all diagnosed malignant gliomas. Ionizing radiation (IR) and some chemotherapeutics strategically target cancer cells by causing DNA double-strand breaks (DSBs). However, cancers like GBM often develop resistance to DSB-inducing therapeutics due to dysregulated DNA repair. Homologous Recombination (HR) is an error-free DSB-repair process consisting of proteins that are often dysregulated in GBM, causing overactive DNA-repair, therapy resistance, and poor patient outcomes. One of these proteins, SAMHD1, has been shown to sensitize GBM to radiotherapy. However, the delivery method was not compatible with delivery through the blood-brain barrier. Here, we used a novel approach to sensitize the GBM cells to radiotherapy. Utilizing adenovirus-associated vectors (AAVs) carrying a key gene for a protein called Vpx, we were able to degrade SAMHD1 significantly, reducing GBM viability by increasing apoptosis. Clonogenic assays, allowed the assessment of the proliferation of cells in response to treatment conditions. Cell counting involved the staining of harvested cells with Trypan Blue, and these cells were counted with a hemocytometer to quantify the viable cells based on membrane integrity. Alamar Blue Assay quantified cell viability through metabolic activity. Apoptosis assays enabled the quantification and detection of apoptosis in cell populations. Annexin V detects early apoptotic cells by binding to PS on the outer membrane, while 7-AAD identifies late apoptotic and necrotic cells by staining their DNA. Thus, the occurrence of apoptosis can be quantified by utilizing a flow cytometry. The significant decrease in cell proliferation and increase in apoptosis in the AAV-VPX group compared to the IR only group signifies a significant increase in sensitivity to DSB-inducing therapeutics. The successful incorporation of the VPX protein in an AAV system may provide a more translational benefit for patients with cancers protected by the blood brain barrier.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Matthew Kededa, Augusta University, 1120 15th St. Augusta, GA 30912, mkededa@augusta.edu

Impact of KIF1A Mutations on Intracellular Transport in Neuronal Glioblastoma

Authors: Samantha Kendrick, Stephen Tymanskyj

Faculty Sponsor: Stephen Tymanskyj, PhD

Affiliations: Augusta University, Department of Biological Sciences

ABSTRACT

The distribution of proteins from sites to the areas where required is an essential process for all cells. In neurons, this process is complicated by the large distances that proteins must travel, up to a meter in humans. Anterograde transport is mediated by the kinesin (KIF) motor proteins. Of particular importance is KIF1A, responsible for transporting synaptic precursors amongst other cargos. Efficient intracellular transport is essential for proper neuronal activity and synaptic transmission as it delivers cellular components such as organelles, synaptic vesicles, and proteins from the cell body to the axon terminals. Disruptions in KIF1A function due to pathogenic mutations compromise the distribution of these essential components, leading to a variety of neurodevelopmental disorders including neuropathy, hereditary spastic paraplegia, and intellectual disabilities. Recently, mutations in KIF1A have been identified in patients with ALS. The aim of this study was to investigate how mutations identified in human disease affect cargo transport. To address this, we used a light inducible cargo assay. This system allowed for the formation of artificial clusters in response to blue light exposure. Following formation, clusters were optogenetically linked to constitutively active KIF1A motors, which moved the clusters along the microtubules towards the periphery of the cell. We generated KIF1A constructs containing point mutations identified in humans. We expressed these constructs in neuronal glioblastoma (N2A), enabling real-time visualization of intracellular transport via live imaging confocal microscopy. We found that the P305L KIF1A mutant caused a reduction in cargo transport velocity and saw a slower accumulation rate to the periphery of the cell, while the S274L mutation caused a total arrest in movement of the motor protein. These results highlighted the functional impact of specific mutations and how disruptions of KIF1A activity contribute to intracellular deficiencies and neuron dysfunction. Notably, patients with known S274L KIF1A mutants exhibit more severe neurodevelopment deficiencies than those with the P305L mutation. Combined, we have developed an assay to probe the effects disease-linked mutations identified in humans have on cargo transport.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Samantha Kendrick, Augusta University, 1120 15th St. Augusta, GA 30912, sakendrick@augusta.edu

Breast Cancer Data Analysis Using Supervised Machine Learning Algorithms

Author: Beyza Koseoglu

Faculty Sponsor: Dr. Durga Kutal

Affiliation: Department of Mathematics, Augusta University

ABSTRACT

Breast cancer is one of the most serious diseases affecting women and is one of the leading causes of cancer-related deaths for women worldwide. In this study, we employ machine learning models to predict breast cancer malignancy based on age and clinical features. The breast cancer data set used in this study was obtained from the Kaggle.com website and contains 212 observations and 10 attributes. In our analysis, we used 12 attributes including age, tumor size, lymph node involvement, menopause status, and breast quadrant. We analyzed and compared this data set with different machine learning algorithms: Classification Regression, Decision Trees, Random Forests, and others. Our analysis identified age, tumor size, and breast quadrant as statistically significant risk factors for breast cancer based on Classification Regression. The accuracy and area under curve (AUC) values of the Classification Regression model are 0.906 and 0.965, respectively, indicating that the model prediction is highly accurate. Using the decision tree model, we identified the tumor size and lymph node involvement as the most significant features. The random forest algorithm highlighted involved lymph nodes, tumor size, metastasis status, and patient's age as the most significant features. Our analysis, employing various machine learning algorithms, revealed several common attributes that are highly influential in breast cancer occurrence.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Beyza Koseoglu, Augusta University, 1120 15th St. Augusta, GA 30912, bkoseoglu@augusta.edu

Investigating Adhesion Forces in T-Cell Mediated Cancer Killing

Authors: Corbin Lane, Abdul Malmi-Kakkada

Faculty Sponsor: Dr. Abdul Malmi-Kakkada

Affiliation: Department of Physics and Biophysics, Augusta University

ABSTRACT

Immunotherapy is the activation of the immune system to attack and kill cancer cells. A significant focus of this research is on the interaction between T-cells and cancer cells. T-cells are a type of immune cell, and they are responsible for killing foreign invaders and diseased cells. A critical aspect of this interaction is the formation and maintenance of a protein complex between cells that allows them to stick together so T-cells can carry out their duties. This complex is largely dependent on adhesion between the two cells, and within this complex, adhesion is largely mediated by the protein LFA-1. Blocking LFA-1 reduces the adhesion force by 33-fold, highlighting its importance in T-cell activation, adhesion, and cell killing. Another key interaction involves PD-1 (programmed cell death protein 1) on T-cells and PD-L1 (programmed death-ligand 1) on cancer cells. The interaction between the protein and its ligand is what signals to T-cells if a cell should be killed or not. When binding between the two occurs, the T-cell does not activate, and the other cell is not harmed. However, when binding between the protein and ligand does not occur, either because the ligand is not present on the cancer cell or because the interaction is blocked, T-cells kill the cell. Notably, the binding between protein and ligand has a significant effect on adhesion force between T-cells and immune cells. When binding occurs, there is a decrease in the adhesion force by half, and killing does not occur. Based on this interaction, we hypothesize that there is a correlation between the adhesion force between T-cell and cancer cells, the ability of the T-cells to recognize tumor cells as enemies, and the ability of T-cells to kill their targets. Our research focuses on the analysis of quantitative adhesion force data between T-cells and cancer cells and how this impacts the ability of T-cells to kill cancer cells. We provide insight into how long cells remain in contact, interactions between proteins, and T-cell states, all of which are relevant to understanding how adhesive forces determine how effective T-cells are at the killing of cancer cells.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Corbin Lane, Augusta University, 1120 15th St. Augusta, GA 30912, colane@augusta.edu

The Cultural Impact of Beauty Standards

Author: Folasadé Logan-Batista

Faculty Sponsor: Dr. Angela Bratton

Affiliation: Department of History, Anthropology, and Philosophy, Augusta University

ABSTRACT

The concept of beauty has existed alongside human society for generations. Some historians would claim that prescribing "beauty" to certain people served an evolutionary purpose, that some physical features were considered "necessary" to survive and have offspring. In modern societies, which account for over 8 billion humans on the planet, this evolutionary theory becomes controversial as beauty grows increasingly monetized, therefore isolating those who cannot financially afford to achieve presumed standard of beauty. "Beauty" itself becomes more aligned with being "aesthetically pleasing," which may reject the notion that beauty is necessary for survival. The beauty industry is massive, lucrative, and influential. While beauty standards may not be universal across cultures, women in general become susceptible to their culture's respective beauty standards, which may be perpetuated by beauty industries around the world. There has been a notable interest in the effects beauty standards have on people, especially women. Mental health impacts involve the consequences of being surrounded by societal expectations to be aesthetically pleasing. Physical health impacts include the somatic side effects of achieving beauty, as well as iatrogenic effects. The purpose of this study is to understand how culture can influence beauty standards and the health impacts of those who choose to align with those standards. This small-scale study included American women aged 18 to 24, due to this age cohort being considered especially vulnerable to mental health issues. A survey was distributed to Augusta University students for this class project. All participants remained anonymous while participating in the study. Collected data underwent thematic analysis to summarize the key points of the participants' answers to the questions. According to the results of the survey, most of the participants felt influenced by American beauty standards to partake in dieting and makeup and have considered getting plastic surgery. Some participants stated they did not feel affected by beauty standards, but those who were said that it had an overall negative effect on their mental health. Most expressed a desire to reject beauty standards and promote the beauty of individuality, instead. Future studies should explore other social factors that may affect one's connection to beauty standards, such as race and age.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Folasadé Logan-Batista, Augusta University, 1120 15th St. Augusta, GA 30912, fologan@augusta.edu

Advancing Antimicrobial Drug Design: Fluoroquinolone Hybrids with Dual-Action Potential

Author: Brianna Lynn

Faculty Sponsor: Dr. Siva S. Panda

Affiliation: Department of Chemistry and Biochemistry, Augusta University

ABSTRACT

Inflammation is a critical component of innate immunity and typically occurs in response to harmful pathogens or damaged cells. Nonsteroidal anti-inflammatory drugs (NSAIDs), which primarily function through COX inhibition, represent a significant category of medications. They are widely used to treat various conditions, including fever, inflammation, mild pain, and severe chronic inflammatory disorders. Common NSAIDs include ibuprofen, diclofenac, mefenamic acid, indomethacin, and naproxen. However, long-term use of these NSAIDs can lead to considerable gastrointestinal (GI) damage and renal dysfunction, thereby limiting their application. To address these limitations, a new group of molecules derived from 2-(4-isobutylphenyl) propanoic acid was designed. These synthesized conjugates were assessed for their anti-inflammatory, analgesic, and ulcerogenic properties. Some of the molecules showed significant anti-inflammatory effects, while several exhibited promising analgesic potential. Importantly, none of the newly synthesized conjugates demonstrated ulcerogenic liability. In vitro studies on COX-1 and COX-2 enzyme inhibition indicated that some compounds are more selective for COX-2 compared to ibuprofen.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Brianna Lynn, Augusta University, 1120 15th St. Augusta, GA 30912, brilynn@augusta.edu

Computational Modeling to Understand How Contact Length Affects synNotch Output

Author: Shawn Macon

Faculty Sponsor: Dr. Abdul Malmi-Kakkada

Affiliation: Department of Physics and Biophysics, Augusta University

ABSTRACT

Cell-cell signaling and communication are fundamental to the existence of complex life. Among the various mechanisms by which cells communicate, the Notch signaling pathway is a prominent example. Synthetic Notch (synNotch) is a modified version of the Notch signaling pathway whereby direct contact between a signal-sending and a signal-receiving cell induces the transcription of a specific gene in the receiving cell. We focus on the synNotch implementation where its activation leads to the expression of Green Fluorescent Protein (GFP) in the receiving cell. Our previous in vivo observations showed that the synNotch GFP output increases with the length of contact between signal sending and receiving cells, with significant cell to cell variability in contact lengths. To understand and predict the impact of cell-cell contact length variations on synNotch signaling output, we developed a computational model for synNotch output based on the Gillespie Simulation Algorithm. By incorporating experimental measurements such as the signal output intensity and cell-cell contact lengths, our model aims to constrain parameters such as the synthesis and decay rates governing synNotch output in vivo.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Shawn Macon, Augusta University, 1120 15th St. Augusta, GA 30912, smacon@augusta.edu

Chloroplasts From the Past: Digitizing Augusta University's Herbarium

Authors: Victoria Makowski, Gina Kelley, Stacy Bennetts

Faculty Sponsor: Stacy Bennetts, PhD

Affiliation: Department of Biological Sciences, Augusta University

ABSTRACT

The preservation of plants and related species that herbaria provide is imperative to the comprehensive understanding of these organisms and their evolution. Equally as imperative is the digitization of herbaria, which not only allows for easier trading between collections, but also a broader audience to view specimens not available in their area, and to memorialize specimen details as it was when photographed. Such data aids in mapping organism dispersal and habitat ranges throughout natural and anthropogenic environments, while also preserving species that may become endangered or extinct. This project focused on digitizing the collection within the Augusta University Herbarium, which previously was undocumented, inaccessible, and unknown to those outside a select few. A large portion (featuring over 1,000 specimens) is now cataloged, photographed, and uploaded to the Southeast Regional Network of Expertise and Collections (SERNEC) Symbiota Platform for free, accessible viewing to all. Despite the extensive work of this project, the digitizing efforts will be ongoing to encompass more specimens not yet mounted on standard preservation sheets. After digitization, herbarium collections such as Augusta University's allow not only botanists but also historians, statisticians, and many others to analyze natural history data provided by these preserved specimens for as long as digital access lives.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Victoria Makowski, Augusta University, 1120 15th St. Augusta, GA 30912, vmakowski@augusta.edu

DOpTC: A Low-Cost Water Quality Monitoring System

Author(s): Victoria Makowski, Wesley Cooke, Emma Herndon, Mason Leavins, Alexi Wilcher, Wes Byne, Oscar Flite, and Joseph Hauger

Faculty Sponsor(s): Dr. Joseph Hauger

Affiliation(s): Department of Physics and Biophysics, Department of Biological Sciences, Department of Chemistry and Biochemistry, Augusta University; City of Augusta Utilities Department

ABSTRACT

Ecological research is often limited by the inability to collect real-time, high-spatial-resolution data across a large geographic area. This limitation is not only due to particular locations being inaccessible or hazardous but also due to the prohibitive costs of the equipment required to collect the data. To overcome these limitations, we have developed a low-cost sensor suite that can be deployed in multiple configurations to meet the needs of various environmental conditions. Our approach to building a sensor suite is to use a common set of processing, communication, and sensor technologies while using modified packaging based on the environment and collection method. We use Arduino due to the low hardware costs and Atlas Scientific sensors due to their compatibility with a variety of electronic hardware. Our sensor suite is integrated with existing research projects to gain advantaged access to areas via autonomous surface vehicles (ASV) in addition to our stationary sensors. We aim to replicate or exceed the capability of the commercially available environmental sensors, such as Hydrolab, YSI, and Hanna, at a fraction of the cost but with a significant increase in customization and deployment options. While this research project is still in active development, we have conducted an initial ASV data collection test with further testing planned in the near future. This testing has validated our decision to mount sensor hardware directly to the ASV for data collection; we have proven our ability to collect data in environmental conditions at numerous points along a predetermined path navigated by the ASV. Post-survey, we are able to correlate these collected sensor readings to specific locations with meter-level accuracy based on the recorded time and the ASV's GPS position.We have also completed initial calibration testing, and our data demonstrates that our sensor suite is superior to commercial sensors in several key areas compared to sensors from Hydrolab, YSI, and Hanna, particularly in the error observed in readings of standard solutions. Overall, our sensor suite returned values within 0.7% of the known calibration standards, compared to the 4.9% average of the commercial sensors. Additionally, our temperature sensor agreed with the values of 2 commercial sensors and a standard thermometer. Finally, we plan to conduct further testing in Lake Olmstead, the Augusta Canal, Phinizy Swamp, and Saint Catherines Island in the spring of 2025.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Victoria Makowski, Augusta University, 1120 15th St. Augusta, GA 30912, vmakowski@augusta.edu

Burnout and Compassion Fatigue within Nursing

Authors: Julianna McGahee, Taylor Walker, PhD, Pamela Hayward, PhD, Dustin Cox, PhD

Faculty Sponsors: Taylor Walker, PhD, Pamela Hayward, PhD, Dustin Cox, PhD

Affiliations: Honors Program, Pamplin College of Arts, Humanities, and Social Sciences, Augusta University

ABSTRACT

Several factors impact nurses throughout their careers in both positive and negative ways. Two factors that have been heavily researched are burnout and compassion fatigue (see Ellis & Miller, 1993; Miller et al., 1989; Peterson et al., 2013; Wang et al., 2023). Such factors include implications for job performance, morale, work environment, mental health, and identity. However, these factors do not just impact nurses, but they also affect patients and the quality of care they receive. Despite heavy research on the impact of burnout and compassion fatigue, less research has emphasized the experiences of nurses themselves. The goal of this project was to better understand nurses' experiences with burnout and compassion fatigue. Utilizing 23 online blogs and threads posted by nurses, a content analysis was conducted to examine nurses' experiences and explore how these factors impact them in their personal and work lives. The research focused on how burnout and compassion fatigue affect job performance, the physical and emotional impacts of burnout and compassion fatigue, which words/phrases are most associated with burnout and compassion fatigue, and the most common coping strategies nurses use for burnout and compassion fatigue. The research demonstrated that burnout was more common than compassion fatigue among nurses, as it was mentioned 79% more throughout the analysis. Nurses indicated that issues surrounding their mental health were of particular concern, followed by frustration, stress, and then anxiety. The analysis also revealed that nurses are quitting their jobs, feeling impatient in their everyday lives, making mistakes on the job, feeling careless, and feeling pressure and guilt because of such factors. The project is still in progress. As such, the introduction, purpose, methodology, analysis, and majority of the results, if not all the results, will be included in the oral presentation. Burnout and compassion fatigue are significantly impacting the professional and personal lives of nurses and understanding the experiences of nurses allows for the creation of pathways to decrease burnout and compassion fatigue—overall helping both nurses and patients.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Julianna McGahee, Augusta University, 1120 15th St. Augusta, GA 30912, jumcgahee@augusta.edu

Alabama COVID-19 Vaccination Rates: Impact of Site Availability per Capita

Authors: Mustafa Farooq BS[1]; Yasaswini S. Potturi[2]; Mehul Mehra BS[1]; Wasef Y. Nijim BS[1]; Aditya Sood[3]; Kaamya Mehra[4]; Rodger D. MacArthur, M.D.[5]

Faculty Sponsor: Rodger D. MacArthur, M.D.

Affiliations: [1]Medical College of Georgia, Augusta, Georgia, United States of America, [2]Edward Via College of Osteopathic Medicine- Carolinas, Spartanburg, South Carolina, United States of America, [3]Emory University School of Medicine, Atlanta, Georgia, United States of America**,** [4]College of Science and Mathematics, Augusta University, Augusta, Georgia, United States of America**,** [5]Division of Infectious Diseases and Office of Academic Affairs, Medical College of Georgia, Georgia, United States of America

ABSTRACT

COVID-19 is a viral respiratory illness caused by the SARS-CoV-2 virus. Since the viral illness was first identified, vaccines were established and released to the United States public in 2021 by Pfizer- BioNTech, Moderna, and Johnson & Johnson. Alabama has one the lowest vaccination rates in the United States. We hypothesized that counties with more vaccination sites per capita would have higher vaccination rates. Vaccination data for Alabama counties, including the percentage of residents receiving at least one dose and those fully vaccinated, were obtained from the CDC's COVID Data Tracker. Zip codes for each county were identified using unitedstateszipcodes.org, and vaccine site locations were determined via vaccines.gov. Population linear regression was performed on the data, and an R^2 goodness of fit measure was determined for the data. Our analysis found no statistically significant correlation between vaccination sites per capita and vaccination rates in Alabama counties. Specifically, Pearson's correlation coefficients showed an R^2 value of 0.0009 for the percentage receiving at least one dose and 0.0021 for the percentage fully vaccinated. These results suggest that the number of vaccine sites alone does not significantly impact county-wide vaccination rates. Given Alabama's relatively low vaccination rates, identifying effective strategies to increase vaccine uptake is crucial. Our findings indicate that policymakers and public health officials should explore additional factors influencing vaccine hesitancy and access. Factors such as public perception, misinformation, socioeconomic status, healthcare accessibility, and political influences may play a more substantial role in vaccination rates than site availability alone. As COVID-19 continues to pose serious health risks, understanding and addressing barriers to vaccination remain vital. Future studies should examine other determinants, such as public health messaging effectiveness, vaccine accessibility beyond site availability, and targeted outreach programs. These insights can help shape policies to improve vaccination rates and enhance public health outcomes in Alabama and beyond.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Kaamya Mehra, Augusta University, 1120 15th St. Augusta, GA 30912, kmehra@augusta.edu

Exploring Modified Piperines for Cancer Therapy: A Computational Approach

Author: Josh Melton, Andrew Perez-Manso

Faculty Sponsor: Dr. Siva S. Panda

Affiliation: Department of Chemistry and Biochemistry, Augusta University

ABSTRACT

Piperine (PIP), a bioactive alkaloid derived from *Piper nigrum*, exhibits a range of pharmacological properties, including antibacterial, antitumor, antioxidant, anti-inflammatory, antifungal, and immunomodulatory activities. Structural modifications of PIP and its derivatives, such as piperic acid analogs, have shown promise in enhancing its therapeutic potential, especially in the development of anticancer drugs. Our study examines the computational approaches used to investigate the anticancer potential of modified PIP derivatives, including ADMET (Absorption, Distribution, Metabolism, Excretion, and Toxicity) predictions. An extensive review of existing literature was conducted to evaluate the structural alterations of PIP and its computational efficacy as a potential anticancer agent. The findings indicated that PIP and its derivatives display considerable anticancer activity, showing robust interactions with cancer-associated molecular targets and advantageous pharmacokinetic characteristics. This computational exploration highlights the potential of modified PIP derivatives as novel candidates for anticancer drug development.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Josh Melton, Augusta University, 1120 15th St. Augusta, GA 30912, jomelton@augusta.edu

NLRP3 Deletion Improves CBF and Functional Outcomes in VCID Models

Authors: Mohammad B. Khan, Shahneela Siddiqui, Pradip K. Kamat, Mohammad A. Nisar, Ashraar Dua, Tej Murudkar, Hunarmeet Gill, Ana Sofia Santiago Urbauer, Ali S. Arbab, David C. Hess

Faculty Sponsor: Mohammad B. Khan, MS, Ph.D.

Affiliations: Department of Neurology, Medical College of Georgia; Cancer Center, Medical College of Georgia, Augusta University

ABSTRACT

Vascular dysfunction is the second leading cause of dementia after Alzheimer's Disease, contributing to about 50% of cases, and vascular pathologies, such as microinfarcts, white matter disease, and cerebral small vessel disease, play a critical role in cognitive impairment and lowering the dementia threshold. Chronic cerebral hypoperfusion (CCH) is associated with decreased cerebral blood flow and brain injury and triggers a cascade of events that lead to white matter damage and impaired cognition. However, the pathophysiology of how CCH may lead to vascular cognitive impairment and dementia (VCID) has previously been poorly articulated. Inflammation, a key player in both acute and chronic cerebral ischemia, is activated in brain tissues by bilateral carotid artery stenosis (BCAS)-induced chronic cerebral hypoperfusion. A key mediator of inflammation is the inflammasome, a multiprotein complex that, when activated, increases the release of pro-inflammatory cytokines and pyroptotic cell death. In this study, we aimed to determine the role that the NLRP3 inflammasome plays in inflammation and functional outcomes in BCAS-induced-VCID animal models by comparing biomarkers and functional outcomes in wild-type (WT) and NLRP3 Knockout (NLRP3KO) mice. Middle-aged (male, 4-5 months old, 8-10 male/group) WT and NLRP3KO mice were randomly chosen to undergo BCAS-induced chronic hypoperfusion for four weeks. Cerebral blood flow (CBF) was measured in both groups by laser speckle contrast imaging (LSCI) pre-, immediately post-, and one-month post-BCAS surgery, and relative cerebral perfusion was also measured by arterial spin labeling (ASL) MRI in both groups. Functional outcomes were measured with the use of behavioral tests, such as novel object recognition tests (NOR) and wire-hanging tests, which quantified short- term memory/cognition and motor function, respectively. After four weeks of BCAS, there was a significant increase in CBF, as measured by LSCI ($p<0.001$, t-test) and as measured by ASL-MRI perfusion ($p<0.05$, t-test) in NLRP3KO mice as compared to WT mice. Furthermore, remarkable improvements were observed in cognitive and motor function in the NLRP3KO mice as compared to the WT mice, as measured by the NOR and wire hanging tests. The findings demonstrate that deletion of the NLRP3 inflammasome not only mitigates the cognitive impairment and motor effects of CCH but also significantly improves cerebral blood flow. This indicates that targeting the NLRP3 inflammasome may be a new therapeutic approach against VCID.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Tej Murudkar, Augusta University, 1120 15th St. Augusta, GA 30912, tmurudkar@augusta.edu

Investigating the Role of BicD2 in Nuclear Import

Authors: Grace Neiswender, Graydon Gonsalvez

Faculty Sponsor: Graydon Gonsalvez, PhD

Affiliations: Department of Cellular Biology and Anatomy, Medical College of Georgia

ABSTRACT

Our lab recently discovered that a protein called BicD2 binds to a protein called importin beta-1, which helps move molecules into the cell's nucleus (the control center of the cell). BicD2 is known as an adaptor protein which helps binds molecules like importin beta to a protein called dynein to create a complex. Formation of this complex allows for transport to begin. BicD2 can also be a gene. Recent studies have shown that changes in the R747C region of the BicD2 gene are linked to a disease called SMALED2. Patients with this disease usually have muscle weakness in their legs. Significantly, there is no treatment available yet. Recent data in our lab shows that when BicD2 has these changes, the binding between BicD2 and importin beta is much weaker. While previous research has focused on BicD2's role in moving cargo within the cell, not much is known about how it might help bring cargo into the nucleus (import). We suggest that BicD2 binds dynein to importin-beta (with the help of RanBP2) to bring cargo into the nucleus. To test this hypothesis, we made changes in the BicD2 gene and wanted to see whether it affected how well BicD2 binds to Importin beta-1 as well as the protein called RanBP2 (the 'door' of the nucleus to allow cargo into the nucleus). We found that binding was reduced in both cases. Next, we reduced the amount of RanBP2 in cells and found that the binding between BicD2 and importin beta-1 became weaker. Additionally, we lowered the amount of either BicD2 or RanBP2 in the cell and found importin beta-1 did not end up in the right place in the cell, supporting the idea that these proteins work together to bring molecules into the nucleus. Overall, our findings suggest importin beta-1 as a protein that binds to BicD2 and helps transport molecules into the nucleus with the help of RanBP2. Furthermore, the changes in BicD2 that are linked to SMALED2 may disrupt this process. Understanding the effect of the SMALED2 related changes to BicD2 in nuclear import could lead to new treatment ideas for the disease. Future research will explore whether BicD2 helps bring other molecules into the nucleus.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Grace Neiswender, Augusta University, 1120 15th St. Augusta, GA 30912, gneiswender@augusta.edu

Cognition Predicts Sleep Issues in Older Adults with Mobility Impairments

Authors: Elizabeth O. Nelson-Twakor[1], Antinett A. Ampiah[1], Albert K. Okrah[1], Katherine L. Hsieh[2], Deborah A. Jehu[1]

Faculty Sponsor: Dr. Deborah A. Jehu

Affiliations:1, Department of Community & Behavioral Health Sciences, Augusta University
2, Department of Physical Therapy, Georgia State University

ABSTRACT

Sleep disturbances can contribute to cognitive decline and increase fall risk in older adults. However, the connection between sleep quality and cognitive function among older adults with poor mobility is not well understood. The purpose of this study was to examine the relationship between sleep and cognition in older adults with impaired mobility. The study recruited n=64 older adults with impaired mobility, aged 65 and older, with self-reported balance and walking impairment (Age: 79.2 years, Montreal Cognitive Assessment (MOCA)=24.7 points, 57.81% Female). Each participant underwent cognitive assessments including the MOCA, Rey Auditory Verbal Learning Test (RVLT; learning and memory), Digit Symbol Substitution Test (DSST; processing speed), and Trail Making Tests (TMT; set shifting). Sleep patterns were monitored using an ankle-worn activity tracker for seven days on the non-dominant ankle. Statistical analyses were used to explore relationships between cognitive function and two sleep measures: variability in sleep duration and time spent awake after initially falling asleep. Result showed that greater difficulties in set shifting (mental flexibility) were linked to higher variability in sleep duration. Additionally, slower processing speed and worse set shifting trends predicted more time spent awake during the night. These findings suggest that poorer cognitive function is associated with greater sleep variability and increased wake time. These results highlight the importance of targeted interventions to improve sleep quality and cognitive function in this population.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Elizabeth Nelson-Twakor, Augusta University, 1120 15th St. Augusta, GA 30912, enelsontwakor@augusta.edu

Go with the Flow: Building a Low-Cost Water Velocity Sensor

Authors: Kaylee O'Steen, Patrick Rimbey, Wes Byne, Oscar Flite, Joseph Hauger

Faculty Sponsor: Dr. Joseph Hauger

Affiliations: Department of Physics and Biophysics, School of Computer and Cyber Sciences, Augusta University; City of Augusta, Utilities Department

ABSTRACT

Stream flow velocity, which varies with location, depth, and time, is a quantity that impacts biological, chemical, and physical aspects of all bodies of water. Commercially available flow velocity sensors are typically several thousand dollars and intended for short-term periodic sampling. Hand-held versions are limited by the availability of a trained technician and short battery life. To address these limitations, we have designed a low-cost flow velocity sensor capable of long-term real-time remote sampling. Our device uses a load cell to measure the drag force of water flowing past an attached solid cylinder. The load cell is interfaced to a dedicated microcontroller via an HX711 amplifier. A two-point method is used to calibrate the load cell readings. Because the drag force is proportional to the square of the flow velocity, these force measurements are used to determine real-time flow velocity. Data is transmitted from the sensor to a near real-time dashboard using the cellular capability of our selected microcontroller. Our force readings are cross calibrated with a commercial flow velocity sensor. This research is still in progress, but preliminary results show that our sensor accurately measures flow velocities up to 2 m/s using only force sensor readings.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Kaylee O'Steen, Augusta University, 1120 15th St. Augusta, GA 30912, koasteen@augusta.edu

Characterization of a New Mouse Model for COVID-19

Author: Osarume Ogala[2], Joseph Miano, PhD[1]

Faculty Sponsor: Dr. Joseph Miano

Affiliation: 1, Department of Cardiology, Medical College of Georgia
2, Department of Biological Sciences, Augusta University

ABSTRACT

ACE2 is the primary receptor for SARS-CoV-2 (SCV2), which is the virus responsible for the recent COVID-19 pandemic. Our lab has created a humanized ACE2 (hACE2) mouse model that we believe is a more reliable model for studying COVID-19 than the popular K18 mouse model because the hACE2 model uses the actual human ACE2 promoter, unlike K18. I characterized this hACE2 mouse model using Western Blots and Immunofluorescence Microscopy (IFM) to compare the expression of ACE2 protein in different tissues as compared to the K18 model. In addition, I studied inflammatory cell infiltration following viral infection of hACE2 versus K18 mice 3-, 5-, and 12-days post infection. It was found that our hACE2 model more accurately mimics the infection pattern after administration of a dosage of SCV2 and expression profile of ACE2 of humans than the K18 model does. Evidence of infection was observed initially and followed by recovery.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Osarume Ogala, Augusta University, 1120 15th St. Augusta, GA 30912, oogala@augusta.edu

Impact of Blood Pressure Variability on Cerebrovascular Function in Mice

Authors: Riya M. Patel[1,2], Perenkita J. Mendiola[1], Rachel E. Patterson[1], Sami Agus[1], Jessica A. Filosa[1]

Faculty Sponsor: Dr. Jessica Filosa

Affiliations: Department of Physiology[1], Medical College of Georgia; Department of Psychology[2], Augusta University

ABSTRACT

Increased blood pressure variability (BPV), reflected as exacerbated blood pressure fluctuations can negatively impact vascular and neural health with chronic BPV leading to cerebrovascular dysfunction, and cognitive decline. We hypothesize that in the presence of BPV, the lack of protective mechanisms (e.g. estrogen) in middle-aged female mice worsens microvascular function. Using an ex vivo approach, we measured the reactivity of cerebral parenchymal arterioles (PA) to U46619 (a thromboxane A2 agonist) in middle-aged male and female mice subjected to 20-25 days of intermittent infusion of Angiotensin II. Within group comparisons showed a significant increase in PA reactivity to U46619 in BPV mice vs saline-infused for both males and females ($P<0.0005$). In addition, we observed significant sex differences with female arterioles showing greater constrictions to U46619 ($P<0.05$) compared to males. These findings indicate that BPV induced by Ang II impairs microvascular function providing insights into the cellular targets underlying BPV-related health risks.

Research funded by NIH (5R01NS123644) to JAF

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Riya Patel, Augusta University, 1120 15th St. Augusta, GA 30912, rpatel28@augusta.edu

Loss of PKG2 Contributes to Age-Related Constipation in Mice

Authors: Tanvi Patil, Sakshi Shah, Grace Oh, Dr. Darren Browning

Faculty Sponsor: Dr. Darren Browning, PhD

Affiliation: Department of Biochemistry & Molecular Biology, Medical College of Georgia

ABSTRACT

The United States Census Bureau projects that the population aged 65 and over is increasing and will reach 82 million (23% of the total population) by 2050. The development of new tools for the prevention and treatment of age-associated pathologies that reduce quality of life is therefore an important goal. Intestinal barrier dysfunction and chronic constipation are common in the aging intestine, and we recently demonstrated that this aged-gut phenotype was associated with loss of cGMP-signaling component expression in elderly female mice. The present study tested that hypothesis that loss of intestinal type 2 cGMP-dependent protein kinase (PKG2) contributes to age-related constipation and further explored the role of estrogen in the regulation of cGMP signaling component expression. To determine whether loss PKG2 had a causative role in the age-dependent constipation, Prkg2-/- mice (PKG2 KO) were subjected to intestinal transit assays at 4, 12, and 20 months of age. There was no difference in young mice (4 months), but PKG2 KO mice showed slower transit at 12 months in both sexes. Strikingly, male PKG2 KO mice exhibited slow transit to the same degree as both wild-type and PKG2 KO females at 20 months. These results support the idea that loss of intestinal PKG2 during aging contributes to constipation but requires additional age-dependent processes. Reduced expression of intestinal cGMP signaling components was only observed in aged female mice, most prominently in the small intestine and proximal colon. To explore a potential role for estrogen in the maintenance of cGMP signaling, we used RT- qPCR to measure the expression of estrogen receptors in different regions of the intestine and in organoids derived from them. GPER and ESR1 were found to be the most prominent receptors with increasing expression in a rostral-caudal pattern. Studies are ongoing to determine whether intestinal organoids are suitable avatars of the aging gut in order to better understand the role of estrogen in cGMP signaling during aging.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Tanvi Patil, Augusta University, 1120 15th St. Augusta, GA 30912, tpatil@augusta.edu

The Role of BICD2 in Ciliogenesis

Authors: Avneesh Prabakar, Jessica E. Pride, Rajalakshmi Veeranan-Karmegam, Hannah Neiswender, Phylicia Allen, Graydon Gonsalvez

Faculty Sponsor: Graydon Gonsalvez, PhD

Affiliation: Department of Cellular Biology and Anatomy, Augusta University

ABSTRACT

Primary cilia are microtubule-based organelles that sense signals from the environment and regulate cell processes. Disruptions in the development of these primary cilia can lead to a variety of ciliopathies (cilia-related disorders), such as Bardet-Biedl syndrome, polycystic kidney disease, and Meckel-Grouber syndrome, which affect multiple organs throughout the body and can lead to negative health outcomes. One key step in the formation of primary cilia is the removal of CP110, a protein that regulates the formation of these structures. Specifically, the ubiquitin ligase HERC2 is believed to tag CP110 for degradation, which allows primary cilia to grow. However, the mechanism of how HERC2 is brought to CP110 remains unclear. Centrosomes, which are the site of primary cilia formation, are located at the minus ends of microtubules. Microtubules act as "train tracks" across the cell, allowing cargo to be delivered. Dynein is a motor protein that travels along these microtubules and brings cargo to the minus ends. We validated the interaction between BICD2, which is an adaptor molecule for dynein, and HERC2. By mapping their interactions, we newly identified that the dynein cargo adaptor BICD2 is required to bring HERC2 to the centrosome, which allows HERC2 to tag CP110 for degradation. After CP110 is degraded, the mother centriole (a part of the centrosome) becomes "uncapped", allowing primary cilia to grow. Supporting this hypothesis, testing hyperactive mutants of BICD2 showed an increased localization of HERC2 to the centrosome area. Additionally, depleting BICD2 caused a significant decrease in the formation of primary cilia, even more than simply depleting HERC2 levels. These findings suggest that BICD2 might play a larger role in primary cilia formation than just interacting with HERC2. Future studies will further investigate the role of BICD2 in the formation of primary cilia and its effects for ciliopathies, potentially discovering new targets for these disorders.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Avneesh Prabakar, Augusta University, 1120 15th St. Augusta, GA 30912, aprabakar@augusta.edu

Electromagnetic Frequency Response of Damaged Nerves

Authors: Calvin Puch, Trinanjan Datta

Faculty Sponsor: Trinanjan Datta, PhD

Affiliation: Department of Physics and Biophysics, Augusta University

ABSTRACT

Investigating the effects of external stimulation on human axons is of interest in both biological physics and in biomedical engineering. Myelinated or unmyelinated axons with the spinal afferent neuron are activated by low-intensity innocuous stimuli, to which they should not be responsive, to release inflammatory neuropeptides into the spinal cord and sensitize the central nervous system in a process also known as central sensitization, that is seen in multiple medical conditions, including diabetic gastroparesis. When these myelinated neurons of diabetic gastroparesis patients are treated with an electromagnetic signal at an inhibitory low-frequency, symptoms of diabetic gastroparesis improve. It is hypothesized that central sensitization reverses, however, there is little research concerning the biophysical mechanism behind this transformative occurrence. To investigate this, we utilize a transfer function to represent the membrane capacitance and computationally study the effect of frequency on the nerve action potential. We find that the nerves are stimulated both at low and high frequencies. This result provides a potential physical mechanism to explain the efficacy of treating damaged nerves with frequency stimulation.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Calvin Puch, Augusta University, 1120 15th St. Augusta, GA 30912, cpuch@augusta.edu

The Illness Experience of Organ Transplantation Recipients

Author(s): Francess Pujeh

Faculty Sponsor(s): Dr. Andrew Goss

Affiliation(s): Department of History, Anthropology, and Philosophy, Augusta University

ABSTRACT

The surgical procedure of organ transplantation is one that no doubt provokes the boundary of ethics in medicine and the distance biomedicine travels to improve the health of humanity. In the United States, as there are continuous innovations in delivery of care and the line between technology and medicine gradually blurs, it is no wonder that an aspect such as organ transplantation leaves medical anthropologists and sociologists wondering how the medical procedure impacts recipients as well as all donors beyond the physiological implications. Through literature review and qualitative data analysis, this research will engage questions such as what are the psychological impacts of the surgical procedure on both donors and recipients. Other questions such as these will seek to analyze the illness experience of patients who undergo organ transplantation as well as those who decide to act as organ donors.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Francess Pujeh, Augusta University, 1120 15th St. Augusta, GA 30912, fpujeh@augusta.edu

Inflammatory Response to Pyridostigmine Bromide and Permethrin in Mice

Authors: Abraham Raji, Alvin Terry, Raghavan Pillai Raju

Faculty Sponsors: Alvin Terry, PhD and Raghavan Pillai Raju, PhD

Affiliations: Department of Chemistry & Biochemistry, Augusta University; Department of Pharmacology & Toxicology, Medical College of Georgia

ABSTRACT

Gulf War Illness (GWI)is a multi-symptom illness having at least one symptom from a cluster of symptoms, which include: fatigue, mood-cognition, musculoskeletal problems and chronic inflammation. The cause of this disease has been attributed to exposure to one or more environmental agents such as insecticides/pesticides, anti-nerve agents, heavy metals, solvents, depleted uranium, chemicals from burning oil wells, and stress. Studies have shown that mice treated with the insecticide permethrin (PER) and the anti-nerve agent pyridostigmine bromide (PB) developed GWI symptoms. These symptoms include chronic inflammation, fatigue and cognitive deficits. My hypothesis was that exposure of macrophages, a type of white blood cells, to permethrin and pyridostigmine bromide will elicit an inflammatory response. We treated mouse macrophages with PB and PER for 24 hours, but failed to observe a significant increase in the expression of inflammatory genes IL-1b, IL-6 and TNF-a. However, when mice were treated with PB and PER together for 10 days and tested after 8 months, there was elevated expression of inflammatory markers such as IL-1β, IL-6, IFNγ in gastrocnemius muscle tissue (a major muscle in the back of the lower leg). When the PB/PER exposed mice were treated with mitochondria affecting agents, MitoQ and Metformin, individually or in combination, after 8 months of observation, we found a return to pretreatment levels of the expression of IL-1β, IL-6, IFNγ genes in skeletal muscle tissue. The lack of response to PB or PER in the macrophage cells could suggest the need for a dose-response and combination testing. The inflammatory response in the skeletal muscle suggests a molecular basis for the chronic fatigue observed in GWI. The study has impact on the health of veterans exposed to GWI agents in the Gulf War and how those symptoms might be alleviated.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Abraham Raji, Augusta University, 1120 15th St. Augusta, GA 30912, araji@augusta.edu

In Silico Evaluation of Piperine as a Promising Anticancer Agent

Author: Nathan Ramaswamy

Faculty Sponsor: Dr. Siva S. Panda

Affiliation: Department of Chemistry and Biochemistry, Augusta University

ABSTRACT

Natural products have long served as effective medicines throughout human history. Before the rise of modern drug-design techniques like high-throughput screening, most pharmaceutical agents were derived from natural sources. Today, these products are considered reliable sources of novel therapeutic compounds. One notable example is the plant *Piper nigrum*, or black pepper, a dietary staple and a significant component of traditional East Asian medicine for centuries. Piperine (PIP) has gained attention for its potential as a leading anti-cancer compound alongside its various derivatives. Research has shown that PIP possesses anti-inflammatory, antioxidant, and anti-cancer properties. Further studies indicate it can limit tumor growth, induce cell cycle arrest, promote apoptosis, and enhance the efficacy of other treatments by increasing cancer cells' sensitivity to therapies. This study evaluates the potential of PIP as an effective anti-cancer treatment through computational investigation and assessment of its drug-like properties.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Nathan Ramaswamy, Augusta University, 1120 15th St. Augusta, GA 30912, naramaswamy@augusta.edu

Real-Time Waste Monitoring Using Low-Cost Cellular Capable Microcontrollers

Authors: Patrick Rimbey, Wes Byne, Oscar Flite, Joseph Hauger

Faculty Sponsor(s): Dr. Joseph Hauger

Affiliation(s): Department of Physics and Biophysics, School of Computer and Cyber Sciences, Augusta University; City of Augusta, Utilities Department

ABSTRACT

Most municipalities and large organizations service trash receptacles at regularly scheduled time intervals. This is an inefficient use of resources because trash receptacles in higher traffic locations may need more frequent attention whereas those in other locations need less frequent service. This can lead to overflowing trash bins and subsequent hygiene and environmental contamination risks. In addition, too frequent servicing of low use trash bins wastes valuable resources that could be applied to higher demand locations.

We have developed a low-cost solution that allows for real-time remote monitoring of trash levels. We use a weatherproof ultrasonic sensor and a Particle Boron microcontroller to measure the level of trash and transmit this data using the cellular capabilities of the microcontrollers. We use Microsoft Azure to host our database and provide a real-time dashboard for user awareness. In addition, our system can transmit a targeted message indicating the need for immediate maintenance. This allows facilities employees to know when a trash receptacle needs service while providing data about trash volume at each monitored location. Solar charging allows long term deployment.

Initial testing conducted in the lab validated our approach to monitoring trash levels by demonstrating that the ultrasonic sensor could operate in the proposed environment. This led to a small-scale outdoor test of three smart trash cans. This applied research effort was one of two projects selected for presentation to a congressional staff delegation visiting campus and has been approved and funded by Augusta University Facilities for full deployment in the new Health Science campus parking garage.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Patrick Rimbey, Augusta University, 1120 15th St. Augusta, GA 30912, primbey@augusta.edu

Depleting Neutrophil Mobilization to Prevent Stroke Deterioration and Aid Recovery

Authors: Mariya Saju, Anika Bushra, Fowzia Selina, Ali Arbab

Faculty Sponsors: Ali Arbab, MD, PhD

Affiliation: Department of Biochemistry and Molecular Biology, Augusta University

ABSTRACT

Stroke is a major cause of cognitive impairment, long-term disability, and death, affecting around 12 million people worldwide each year. When the stroke occurs, the body's immune response quickly activates white blood cells called neutrophils, which then form structures known as neutrophil extracellular traps (NETs). These NETs can trap other blood cells, leading to the formation of small blood clots (microthrombi), which worsens brain damage and makes recovery more difficult. To prevent this harmful process, our lab is exploring the use of engineered exosomes. Exosomes are tiny particles (about 30-150 nanometers in size) that help cells communicate with each other. Because exosomes are safe for the body, can easily pass through blood brain barrier, and naturally accumulate at injury sites, they could be used to deliver treatments directly to the stroke-affected area, helping the brain heal more effectively. In this study, exosomes are being created from human embryonic kidney (HEK293) cells. Using DNA technology these exosomes carry a peptide (a small protein) that targets neutrophils, along with a therapeutic protein (Fc-portion of mouse IgG2b) that will attach with natural killer cells to kill neutrophils to help treat the stroke damage. We designed the plasmid to transduce the HEK293 cells with a lentivirus, generated the engineered exosomes, and confirmed its characteristics. We confirmed our inserted peptides by PCR. We tested and confirmed the uptake of exosomes to neutrophils using. We need to test the presence of inserted protein using electron microscopy and western blotting. The ultimate goal of this study is to explore whether these exosomes can effectively slow down stroke progression and improve recovery for stroke.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Mariya Saju, Augusta University, 1120 15th St. Augusta, GA 30912, msaju@augusta.edu

The Percy That Could Have Been: Devaluing Underdogs in *The Lightning Thief*

Authors: Cheo Saromines, Lee Anna Maynard PhD

Faculty Sponsor: Lee Anna Maynard, PhD

Affiliation: Department of English & World Languages, Augusta University

ABSTRACT

For twelve-year-old Percy Jackson, protagonist of Rick Riordan's bestselling novel The Lightning Thief (2005), life is anything but easy, between his unsatisfactory home life and turbulent academic experiences. His troubles do not end there, however, as his familial connection to Poseidon, the sea god, forces him to contend with a society of ancient monsters and gods that can squash him in one fell swoop. To survive, Percy is forced to continuously adapt and repeatedly defy expectations to emerge victorious despite his innate disadvantages. This struggle is undermined in the films as Christopher Columbus, the film adaptation's director, minimized Percy's unique shortcomings with a slew of questionable changes from the original material. My paper focuses upon Columbus's disruptions, referencing the original Percy characterized in Riordan's book. I argue that Percy Jackson's character in the film deviates substantially from the books in a way that harms the core tenets of what made Percy who he was in the first place -- an underdog -- noting the changes made to his backstory, his motivations, his hobbies, and his capacity and willingness to do certain activities. My analysis of Percy's character in The Lightning Thief draws upon the commentary of the book author, the reception by fans to the filmic changes, and relevant contextual sources that help elucidate what makes these changes antithetical to Percy's character and to his underdog status. I posit that Percy Jackson's character in the film is inferior compared to the original character portrayed in the books, as "film Percy" lacks the relatability and depth readers are able to enjoy in "book Percy." Based purely on aesthetics, the film version looks perfect, but, in the end, the perfect may be the enemy of the truly good. By leaning into perfection, Columbus diminished much of what made Percy who he was: a troubled and disadvantaged kid who never gave up despite his many plights. The stark disconnect between the two versions of the same character highlights the difference of priorities from the book's author and the film's director. Whereas one prioritized persistence and wit, the other leaned into innate talent, luck, and good looks, foregoing the author Riordan's original underdog theme. For this reason, I conclude, Columbus's vision of Percy was a failure of thematical mismatch, misunderstanding and devaluing the appeal and significance of his flaws and disadvantages.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Cheo Saromines, Augusta University, 1120 15th St. Augusta, GA 30912, csaromines@augusta.edu

Occupational Physical Activity Influence on Hispanic Agricultural Workers' Diabetes Risk

Authors: Paige Sheppard, Pamela Cromer, Thomas Joshua, Lynn Glenn

Faculty Sponsor: Dr. Lynn Glenn

Affiliation: Department of Nursing, Augusta University

ABSTRACT

This study examines the influence of occupational physical activity (OPA) on Type 2 Diabetes risk in Hispanic agricultural workers. In the United States, the Hispanic population has a higher prevalence (15.5%) and mortality rates from Type 2 Diabetes compared to the non-Hispanic White population (13.6%). Migrant agricultural workers often face barriers to accessing quality health care and have an increased risk of undiagnosed conditions, including Type 2 Diabetes. The purpose of this study was to increase the number of American Diabetes Association-recommended diabetes screenings among high-risk, underserved populations and further examine the risk factors among Hispanic migrant agricultural workers that may contribute to the development of Type 2 Diabetes. This non-experimental, cross-sectional study included 102 agricultural workers employed at Costa Farms, 18 years and older, with no previous diagnosis of Type 1 or Type 2 Diabetes. The American Diabetes Association (ADA) "Diabetes Risk Test" [Sensitivity = 0.83 (DM), 0.76 (preDM); Specificity 0.54 (DM and preDM) Spanish version α=0.27] surveys were administered to Hispanic agricultural workers at the annual laboratory testing and health fair. Hemoglobin A1C (HgA1C) and Serum Blood Glucose values collected from the employees were linked to their diabetes risk survey scores. Results indicate that physical activity did not demonstrate a statistically significant association with risk score, lab glucose, or HgA1C level. There was a statistically significant association between blood glucose and family history of diabetes, and between Hg A1C and male gender or family history of diabetes. This sample did have a slightly lower prevalence of prediabetes (31%) than the overall U.S. Hispanic population (34%). Future research should examine the 'Physical Activity Paradox' and how leisure-time physical activity (LTPA) and OPA relates to Type 2 Diabetes risk and development in this population.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Paige Sheppard, Augusta University, 1120 15th St. Augusta, GA 30912, psheppard@augusta.edu

Determinants of Racial Disparities in Infant Mortality in Georgia

Authors: Aniyah Stevenson, Simon Medcalfe

Faculty Sponsor: Dr. Simon Medcalfe

Affiliation: Hull College of Business, Augusta University

ABSTRACT

Black infant mortality rates in Georgia continue to be significantly higher than both the state average and those for White infants. While medical advancements have improved healthcare, addressing this disparity also requires considering the social, service, and physical environments. Data from all 159 counties in Georgia, covering the years 2014 to 2019, is analyzed using Poisson regression, given the count-based and skewed nature of the data. The analysis highlights that poor housing conditions (physical environment) and limited access to nutritious food (service environment) are significant factors influencing infant mortality rates. Housing problems, especially in segregated areas, increase racial disparities, while rural counties (social environment) appear to have resources that may help lower infant mortality rates. The findings reveal implications for health policies addressing the importance of housing and food security when working to reduce infant mortality. Future research should endeavor to understand how rural areas maintain lower mortality rates and identify approaches that can work in both rural and urban areas. By examining these social, service, and physical environmental factors, we can gain a clearer understanding of how to reduce racial disparities in infant mortality across Georgia.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Aniyah Stevenson, Augusta University, 1120 15th St. Augusta, GA 30912, anstevenson@augusta.edu

Mapping of Oral Tissue Extracellular Vesicles in Health and Disease

Authors: Sophia Tang, Angelica Carroll, Jasmine Williams, Xiaogang Chu, Ranya Elsayed

Faculty Sponsor: Dr. Ranya Elsayed

Affiliations: Periodontics Department, Dental College of Georgia

ABSTRACT

Periodontitis (PD) is a chronic inflammatory disease that becomes more common with advanced age. It is primarily caused by infection and can result in significant damage to tooth-supporting structures, ultimately leading to the loss of both soft and hard tissues. Porphyromonas gingivalis (Pg) has been recognized as a keystone pathogen that plays a crucial role in the progression of PD. The infection of oral immune cells by Pg stimulates the release of small extracellular vesicles known as exosomes (Exo), which can modify immune responses and contribute to the progression of periodontitis. Exo are membrane- bound vesicles secreted by various cell types and are essential for intercellular communication. They carry a diverse array of biomolecules—including RNA, DNA, lipids, and proteins—reflecting the characteristics of the parent cell. The extracellular microenvironment significantly influences the activity, genetic composition, molecular mechanisms, and functional profiles of cells. Exo are a critical element of this extracellular environment. The objective of this study was to characterize the Exo released in gingival tissues in healthy and diseased states and identify their cellular origin, with a particular focus on age as a variable. In this study, young and old mice were subjected to oral gavage either with Pg or a sham infection over a six-week period. Subsequently, Exo were isolated from the gingival tissue using enzymatic digestion and ultracentrifugation and characterized using a multiplexed bead-based flow cytometry platform. The semi-quantitative multiplex analysis revealed that the expression of cell-specific markers on the Exo varied with both the age of the subjects and the presence of periodontal infection. In the gingiva of older mice, there was a significant increase in Exo derived from lymphocytes and myeloid cells compared to the young. Gingiva from periodontitis animals exhibited elevated levels of Exo from T cells, B cells, dendritic cells, and platelets, while the expression of epithelial cell and stem cell markers was notably downregulated. These results provide valuable insights into the cellular origins of exosome release in the contexts of aging and periodontal disease. They underscore the potential roles of these parental cells in the pathological processes associated with periodontal disease. The findings from this study suggest promising avenues for therapeutic intervention aimed at treating periodontal disease and enhancing our understanding of its underlying pathogenesis

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Sophia Tang, Augusta University, 1120 15th St. Augusta, GA 30912, soptang@augusta.edu

Immunobiology and Therapeutic Intervention of Ovarian Cancer

Authors: Neha Thomas, Evila da Silva Lopes Salles

Faculty Sponsors: Evila da Silva Lopes Salles PhD, Babak Baban PhD

Affiliation: Department of Oral Biology and Diagnostic Sciences, Dental College of Georgia

ABSTRACT

According to the American Cancer Society, 19,680 women in the United States are estimated to receive a new ovarian cancer (OC) diagnosis, and 12,740 women are expected to die from the disease. OC is one of the deadliest gynecologic cancers and accounts for 2.5% of cancers in women. Although ovarian cancer is only the 11th most common cancer among women, it is the fifth leading cause of cancer-related death. Several risk factors have been associated with OC, including lifestyle, environmental, and genetic components. The major challenges in this field, aside from delayed diagnosis, are treatment and survival. The primary therapeutic intervention for OC is chemotherapy, specifically platinum-based chemotherapeutics. Although patients initially respond favorably to platinum-based drugs such as cisplatin, resistance to these drugs often develops in cases of relapse. Recent studies have demonstrated that cannabidiol (CBD), a compound derived from cannabis, can influence cisplatin resistance in specific cancer types. CBD appears to inhibit the growth and metastasis of cisplatin-resistant non-small cell lung cancer. In this study, our goal is to investigate the impact of CBD treatment on SK-OV-3 cancer cells' biology and cisplatin resistance. We anticipate that CBD will render SK-OV- 3 cells more susceptible to cisplatin treatment. The experiment involved mouse models induced to develop cancer through the injection of cultured SK-OV-3 cells. The mice were monitored for tumor progression, and all eventually developed tumors. Once the tumors reached 3 mm in size, CBD was administered to the experimental group via inhalers, while the control group received a placebo. Each mouse received three weeks of treatment. A visible reduction in tumor size was observed in the CBD-treated group compared to the controls. The control group mice were euthanized once their tumors reached 16 mm, in accordance with protocol, and the tumors were collected for further analysis. Flow cytometry and immunohistochemistry were done on the collected samples. Analysis showed that there was an increase in ILC-2, which downregulates tumor progression and metastasis. Thus, suggesting a positive overall effect on ovarian cancer

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Neha Thomas, Augusta University, 1120 15th St. Augusta, GA 30912, nethomas@augusta.edu

Ibuprofen-Derived Hybrid Molecules: Unlocking New Therapeutic Potential

Author: Iris Truong

Faculty Sponsor: Dr. Siva S. Panda

Affiliation: Department of Chemistry and Biochemistry, Augusta University

ABSTRACT

Inflammation is a critical component of innate immunity and typically occurs in response to harmful pathogens or damaged cells. Nonsteroidal anti-inflammatory drugs (NSAIDs), which primarily function through COX inhibition, represent a significant category of medications. They are widely used to treat various conditions, including fever, inflammation, mild pain, and severe chronic inflammatory disorders. Common NSAIDs include ibuprofen, diclofenac, mefenamic acid, indomethacin, and naproxen. However, long-term use of these NSAIDs can lead to considerable gastrointestinal (GI) damage and renal dysfunction, thereby limiting their application. To address these limitations, a new group of molecules derived from 2-(4-isobutylphenyl) propanoic acid was designed. These synthesized conjugates were assessed for their anti-inflammatory, analgesic, and ulcerogenic properties. Some of the molecules showed significant anti-inflammatory effects, while several exhibited promising analgesic potential. Importantly, none of the newly synthesized conjugates demonstrated ulcerogenic liability. In vitro studies on COX-1 and COX-2 enzyme inhibition indicated that some compounds are more selective for COX-2 compared to ibuprofen.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Iris Truong, Augusta University, 1120 15th St. Augusta, GA 30912, itruong@augusta.edu

Photo Series, Harrisburg and the White House Tract Today, 2024

Author(s): Andrew Vincent III

Faculty Sponsor(s): Randy Pace

Affiliation(s): Pamplin College of Arts, Humanities, and Social Sciences, Department of Art and Design, Augusta University

ABSTRACT

A photographic series was developed to explore the story of a historic tract of land sandwiched between downtown Augusta, Summerville, and west Augusta as it exists today. An Indian trading company known as MacKay's Trading Post, or the White House, existed in the 1700's on the land in the area of today's Sibley and King Mills off Broad Street. This preceded today's Augusta Canal, and then the growth of Augusta through the mill area and up to today's Summerville Historic District and on toward Columbia County. That house was destroyed in the first attack on Augusta, during the American Revolution. The property that the White House was on was first officially named the "White House Tract" when it was awarded by a Crown Grant from England in 1756 to two young Englishmen, prior to the declaration of independence and the coming of America. This approximately 500-acre plot of land today is bounded by the Savannah River, Milledge Road, 15th Street, and Walton Way. The Canal was built in 1845, and textile mills were built and put into operation circa 1882 (the Augusta Powder Works preceded the Sibley, built in 1862 and operated until 1865). To house the many mill workers to come, housing was built in the surrounding area, which came to be known as Harrisburg (related to the Ezekiel Harris House that stands today on Broad Streed). That is historic today, but it was not an incorporated district. While it thrived for a time as a mill workers housing district, Augusta development west overtook the area with among other things the John C Calhoun Expressway and the Riverwatch Parkway thoroughfares that slice through the area to access downtown. Many original homes still exist in the neighborhood, and efforts to preserve the historic context are evident in rebuilding efforts in the area. To walk or drive the area today with that history in mind is more than just a drive in an old neighborhood, it is a journey through time.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Andrew Vincent III, Augusta University, 1120 15th St. Augusta, GA 30912, andvincent@augusta.edu

The Role of dNTPs in Therapy-Resistant Glioblastoma

Authors: Arilyn Williams, Matthew Kededa, Aman Kalsi, Ramsha Khanam, Edidiong Usoro, Dominique Monroe

Faculty Sponsor: Waaqo Daddacha, PhD

Affiliations: Department of Biological Sciences, Department of Biochemistry and Molecular Biology, Georgia Cancer Center

ABSTRACT

Glioblastoma multiforme (GBM) is the most aggressive and deadly brain tumor, accounting for nearly half of all cancerous brain tumors. Standard treatments, including ionizing radiation (IR) and chemotherapy, work by inducing DNA double-strand breaks (DSBs) that trigger cell death. DNA double-strand breaks (DSBs) occur when both strands of the DNA molecule are severed. This creates severe damage that can lead to cell death if not restored in time. However, GBM often develops resistance to these standard treatments. It does so by enhancing its ability to repair DNA damage, particularly through homologous recombination (HR). HR is an error-free repair process. It helps tumor cells repair DNA breaks accurately, preventing the activation of cell death pathways.

SAMHD1, a protein crucial to this resistance, facilitates HR by promoting DNA end resection, a key step in the repair of DSBs. Additionally, SAMHD1 regulates the levels of deoxyribonucleoside triphosphates (dNTPs) in the cell, which are essential building blocks for DNA synthesis.

In this study, we investigate how increasing dNTP levels affect DNA repair and treatment resistance in both established and patient-derived GBM cell lines. We hypothesize that elevated dNTP levels may disrupt SAMHD1's involvement in HR. This disruption could sensitize GBM cells to IR and chemotherapy. Our findings suggest that when dNTP levels increase, SAMHD1 interacts more with the dNTP pool. As a result, it interacts less with the DNA repair mechanisms. This shift may reduce SAMHD1's effectiveness in promoting HR, ultimately increasing the vulnerability of GBM cells to DNA damage.

By understanding how changes in dNTP levels affect DNA repair mechanisms in GBM, our research aims to uncover strategies to overcome GBM resistance to treatment. Altering dNTP levels could potentially enhance the efficacy of current therapies, making them more effective in managing this treatment-resistant cancer. Overall, our findings may contribute to the development of targeted approaches to improve patient outcomes and overcome the challenge of GBM resistance.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Arilyn Williams, Augusta University, 1120 15th St. Augusta, GA 30912, awilliams33@augusta.edu

Nrf2 Inhibitor Peptides as New Therapeutics for Resistant Cancers

Authors: Amanda Wolbert, Brian Rex Adams, Eli Corn, Emil Ayala-Cosme, Khadijah Ladoo, Kyara Vences, Deborah Yang

Faculty Sponsors: Dr. Matteo Borgini and Dr. Lindsey Davis

Affiliation: Department of Chemistry and Biochemistry, Augusta University

ABSTRACT

When therapeutic agents are developed, their goal is to target specific molecules in the body, such as proteins, to repristinate their normal function or production. When the activity these biological macromolecules can be therapeutically modulated by medicine, these proteins can be classified as "druggable." Unfortunately, many proteins involved in diseases, such as transcription factors, are classified as "undruggable" due to structural characteristics that make traditional drugs ineffective. As an example, the nuclear factor erythroid-related factor 2 (Nrf2) is a transcription factor which acts to counteract oxidative stress in cells. Several cancer types, such as lung and liver cancers, overexpress Nrf2, which protects cancer cells against anticancer drugs, leading to what is known as cancer resistance and resulting in a poor prognosis for patients. To counteract Nrf2-dependent anticancer drug resistance, scientists have tried to develop Nrf2 inhibitors for more than two decades without success. The unsuccess in developing effective Nrf2 inhibitors to overcome anticancer drug resistance is due to Nrf2 characteristics that make it an "undruggable" target. Our focus is to develop novel medicinal chemistry approaches to modulate protein activity, including proteins considered "undruggable," such as Nrf2. The goal of our research is to synthesize peptides that act as protein-protein interaction inhibitors and prevent the expression of Nrf2-dependend genes. The microwave-assisted solid-phase peptide synthesis has been used for the quick synthesis of various peptides. We will report details of their synthesis, purification, and screening of our peptides against Nrf2-dependent chemo resistant cancer cells.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Amanda Wolbert, Augusta University, 1120 15th St. Augusta, GA 30912, awolbert@augusta.edu

Cannabidiol and its Effects on Brain Metastasis from Breast Cancer

Authors: Priscilla Xiong, Evila Salles, Babak Baban

Faculty Sponsor: Babak Baban, PhD

Affiliation: Department of Oral Biology and Diagnostic Sciences, Dental College of Georgia

ABSTRACT

Breast cancer is one of the most diagnosed cancers and arises from the uncontrolled growth of breast cells, influenced by genetic, hormonal, and environmental factors (Brandao et al., 2015; Jian et al., 2017). Approximately 30% of breast cancer patients develop metastatic breast cancer, an aggressive form of cancer that invades other organs in the body such as the bones, liver, lungs, and the brain (Bozkurt et al., 2024; Othman et al., 2021). Brain metastasis from breast cancer is a significant clinical challenge, occurring in approximately 10%-15% of patients with advanced or recurrent disease (Yamashiro, 2023; Doshi, 2024). Patients with brain metastasis develop tumors in the cerebrum, cerebellum or brain stem, and encounter symptoms like headaches, seizures, difficulty breathing, numbness, and hydrocephalus. In this study, Cannabidiol (CBD), a non-psychoactive compound derived from Cannabis sativa, will be used as a treatment for the breast cancer brain metastases (BCBM) model. The BCBM model consisting of 8 wild-type, 9–11-week-old Balb/c mice will be grafted with 100,000 mouse 4t1 breast cancer cells. The tumor growth will be observed with bioluminescence imaging. On day 7 post-implantation, the mice will be treated with 8.56 mg of inhalant CBD or a placebo for two weeks or until the tumor reaches 16mm. After treatment, the mice will be euthanized, and the tumors will be harvested for flow cytometry-based assays and histological analysis. In previous studies at Dr. Baban's laboratory at the Dental College of Georgia Department of Oral Biology, CBD was capable of inhibiting tumor growth in a murine model of glioblastoma by modulating immune factors within the tumor microenvironment (Khodadadi et al., 2021). Therefore, the objective of this study is to evaluate the potential therapeutic effects of CBD on brain metastasis and uncover the role of innate lymphoid cells in the cancer microenvironment. Results from this study will offer valuable insights into the development of brain metastasis from breast cancer along with the potential therapeutic effects of CBD.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Priscella Xiong, Augusta University, 1120 15th St. Augusta, GA 30912, pxiong@augusta.edu

Guidelines for Patients to Find Scientifically Accurate Medical Information

Authors: Taylor Grace Yancey, Dr. Andrew Balas

Faculty Sponsor: Dr. Andrew Balas

Affiliations: Department of Health Management, Economics, & Policy, Honors Program, Augusta University

ABSTRACT

The purpose of this qualitative study is to develop a guide for patients to find and review medical information relevant to their conditions and priorities. As technology improves, accessibility to information has never been greater; however, the presence of misinformation has also never been higher. It is becoming increasingly difficult for people to find scientifically accurate information about their medical concerns. For this project, we will create a guide for patients to find and better understand medical information that is scientifically accurate. After reviewing a large variety of clinical guidelines, we abstracted information about their evidence filtering and rating methods. Our abstraction separated the actionable recommendations from those that are vague or difficult to interpret. We found information that patients can use to better understand how to find accurate medical research to learn about their health concerns. Our plan is to develop filtering methods that will be supported by medical organizations, such as the US Preventative Services Task Force, and other outside research. The guidelines we propose will teach patients how to research medical questions and determine which resources are trustworthy. This project is important because people should know how to find relevant and accurate information pertaining to their medical inquiries. With this information, patients could find answers to their medical questions and possibly find management plans that they can practice or discuss with their physicians. Our research is in progress; we are currently filtering through numerous medical journals to make sure our guidelines are effective and find any errors in our statements.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Taylor Yancey, Augusta University, 1120 15th St. Augusta, GA 30912, tyancey@augusta.edu

Age-Related Lipid Droplet Accumulation in the Brain

Author: Aditi Yellu

Faculty Sponsor: Xin-Yun Lu, MD, PhD

Affiliation: Department of Neuroscience and Regenerative Medicine, Medical College of Georgia

ABSTRACT

Progressive cognitive decline is a natural aspect of aging and a significant risk factor for neurodegenerative diseases such as Alzheimer's. Understanding the cellular mechanisms underlying aging-related changes in the brain is crucial for identifying potential therapeutic targets. Among these changes, alterations in lipid metabolism have emerged as a key factor. While previous studies have explored lipid metabolism in general, the specific role of lipid droplets remains less understood. This study investigates lipid metabolism changes, specifically focusing on lipid droplet accumulation in the aging hippocampus. Using immunostaining and confocal microscopy, we examined lipid droplet accumulation in microglia and neurons across hippocampal subregions. Notably, lipid droplets preferentially accumulated in microglia within the Dentate Gyrus (DG) compared to the CA1 and CA3 regions. Quantitative analyses consistently demonstrated elevated lipid droplet content in DG microglia in both aging and region-specific comparisons. Additionally, aged mice exhibited a significant increase in lipid droplet volume within neurons. These results show that lipid droplets may play a functional role in the aging brain, potentially influencing neurodegenerative processes. Further exploration of techniques to visualize lipid droplets and lipid content within neurons will provide deeper insights into the cellular mechanisms driving these changes. Ultimately, this research aims to contribute to the development of therapeutic strategies for neurodegenerative diseases such as Alzheimer's.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Aditi Yellu, Augusta University, 1120 15th St. Augusta, GA 30912, ayellu@augusta.edu

Ursolic Acid-Based Hybrid Conjugates: A New Avenue for Cancer Therapy

Authors: Sophia Ying, Nihal Amineni

Faculty Sponsor: Dr. Siva S. Panda

Affiliation: Department of Chemistry and Biochemistry, Augusta University

ABSTRACT

Cancer is the second leading cause of death in the U.S., with 611,720 fatalities out of 2.01 million diagnoses in 2024. Urinary bladder cancer (UBC) is the ninth most prevalent cancer globally, characterized by high recurrence rates and a treatment approach primarily involving surgery, along with chemotherapy, immunotherapy, and radiation therapy. Despite advancements in cancer treatments, current chemotherapeutics are often ineffective due to high toxicity, increasing the need for safer alternatives. Natural products, such as Ursolic Acid (UA) from apple wax, have been researched for their anticancer properties, though low solubility and bioavailability limit their use. To enhance UA's effectiveness, researchers have employed molecular hybridization to create compounds linked with secondary amines, testing their anticancer efficacy against UBC cell lines and gemcitabine, a standard chemotherapy drug. This synthesis aims to develop safer and more bioavailable anticancer drugs.

Received: 02/05/2025 Accepted: 02/21/2025

Correspondence: Sophia Ying, Augusta University, 1120 15th St. Augusta, GA 30912, sying@augusta.edu