STEM Day 2024

Cultivating Diversity in STEM Solutions

TVA
NORTHROP GRUMMAN
AMERICAN CAST IRON PIPE COMPANY
Brookhaven National Laboratory
BOEING
Constellium
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MARMON
Southern Company
CAT Financial
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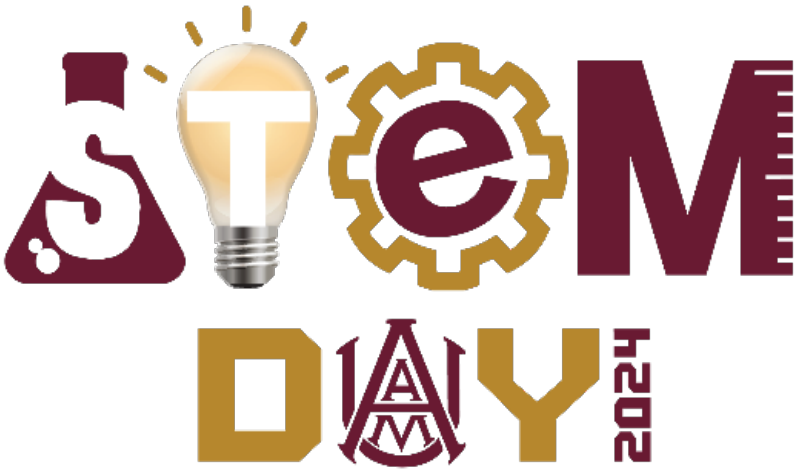
extension ALABAMA A&M & AUBURN UNIVERSITIES
CAREER DEVELOPMENT SERVICES ALABAMA A&M UNIVERSITY



ALABAMA A&M UNIVERSITY

Thursday, March 28, 2024 | 8 AM – 4 PM

The Event Center, Alabama A&M University

COLLEGE OF AGRICULTURAL, LIFE AND NATURAL SCIENCES
COLLEGE OF Engineering, Technology & Physical Sciences ALABAMA A&M UNIVERSITY
ALABAMA A&M UNIVERSITY COLLEGE of BUSINESS & PUBLIC AFFAIRS
COLLEGE OF EDUCATION, HUMANITIES & BEHAVIORAL SCIENCES

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ALABAMA A&M UNIVERSITY

OFFICE OF THE PRESIDENT

March 28, 2024

Greetings, STEM Day Participants!

I am pleased to welcome each of you to Alabama A&M University's Annual STEM Day event as we gather to celebrate the wonders of science, technology, engineering, and mathematics under the 2024 theme - "Cultivating Diversity in STEM Solutions."

Here at Alabama A&M University, we embrace the power of diversity in all its forms, understanding that it is the key to unlocking innovative solutions to the challenges facing the world today. As we come together to explore the vast possibilities that STEM fields offer, let us remember that it is AAMU's unique perspectives and experiences that fuel progress and drive the University's students, faculty and staff towards a brighter future.

As the preceding Black History Month and Women's History Month demonstrate each year, there have been numerous inventions and accomplishments fueled by minds from every walk of life. This exciting event is a logical continuation of those celebrations and the diversity that is at the heart of STEM solutions. Indeed, Alabama A&M University remains a leading producer of African-American and other minority computer scientists, engineers, mathematicians, agriculturalists and researchers.

Thus, today celebrates the contributions of our students, faculty and staff who continue each day to promote the importance and relevance of STEM disciplines. Together, we can make a difference and shape a world that is inclusive, innovative, and full of endless possibilities. We know the presentations will maintain the fervor of past events and build excitement for years to come. Thank you for being a part of this important event, and let us make the most of this day dedicated to the advancement of STEM at Alabama A&M University.

Sincerely,

Daniel K. Wims, Ph.D.
President

Alabama A&M UNIVERSITY

Academic Affairs
108 Patton Hall
Normal, Alabama 35762
(256-372-5275 Office
(256) 372-5278 Fax

March 22, 2024

Dear STEM Day Participants:

Welcome to Alabama Agricultural and Mechanical University! It is my genuine pleasure to extend my greetings and support to the 17th Annual Science, Technology, Engineering and Mathematics (STEM) Day. We are especially pleased to promote and foster the STEM disciplines of the university while showcasing the achievements of our faculty, staff, and students. In addition to showcasing achievements, STEM Day provides our students opportunities to partner and collaborate with faculty and professional mentors from local businesses and industry, presenting research projects in science and technology.

Our 2024 STEM Day theme, "***Cultivating Diversity in STEM Solutions,***" reflects an approach to discovery reliant on interdisciplinarity and ingenuity in the quest for discoveries in STEM. Essential concepts and techniques learned in the classroom and applied through research provide our students with an excellent skill set required for future scientists and scholars.

We intend for STEM Day to continue cultivating initiatives, creating alliances, and encouraging student participation in the science, technology, engineering, and mathematics disciplines. I wish each of you the best as you engage all that the program has to offer.

Again, welcome to STEM Day 2024 at Alabama Agricultural and Mechanical University, and best wishes in today's competitions.

Sincerely,

John D. Jones, PhD
Provost and Vice President of Academic Affairs

Alabama A&M UNIVERSITY

Office of the Vice President for
Research and Economic Development
4900 Meridian Street
Patton Hall - Room 217
Normal, Alabama 35762
(256) 372-7010 Office
majed.eldweik@aamu.edu

March 20, 2024

Greetings from the Research and Economic Development Office!

It is hard to believe another year has rolled around. I am happy to share that this year, we collaborated with Innovate Alabama, and I am truly looking forward to this new initiative. We are committed to encouraging our students to seek opportunities in the areas of science, technology, engineering, and mathematics.

This office will continue to support the STEM Day. I know that the presentations and exhibits that will be displayed will show the students the efforts and strong faculty members who are mentoring our students at AAMU.

Because of this event, students will definitely become familiar with research and up-to-date technological advancement in the STEM program. As an advocate of research and Economic Development, it is a pleasure to applaud, promote, and support the STEM program.

I hope this will be a day of learning new and interesting concepts that will enhance your STEM skills. Please take time to listen intently to the speakers and communicate with the AAMU students to find out about their careers, coursework, and what it is like to attend college. Share with others what you learned from this exciting STEM day, and please make plans to come back and join us next year.

Sincerely,

Majed Dweik

Majed Dweik, PhD
Research and Economic Development

Cultivating Diversity in STEM Solutions

March 28, 2024

"Never be limited by other people's limited imaginations." Dr. Mae Jemison, engineer and former NASA astronaut

The Division of Student Affairs is honored to support the STEM Day 2024 event. This year's theme, Cultivating Diversity in STEM Solutions, underscores the importance of STEM Day at Alabama A&M University (AAMU).

Diversity opens the doors to having unique perspectives shared within the workplace. Viewing and tackling problems from multiple viewpoints contributes to solutions that can change the world.

STEM Day prepares AAMU students to be well-rounded leaders. In preparation for showcasing the knowledge and skills being gained in our rigorous academic programs, the students work collaboratively, meet deadlines, and practice communicating clearly. To that end, congratulations to every student who took the initiative to participate in this event. Thanks to their faculty advisors for helping them prepare for this day.

Thank you to the 2024 STEM Day chair, Dr. Pooja Preetha, and her co-chairs, Dr. Laricca London, and Dr. Aaron Adams, and the STEM Day committee members for their tireless efforts to host this event. Thanks to Career Development Services, from the Division of Student Affairs, for adding diverse perspectives to this event by inviting representatives from industry and government to serve as sponsors and judges.

Seventeen years ago, Dr. Matthew E. Edwards launched STEM Day at Alabama A&M University. His vision has flourished. I look forward to seeing some of the concepts presented by students at STEM Day 2024 flourishing in industry and government.

Braque (Brock) Talley, Ph.D.

Vice President, Student Affairs

START HERE. GO ANYWHERE.

Alabama A&M UNIVERSITY

3/17/2024

Greetings Bulldogs,

I want to take this opportunity to welcome you all to the 17th Annual Science, Technology, Engineering, and Mathematics (STEM) Day at Alabama Agricultural and Mechanical University (AAMU)! I applaud the outstanding achievement of our student's hard work, which is translated from their engagement in research activities in various STEM disciplines. In the ever-changing, increasingly complex world, it is more important than ever before our students be prepared to bring knowledge and skills to problem-solving, make sense of information, and know how to gather and evaluate evidence to make decisions. These are the skills that students develop when engaging in research. This occasion is also a testament to our student's hard work and aspirations and their respective faculty mentors in the various STEM disciplines.

We are committed to advancing collaborative work and innovative thinking within our colleges and between our research labs and industry leaders. Hence, this year's STEM Day theme is ***Cultivating Diversity in STEM Solutions.*** I know you have been prepared, and I look forward to your presentations.

As we continue to provide advanced educational opportunities to meet your career aspirations, I encourage you, especially graduating seniors, to explore the possibility of advanced degrees in your preparation to enter the workforce. I extend my best to all STEM Day participants. Remember that regardless of the outcome, you are all winners. Go Bulldogs!

Sincerely,

Tau Kadhi

Tau Kadhi, Ph.D.
Associate Vice President for Academic Affairs and
Dean of Graduate Studies
School of Graduate Studies | Alabama A&M University
256.372.5276 office
Tau.Kadhi@aamu.edu

Alabama A&M UNIVERSITY

College of Agricultural, Life and Natural Sciences
College of Engineering, Technology and Physical Sciences
College of Education. Humanities and Behavioral Sciences
College of Business and Public Affairs

Office of the Deans

March 28, 2024

Dear Participants:

"Cultivating Diversity in STEM Solutions" is the 2024 STEM Day focus at Alabama A&M University (AAMU).

As 2024 STEM Day participants, we are continually encouraged by the depth and excellence of your research efforts and outcomes. This year will be no different, as we display the top research efforts of our science, technology, engineering, and mathematics programs.

As our theme states, our research, as well as our researchers reflect a broad diversity of interests in current local, national, and global issues, as well as the personal perspectives that drive the individual curiosities to seek answers. We thank you for your time and commitment to initiate and work toward results that may ultimately serve as launching points for continued investigation.

The fruitful history of STEM Day at Alabama A&M University underscores the willingness of the Faculty, Researchers, Advisors, and Mentors to uphold their vision to support STEM Day. As always, we also again offer our gratitude to the planners and organizers of this year's events.

Sincerely,

Lloyd T. Walker, PhD
Dean/1890 Research Director
College of Agricultural, Life & Natural Sciences

Zhengtao Deng, PhD
Dean
College of Engineering, Technology & Physical Sciences

Peter Eley, PhD
Interim Dean
College of Education, Humanities & Behavioral Sciences

Timothy K. Mantz., PhD
Interim Dean
College of Business & Public Affairs

Alabama A&M UNIVERSITY

Dr. Matthew (Matt) Edwards
Department of Physics, Chemistry
and Mathematics
P.O. Box 338
Normal, Alabama 35762
(Office) 256-372-8119
(Cell) 256-337-0340

Dear STEM Day Participants:

As the Founder of STEM Day at Alabama A&M University (AAMU), I am delighted to welcome you to the **STEM Day 2024**. Through this correspondence, I wish to take a moment to address this year's theme, "***Cultivating Diversity in STEM Solutions,"*** which suggests excellence and a commitment to research engagement in the STEM disciplines of unprecedented proportions by the faculty and students of the University with greater support of the same by administrators, staff, and stakeholders. This commitment points to having higher levels of and more effective STEM programs at both the graduate and undergraduate levels, which provide students and faculty with a scholarly pathway to success that exemplifies the essence of STEM Day. As such, during the many activities of this day, STEM students with faculty mentors will showcase their research and scholarly investigations, demonstrating the best of what we do. Additionally, some faculty members, especially younger faculty members, will use this academic forum to achieve faculty development by assuming leadership roles in organizing this multiple-disciplinary conference. In this regard, STEM Day provides a reflective quality, allowing students and faculty members to expand their appreciation for the entire STEM enterprise—from the earlier educational component to later career application and employment. Ultimately, we desire that each beginning STEM student gets to the point in their development that they think and implement the notion that "I can do this too." With this realization, the rest of the story is just the STEM student's growth.

Additionally, this year's theme is important and timely as a means to help galvanize our energies in a focused effort to tackle existing problems of science, mathematics, engineering, and technology, including climate change, energy demands, food shortages, and healthcare needs. It invites the ascendancy to a new national normal for our country, where all individuals, regardless of their current location or place of origin, including persons from underrepresented groups—women, minorities, rural-dwelling Americans, people with disabilities, and immigrants—can participate in the scientific enterprise to the level of their abilities and talents. With this broader level of participation, we will encounter no problem beyond our ability to solve successfully when we serve with this personal commitment.

This level of participation and commitment is available to you at STEM Day. To that end, I wish you success in today's competition, continued enjoyment throughout the day, a deepening appreciation for research engagement in the STEM disciplines, and the unending awareness that "I can do this too."

Best regards,

Matthew E. Edwards

Matthew (Matt) Edwards, Ph.D.
Founder of AAMU STEM Day
Professor of Physics,
(Vice President & Assoc. Executive Director of Alabama Academy of Science)
Former Dean, Arts and Sciences

Alabama A&M UNIVERSITY

Pyroelectric & Dielectric Materials Laboratory
Department of Physics, Chemistry and Mathematics
P.O. Box 338
Normal, Alabama 35762
(Office) 256-372-8119
(Fax) 256-372-5622

The Origination, Value, and Sustainability of STEM Day:

Before there was a STEM Day at Alabama A&M University (AAMU), I had attended numerous science and science education meetings, one of which was called Dynamic Days that considered chaos theory and differential equations. Moreover, I had worked previously at another institution, which at that time hosted an Annual Science Program. As an undergraduate student, I had worked at Argonne National Laboratory as a summer intern and later presented my first science talk at the Southeastern Section Meeting of the American Physical Society, while being a new graduate student. These experiences were all fulfilling, which further caused me to realize the significance of conducting research and sharing it with other individuals. In addition, I had previously organized science programs, and had taken students to government laboratories and to many science and engineering conferences. Although there can be no certainty of how or why it occurred, I believe that during the Fall Semester of 2006, somewhere between thinking about attending the Dynamic Days meetings, of presenting talks and posters at regional and national conferences, of taking students to meetings and government laboratories, of participating in previous Annual Science Programs, and of mentoring students at AAMU, the thought arose in my mind of the need for a yearly event at AAMU to be named "STEM Day."

Initially, not only did I contemplate the thought but also knew I had to tell someone about it. Therefore, I requested a meeting with then Provost Beverly Edmond. In a few days after my request, I arrived at the Provost's office and settled into a chair before the desk where she was seated. In order to buffer or assuage myself against a total rejection, I decided to offer two suggestions hoping that she would accept one, at least, and both if I were very lucky, and while not mentioning it earlier, I had been thinking also of how to deliver science content material better to students and how that process could be improved at AAMU. Thus, after exchanging pleasantries, I told Dr. Edmond that I had two ideas that I thought would benefit or be of value to the entire University. I stated that a need exists for a Center for Teaching and Learning to help early career and retooling faculty members to improve their teaching abilities, and secondly a need exists for an annual event called STEM Day to serve scholarly students and faculty members to illustrate the results of their research and individual studies. After a few other exchanges between us, and a brief moment in reflection, Dr. Edmond did not hesitate before replying that the two ideas were meritorious, so "let's make them happen." Thereby, with that simple statement, the goal was achieved, resulting in no rejection of my suggestions but in two positive outcomes all completed with one effort.

I departed from the Provost's office and returned to V. M. Chambers Hall knowing of her support to begin STEM Day and an educational center. The Center was established soon after my meeting with her, without my intervention, and near the end of Fall Semester 2006, I called the first STEM Day Organization Meeting; the meeting was held in the Physics Library with Dr. Edmond in attendance. Starting with that meeting, STEM Day had also begun, and all else about this organization since that time has been about its worth and sustainability.

STEM Day has now existed for many years! What a wonderful reality this is for the University to have some of its brightest students to conduct research and present their findings via posters to persons who have an interest in their work. Moreover, I am delighted to have participated in, have observed faculty members mentoring students in this manner, and have seen faculty and staff members taking leadership roles to make each STEM Day a success, all done with the support of the administration of the institution. Finally, it is each of you who will find the worth in STEM Day and help to sustain its existence at AAMU.

Very sincerely yours,

Matthew E. Edwards

Matthew E. Edwards, Ph.D., Professor of Physics
FRM. Dean, School of Arts and Sciences, and Founder of STEM Day

Biographical Sketch of Dr. Matthew E. Edwards, STEM DAY Founder at AAMU

Employment and Scholarly Activity: Since January 2002, Dr. Edwards has been a Professor of Physics at Alabama A&M University (AAMU) and served as the Dean of the School of Arts and Sciences from 2007 to 2011. Prior to 2002, academic positions he held included associate professorships at Spelman College and Fayetteville State University, and a visiting associate professorship and adjunct faculty position at the University of Pittsburgh, and an assistant professorship at the University of Arkansas at Pine Bluff. He has held summer-faculty-research positions at several Government Labs: the ROME Air Force Research Lab, NASA Langley Research Lab, and the Naval Research Lab. Dr. Edwards is a Condensed Matter physicist with expertise and interests in quantum physics/solitons wave theory, the materials of electrooptics, pyroelectricity, resistivity, and dielectric properties of crystals and nano-particles doped organic thin films, and in STEM Education. Dr. Edwards has more than 50-refereed papers and journal proceedings and has made greater than 55 professional and administrative presentations. He has guided seven students to advanced degrees: four to the Ph.D., and three to the Master's degree, has served on more than 20 dissertation and thesis committees, and has peer-reviewed greater than 25 research manuscripts. Currently, he is guiding two Ph.D.'s and one Master's degree student. Moreover, he sits on the Board of Directors of two science journals and one science education journal and serves on the executive committee of the Alabama Academy of Science.

Formal Training: Dr. Edwards graduated from Central High School in Goldsboro, North Carolina in 1965 and received the Master's and Ph.D. degrees in physics from Howard University, Washington, D.C, in 1975 and 1977, respectively, and received a B.S. degree in engineering physics from North Carolina A&T State University, in 1969. Additional studies included advanced physics courses at the University of North Carolina, Chapel Hill, North Carolina, in 1987, certificate studies at MIT, Boston, Massachusetts, in 2009, and Materials Science studies at the University of Alabama, Sumer 2000.

Honors and Awards: Dr. Edwards has received (1) the award of Fellow of Alabama Academy of Science, March 2022, (2) the award of Interdisciplinary Fellow of the International Institute of Informatics and Systemics (IIIS), July 2019 (3) The William Lesso Memorial Award for Excellence in Physics and Interdisciplinary Communications, July 2018 (4) Session Best Paper Awards, of the Proceedings of the International World Multi-Conference on Systemics, Cybernetics, and Informatics, in three years, July 2013, 2014, and 2016, (5) Top Faculty Award At Online Affordable HBCUs, 2013 & 2014, (6) Nuclear Research Commission (NRC) Faculty Research Participation Program Award, 2011 & 2012, (7) Madison Who's Who Recognition, 2011, (8) American Society for Engineering Education (ASEE) Fellowships, 1996, (9) Received the Noble Achievement Award from NAFEO, 2009, (10) The Special Recognition Award from Science Spectrum Magazine as a Top Minority in Research Science, September 2005, (11) Who's Who in American Colleges and Universities Recognition, 2004, (12) Presidential Award for Excellence in Teaching, from Spelman College, 2001, (13) Outstanding faculty of the year award from the Department of Natural Sciences, Fayetteville State University, 1994, (14) The Award from the National Institutes of Health (NIH)—National Institute of General Medical Sciences, 1991.

Achievements: Dr. Edwards was the Guest Editor of the special issue of the American Journal of Materials Science in 2015. He holds membership in several scientific and scholarly organizations. He has been the PI or Co-PI on more than 20 grants and contracts, totally more than 6.00 million dollars. He founded: (1) the Biomedical Research Program at Fayetteville State University, (2) the Interdisciplinary Center for Health Science and Health Disparities & Materials, at AAMU, and (3) STEM Day at AAMU,

Personal Information: Dr. Edwards's immediate family consists of wife, Glenda Robinson Edwards, a son, Matthew Edwards, Jr., with his significant other Rosalind Combs, two granddaughters, Megan and Misty Edwards, and their mother Shirley Haywood, a daughter, Natasha Hall with her husband Daniel, and two other granddaughters, Kaylie and Alexis Sellers, and Glenda's grandson, and great grandson, Courtland Cutler and Nicholas Cutler, respectively.

Welcome and Greetings!

On behalf of the 2024 organizing committee, it is with great pleasure that we extend a warm welcome to all attendees of Alabama A&M University's (AAMU) 17th Annual Science, Technology, Engineering, and Mathematics (STEM) Day. This event serves as a platform for our students to showcase the results of their diligent research efforts, which have been nurtured through collaboration with their esteemed faculty mentors. Today marks a remarkable opportunity for AAMU to witness the display of your talents and innovative research, while simultaneously engaging the community in the professional dissemination of knowledge.

Aligned with the core values of AAMU, this year's STEM Day theme, "Cultivating Diversity in STEM Solutions," aptly encapsulates the essence of our collective endeavors. As we navigate an ever-evolving landscape, characterized by intricate challenges, interdisciplinary collaboration becomes paramount in driving innovation forward. Our commitment to fostering a cross-disciplinary approach underscores our dedication to equipping students with the necessary skills for success in both academic and professional realms within the STEM discipline.

We take immense pride in the overwhelming response to this year's STEM Day, with a diverse array of abstract submissions from undergraduate and graduate students across various academic programs. This enthusiastic participation underscores the significance of this event as a platform for students to not only present their research findings but also to hone their problem-solving abilities.

We extend our heartfelt gratitude to our esteemed sponsors, including the President's Office, Title III, and the Deans of the Colleges of Agriculture, Life & Natural Sciences; Engineering, Technology, and Physical Sciences; Education, Humanities, and Behavioral Sciences; and Business and Public Affairs. Additionally, we would like to acknowledge the invaluable support of the AAMU Career Development Services Office, as well as express our appreciation to our guest speaker, judges, university administration, and faculty members who have played pivotal roles in mentoring our students.

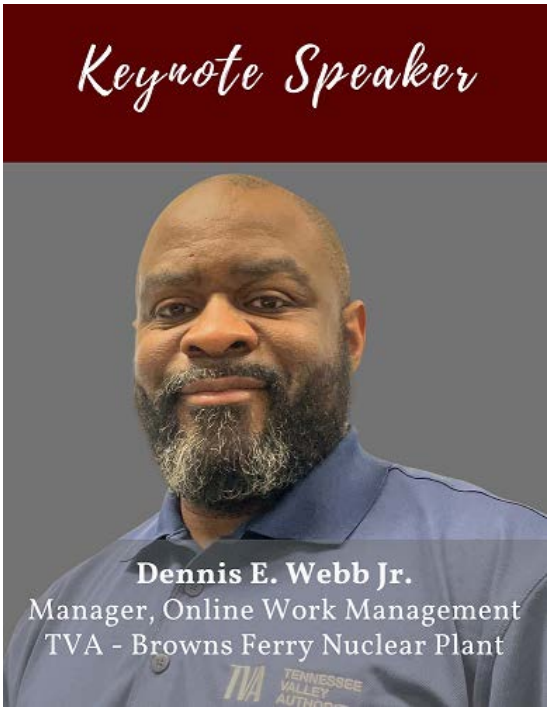
As we embark on this journey of intellectual exploration, the 2024 STEM Day Committee is honored by your presence and eagerly anticipates the vibrant discourse that will ensue as our students present their research endeavors. We trust that today's event will serve as a catalyst for inspiration and innovation, propelling us towards a brighter future in STEM.

Pooja P. Preetha, Ph.D., Aff.M.ASCE Assistant Professor Department of Civil & Mechanical Engineering and Construction Management, CETPS	Laricca Y. London, Ph.D. Assistant Professor of Biology Department of Biological and Environmental Sciences, CALNS	Aaron Lee Adams, Ph.D. Associate Professor Department of Civil & Mechanical Engineering and Construction Management, CETPS

Cultivating Diversity in STEM Solutions

17th Annual STEM Day 2024 Program
Founder: Dr. Matthew E. Edwards
Event Center
March 28, 2024

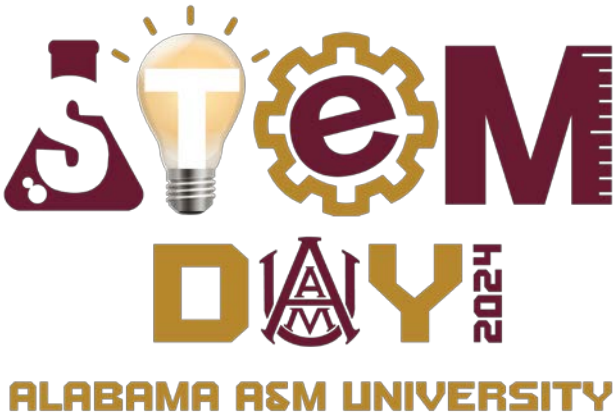
7:30- 8:15 AM	Breakfast	
	Welcome & Opening Remarks	**Pooja P. Preetha, Ph.D.** Chair, 2024 STEM Day
		Daniel K. Wims, Ph.D. President, Alabama A&M University
8:15 – 8:45 AM	Provost Welcome Remarks	**John Jones, Ph.D.** Provost, Alabama A&M University
		Dr. Majed Dweik Vice President of Research & Economic Development, Alabama A&M University
8:45 – 9:15 AM	Introduction of Speaker	**Zoe Delbridge** Senior, Biological Sciences
	STEM Day 2024 Speaker	**Dennis E. Webb Jr.** Manager, Online Work Management TVA – Browns Ferry Nuclear Plant
9:15 – 9:25 AM	Special Presentations	**Pooja P. Preetha, Ph.D.**
9:30 – 12:15 PM	Student Poster Presentations	**Viewing and Judging**
9:35 – 12:30 PM	Graduate Oral Presentations High School STEM Demonstration	
12:15 PM	Lunch	
12:30 – 3:15 PM	**Interactive Programs** Employer Tables Graduate Information Session	
3:30 PM	**Awards Ceremony**	**Sadguna Anasuri, Ph.D., CFLE**
4:00 PM	**Closing Remarks**	**Pooja P. Preetha**
4:00 – 5:00 PM	**Poster Removal and Cleaning**	**Students**



Dennis E. Webb Jr. is the Manager of Online Work Management at TVA's Browns Ferry Nuclear Plant in Athens, Alabama.
Before being named the Manager of Online Work Management in January 2024, Dennis spent 15 years working in the Chemistry Department as the Chemistry Technical Support Supervisor. There, he worked closely with all groups in the plant and the Chemistry Laboratory Supervisor, where he supervised and observed lab activities and processes.

Before joining TVA, Dennis worked at LifeSouth Community Blood Centers as a Components Specialist.

Dennis earned a Bachelor of Sciences in Biology with a concentration in Pre-Med from Alabama A&M University c/o 2007, where he was a Track and Field Athlete competing in the Pole Vault. Following graduation, he also worked as an assistant Track and Field Coach working with the Pole Vaulters.



STEM DAY 2024

ABSTRACT CATEGORIES

POSTERS	
Undergraduate	**Graduate**
Biological and Environmental Sciences	Biological and Environmental Sciences
Community and Regional Planning	Community and Regional Planning
Family and Consumer Sciences	Family and Consumer Sciences
Food and Animal Sciences	Food and Animal Sciences
Electrical Engineering and Computer Science	Physics, Chemistry and Math
Mechanical and Civil Engineering	
Physics, Chemistry and Math	
ORAL PRESENTATIONS	
Biological and Environmental Sciences	
Community and Regional Planning	
Food and Animal Sciences	
Electrical Engineering and Computer Science	
Mechanical and Civil Engineering	
Physics, Chemistry and Math	

ABSTRACTS

POSTERS

BIOLOGICAL AND ENVIRONMENTAL SCIENCES

Undergraduate

Abstract # 101

Beyond Accessibility: The Influence of Transportation on Metabolic Health Across Alabama

Erin Oliver, and Ebony Weems

Mentor(s): Dr. Ebony Weems

Department of Biological and Environmental Sciences

Food deserts are classified as areas in which residents may have limited access to affordable and healthy foods. Currently, in the state of Alabama, over 2 million people reside in a food desert. Food deserts are linked to negative health outcomes, such as metabolic disorders and hypertension. Previous studies from our laboratory show that approximately 13.1% of all Alabama residents suffer from food insecurity. According to the U.S. Census Bureau, Alabama was also one of ten states with a high prevalence of poverty in the country. The southern state was also recently shown in 2016, a study published by UAB showcased how Alabama placed second in the nation for food hardships. These hardships paired with low rates in quality public transportation could potentially create more challenges for proper food distribution and less healthier alternatives to thrive within Alabama. This study aims to investigate the influence of food deserts on metabolic health across Alabama. Metabolic disorders are a spectrum of disorders that are caused by a disruption in normal metabolic processes. Increased prevalence of metabolic disorders is shown to be associated with increased incidence of poverty, psychosocial factors, and decreased access to reliable transportation. We hypothesize that residents in Alabama living in food deserts with inadequate transportation access have a higher prevalence of negative health outcomes compared to areas with accessible transportation. Using data previously collected in our lab, a statistical analysis will be performed. Multivariate regression analysis will be used to analyze the relationship between transportation access and the health outcome of obesity. Results from this study will help to shed light on the importance of access in the prevention of disease.

Abstract # 102

Characterization of the Absolute and Relative Microbiota Abundance in Soil under Different Agricultural Management Systems

Keyshawn Johnson, Kourtney Lamar, and Elicia Moss

Mentor(s): Dr. Elicia Moss

Department of Biological and Environmental Sciences

Measuring the abundance of key populations in soil is important for understanding the contributions of the microbial community. Microorganisms are important components in nutrient cycling and exchange, soil fertility, crop production, and thus can serve as indicators for soil quality. Bacteria and fungi are the most important microbiota groups that closely interact with plants in a beneficial or adverse manner. However, most studies have focused solely on bacteria, and little is known about the diversity and abundance of fungal communities. This study, conducted at the Winfred Thomas Agricultural Research Station at Alabama A&M University provides a comprehensive understanding of the dynamics and interactions of both communities using quantitative PCR (qPCR). Characterization of the absolute and relative microbiota abundance in soil under different agricultural management systems, Industrial Hemp (Cannabis sativa L.), Miscanthus (Miscanthus sinensis), sugarcane (Saccharum officinarum L.) and miscane hybrid (cross between sugarcane and Miscanthus) was analyzed. Results indicated a high target abundance of both the bacterial and fungal DNA in the soil. However, there were differences in the specific concentrations among the agricultural management systems. Particularly, the total bacterial DNA was highest in sugarcane, Miscanthus, followed by hemp, and lowest in miscane hybrid. The total fungal DNA was highest in Miscanthus, sugarcane, hemp, and lowest in miscane hybrid. For all soils, the total fungal DNA was higher than the total bacterial DNA. This study provides greater insight into the absolute and relative abundance of the soil microbiota and indicates that agricultural management of soil significantly influences the diversity of bacteria and fungi.

Abstract # 103

Evaluation of Pollution, Health Disparities, and Climatic Factors within Cities in North, Central, and South Alabama, using the US EPA Environmental Justice Screening and Mapping Tool (EJScreen)

Saiban Chappell, Cameron, J

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Department of Biological and Environmental Sciences

Communities of color often bear the brunt of environmental hazards, residing in areas with higher pollution levels, environmental consequences of climate change, and health disparities such as respiratory issues, cancer, and low birth rates. The US EPA Environmental Justice Screening and Mapping Tool provides consistent data and methodology for examining environmental and demographic socioeconomic factors. This study focuses on three areas in Alabama: Africatown, North Huntsville, and York, which confront disparities related to air toxins, particulate matter, lead paint, wastewater discharge, climate indices, and demographic and socioeconomic characteristics like income, age, education, and unemployment rates. Africatown, three miles north of Mobile, is a historically significant community that has suffered many environmental injustices. Initially developed for mills and industries like Kimberly Clark and Hosea O. Weaver & Sons, it now contends with a myriad of pollution issues. In North Huntsville, the W.H. Councill Community Development Corporation (CDC) and the Huntsville Metro Area Black Chamber of Commerce are collaborating to revitalize the Holy Cross/St. Christopher Church into an economic and job placement hub. The age of the church raises concerns about environmental hazards such as lead-based paint and asbestos, prompting an evaluation of the site in addition to potential environmental concerns from the nearby brownfield. York, Alabama, of the Black Belt region is considered a food desert and has had significant flooding and drinking water issues sits in the same county as the Chemical Waste Management hazardous waste facility. This study highlights the disproportionate environmental challenges faced by communities of color and underscores the importance of the EPA's EJScreening tool in assessing various factors.

Abstract # 104

Evaluating optimum nitrogen fertilization rates in two winter canola hybrids in northern Alabama

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Winter canola (Brassica napus L.), a biennial oilseed crop adapted for autumn planting and early summer harvest, confers significant agronomic and environmental benefits due to its robust root system and winter resilience. It is of economic and sustainable significance to grow this crop in northern Alabama due to its winter adaptability and potential to improve crop rotation systems. However, the successful cultivation of winter canola requires accurate agronomic practices, particularly optimizing the fertilization rates of nitrogen (N), a vital nutrient crucial for crop growth and productivity. This study investigates the optimal N fertilization rates for two promising winter canola hybrids, aiming to maximize their yields in this growing region.

Employing a split-plot design, the experiment included four blocks, each comprising four main plots, with each main plot split into two sub-plots. The four N application rates (0, 50, 100, 200 kg N/ha) were applied to the main plots and the two cultivars to the sub-plots. Planting was done in 2023 Fall at the Winfred Thomas Agricultural Research Station (Hazel Green, AL). Plant stand was monitored on a regular basis to assess the winter survival ability. The results indicated an overall high winter survival rate for these two cultivars, with minimal cold damage despite the extreme coldness in the 2023 winter. The flowering stage (first and end), physiological maturity stage, and yield data will be collected at various growth stages. Statistical analysis will be performed to determine the optimal N applicate rate and its interaction with cultivar types. The findings of this study will provide insights for optimizing N management practices in winter canola cultivation, thereby enhancing crop yield and sustainability in the northern Alabama region.

Abstract # 105

Investigating the Antibacterial Effect of Essential oils

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Due to an increase in bacterial resistance patterns to classical antibiotic therapy, there is an urgent need for novel methods to treat bacterial infections. Research is increasingly focused on discovering new antimicrobial products that can be derived from natural sources, including bioactive compounds from plants. Thus, essential oils have become promising candidates as novel agents for antimicrobial properties as an alternative to the common antibiotics. The aim of this investigation is to evaluate the antibacterial effect of a panel of essential oils on a spectrum of bacterial isolates. The test panel of bacteria included Esherichia coli, Staphylococcus aureus and Pseudomonas aeruginosa and other environmental isolates. In vitro analyses, including Agar Disk Diffusion method and Minimum Inhibitory Concentration (MIC) assays, were utilized to examine the antibacterial activity of each essential oil compound. Here we report the antibacterial effect of each compound.

Abstract # 106

Bacterial Monitoring of Open & Closed Looped Cooling Water Systems at AAMU

Alexis-Marie Parrish, A. Gubara, and Elica Moss

Mentor(s): Dr. Elica Moss

Department of Biological and Environmental Sciences

In modern offices and commercial buildings, the significance of open and closed-loop cooling tower water systems is escalating, demanding meticulous management to safeguard public health, the environment, and operational efficiency. Closed-circuit systems, confining water within pipes, effectively preserve quality, minimizing contamination risks. Conversely, open systems, susceptible to challenges like Legionella contamination, necessitate vigilant management. Alabama A&M University's New School of Business and Wellness Center were the focal points of this study. Water samples from open and closed cooling systems underwent non-culture-dependent bacterial analysis using the IDEXX water test and full-length 16S gene amplicon sequencing by Zymo Research Laboratories. The study encompassed a comprehensive analysis, including the examination of opportunistic human pathogens such as Legionella pneumophila and Pseudomonas stutzeri, along with the assessment of Enterococci, Escherichia coli, and total coliforms in both open and closed-loop water cooling systems. Chemical analysis assessed pH, dissolved oxygen, turbidity, conductivity, copper, aluminum, and lead in both systems. Results revealed the impact of bacterial contamination on chemical characteristics, posing risks such as stagnant water and nutrient deficiency. Elevated turbidity and low dissolved oxygen levels were also observed. Recommendations underscore the need for frequent and accurate testing for appropriate treatments to prevent damage to water-cooling systems and mitigate harmful consequences on human and environmental health. This approach aims to ensure building occupants' safety and curtail the spread of harmful bacteria while providing insights for effective management strategies.

Abstract # 107

A Comparison of the Diversity of Birds of Prey at Two Different Types of Ecological Sites

Dominic L Terry, Ashley woods, and William Stone

Mentor(s): Dr. William Stone

Department of Biological and Environmental Sciences

During the summer of 2023, the senior author conducted a wildlife internship at Wheeler National Wildlife Refuge (WNWR) in Decatur, AL, along the Tennessee River and adjacent wetlands. During this experience, many birds were observed, but the most interesting ones were Birds of Prey, or Raptors. Observing these birds on the nest, perching, or in flight led to greater interest in these bird communities in different types of habitat in Northern Alabama. Upon returning to campus in the fall, we observed birds of prey both at WNWR and at an agricultural area, the Winfred Thomas Agricultural Research Station (WTARS) in Hazel Green,

AL, to compare the diversity of birds of prey in these two very different types of habitat. We primarily observed birds of prey during the late fall period from October through December. This time period coincides with hawk migration, and we expected an influx of hawks in this region. We visited the two sites more than 5 times each, usually early in the day, but also once at night. We used tools such as binoculars, cameras, and a bird identification app. to observe and identify different raptors. Finally, we computed species richness, which is a total count of all species of raptors, and a Shannon-Weaver species diversity index (Shannon and Weaver 1949) that also incorporates evenness in the number of individual birds among the species seen to compare the two habitat sites. We were fortunate to spot a Cooper's Hawk, Northern Harriers, Kestrels, Red-Tailed Hawks, Ospreys, and Bald Eagles. Species richness and diversity were higher at WNWR than at WTARS, which was expected, but WTARS had an impressive raptor fauna, including a nesting pair of bald eagles. We discuss the ecology of birds of prey that we observed to explain the results we discovered.

Abstract # 108

Analyzing the significance of Uromodulin Thr469Met mutation in kidney disease

Kameron Mckinney, Mckinney, K., and Farmer, T.

Mentor(s): Dr. Tyesha Farmer

Department of Biological and Environmental Sciences

Uromodulin (UMOD), a protein primarily expressed in renal tubules, is essential for kidney function. Alterations in UMOD due to genetic variations may impair its protective role, potentially leading to kidney damage. The ClinVar database reports over 200 UMOD missense variants with unclear implications. Among these, the Thr469Met mutation has been implicated in uromodulin-associated kidney disease I and familial juvenile hyperuricemic nephropathy type I. The mutation involves a substitution of Threonine (a polar uncharged amino acid) with Methionine (a hydrophobic amino acid). This study assesses the tolerance of the UMOD gene to mutations and the functional ramifications of the Thr469Met variant. Polyphen2 predicts this variant to be deleterious, while SIFT considers it tolerated. Residual Variant Intolerance Score (-05046) indicate that UMOD is in the 27.4% of human genes least tolerant to variation, suggesting significant functional impacts from mutations. The Thr469Met variant was modeled in YASARA. The contradictory findings from different predictive tools underscore the complexity of interpreting genetic data and the necessity for experimental validation. The current investigation would benefit from in vitro functional assays to evaluate the impact of the Thr469Met mutation on UMOD's ability to form its typical polymer structure, which is crucial for its function. Broad approaches would bridge the gap between bioinformatic predictions and biological reality, contributing to more accurate genetic screening and risk assessment strategies for kidney diseases. Ongoing research aims to comprehensively delineate

characteristics of the Thr469Met variant to better understand its contribution to kidney disease risk.

Abstract # 109

Characterizing the FMR1 Gene Variant R138Q in Fragile X Syndrome

Trinity McIntosh, McIntosh, T., and Farmer, T.

Mentor(s): Dr. Tyesha Farmer

Department of Biological and Environmental Sciences

Fragile X syndrome is the most commonly inherited form of developmental and intellectual disability. This genetic disorder is caused by trinucleotide expansion of CGG repeats in the Fragile X Messenger Ribonucleoprotein 1 (FMR1) gene. Beyond these expansions, additional FMR1 mutations, such as single nucleotide variants, have been identified in affected individuals. However, the functional outcomes of these mutations and their roles in Fragile X syndrome remain unclear. The objective of this study is to survey the effects of the R138Q mutation in FMR1 using a suite of bioinformatics tools to determine whether this variant, which currently has unclear clinical significance, plays a role in the syndrome. The R138Q mutation substitutes an Arginine (a positively charged polar amino acid) with a Glutamine (a polar but uncharged amino acid) at the position 138. Analysis using Polyphen2 and SIFT suggests that this variant may not be well-tolerated, whereas metrics from CADD (23.3) and GERP (5.25) imply a likely tolerance within the protein's context. Moreover, FMR1 ranks among the 66.3% most tolerant human genes based on Residual Variant Intolerance Score (0.2584). The differing outcomes from these analytical tools underscore the complexity of interpreting variants of uncertain significance and the necessity for comprehensive computational assessments bolstered by empirical functional studies. The R138Q mutation was modeled in YASARA to locally visualize the impact of the variant on protein structure. Understanding the molecular and clinical consequences of variants of uncertain significance is critical for accurate diagnosis, prognosis, and the development of targeted therapeutic interventions for Fragile X syndrome.

Abstract # 110

Lunar Life Detection Cubelet Robot: An Autonomous Exploration System for Lunar Surface

Amani Blair, and Y. Fu

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Department of Biological and Environmental Sciences

The Lunar Life Detection Cubelet Robot (LLDCR) is designed to detect signs of life or presence on the lunar surface. With the increasing interest in space exploration and the potential for future human habitation, the need for advanced technology to assess the lunar environment is

essential. The LLDCR is a compact and versatile cubelet robot equipped with a program code specifically tailored for life detection.

The key point of research is to use machine learning to gather comprehensive data about the surroundings within space and allow the robot to adapt to the dynamic lunar environment to be able to detect the unusual: motion. This research aims to enhance environmental monitoring through the application of machine learning techniques within a programmed cubelet. The existing programming within the cubelet provides a foundation for the basic detection of movement in its surroundings using the SENSE cubelet. However, the study proposes an advanced approach by employing C programming to modify the existing code, enabling the cubelet to gather more comprehensive data about its environment. This entails expanding the search parameters to include variables such as distance from the cubelet, directional movement in proximity, and height detection. The objective is to create a more sophisticated system capable of deciphering finer details about detected objects. This ultimately will contribute to a more precise understanding of the anonymous objects identified within the cubelet's surroundings.

The LLDCR demonstrates its potential to enhance our understanding of the lunar environment, paving the way for future exploration and potential discoveries related to lunar life or presence. It represents a significant step forward in autonomous lunar exploration technology, contributing to the broader goal of expanding human knowledge about celestial bodies beyond Earth.

Abstract # 111

The Efficacy of Essential Oils in the Control of Microorganisms

Tikayle Mccreary

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Department of Biological and Environmental Sciences

Microorganisms continue to evade chemicals and antibiotics designed to control them, scientists have begun to look for other alternative measures to combat drug-resistant microorganisms and essential oils from plants are one such alternative. In this study, we determined the antimicrobial effects of essential oils of Ashwagandha, Eucalyptus and Clove on Escherichia coli, Bacillus subtilis and Streptococcus mutans. Streptomycin antibiotic was used as positive control while sterile distilled water served as negative control. The Agar well diffusion method as well as the minimum inhibitory concentrations (MIC) were used to determine antimicrobial efficacy of the essential oils. The zones of inhibition ranged from 25.0mm to 15.4mm for Ashwagandha and Clove; Eucalyptus essential oil was not as effective as an antimicrobial. Bacillus subtilis and E. coli were very sensitive to the oil of Clove. In conclusion plant essential oils emulsions can serve as safe alternatives for antibiotics.

Abstract # 112

Antimicrobial Effects of Plant Extracts on Various Bacterial Species

Marley Muhammad

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Ashwagandha [Withania somnifera], Basil and Moringa are considered important medicinal plants used to treat various ailments such as high blood pressure, diabetes, and inflammation. Agar well diffusion method was used to determine the antimicrobial properties of the ethanolic extracts of these plants against Gram-positive bacteria (Bacillus subtilis, Staphylococcus aureus), Gram-negative bacteria (Escherichia coli, and Pseudomonas aeruginosa). The Soxhlet extractor was used for the ethanolic liquid-solid extractions. The antibacterial assays results show that ethanol extracts of all the plants exhibited broad spectrum activity against both Gram-positive and Gram-negative test organisms - Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus and Bacillus The preliminary minimum inhibitory concentrations of the extracts ranged between 0.24 and 32 mg/ml. In conclusion, ethanolic extracts of Ashwagandha, Basil and Moringa can be used as antibacterials.

Abstract # 113

Analysis of the MC4R, POMC, and SIM1 gene variants and the development of genetic obesity

Uchenna Justin

Mentor(s): Dr. Ebony Weems

Department of Biological and Environmental Sciences

The prevalence of obesity has become a global concern. Obesity is now so common within the world's population that it is beginning to replace undernutrition and infectious diseases as the most significant contributors to ill health. The World Health Organization (WHO) defines overweight and obesity as "abnormal or excessive fat accumulation that may impair health." Obesity is associated with an increased risk of various chronic diseases, including heart disease and stroke, Type 2 diabetes, some cancers, musculoskeletal disorders, and sleep apnea, among others. The causes of obesity are complex, involving a combination of environmental and behavioral factors such as energy imbalance, specific dietary patterns, psychological and socioeconomic factors, and genetics. Genetic obesity is a type of obesity where specific genes increase a person's risk of developing the condition. Types of genetic obesity include monogenic obesity, polygenic obesity, and syndromic obesity.

The purpose of this study was to investigate the relationship between specific genetic variations in the MC4R, POMC, and SIM1 genes and their potential to cause genetic obesity. These genes are involved in regulating appetite, metabolism, and energy balance within the

body, respectively. We hypothesized a significant association between specific variants in the MC4R, POMC, and SIM1 genes and the development of genetic obesity. Using the In Silico Prediction tools, such as PolyPhen-2, SIFT, CADD, and MutationTaster, nine variants were chosen out of over 400—three variants from each gene. Results from a pathogenicity analysis demonstrate the potential for the variants of the MC4R gene, Val50Met and Ser180Pro, to be pathogenic and likely pathogenic, respectively, and the POMC variant Glu214Gly is likely pathogenic. Future functional studies will be conducted using a 2-d in vitro cell model. Overall, the study gives valuable insight into how these genetic variants play a role in the onset of obesity.

Abstract # 114

Understanding the Molecular Mechanisms of IL-6 in Gut Inflammation and its Implications in Chronic Disease in vitro

Oghenetega Miracle, and Kehinde Olawepo

Mentor(s): Dr. Ebony I. Weems

Department of Biological and Environmental Sciences

Chronic diseases, such as inflammatory bowel disease (IBD) and diabetes, is linked to inflammatory processes in the gut. Inflammation is the immune system's response to harmful stimuli and acts by removing injurious stimuli and initiating the healing process. Inflammation occurs in the gut barrier and can lead to a major health problem. The intestinal epithelial layer comprising the gut barrier acts as the primary barrier separating our body from the external environment. It consists of different types of epithelial cells and serves as the first line of defence against external factors like pathogens and undigested food particles. The primary goal of this study is to understand the specific IL-6 inflammatory response in the epithelial found in the gut. Inflammation in the gut barrier leads to an increase in permeability which can allow non-digestive toxins to gain access into the intestine. It disrupts the tight junction of the intestinal barrier. We hypothesized that the inflammatory signalling pathways that comprise the interactions between gut epithelial and immune cells are dysregulated in chronic disease. Intestinal cells were grown in bicameral chamber and treated with varying concentrations of lipopolysaccharide isolated from E. coli. Morphological changes and viability will be monitored to monitor the cellular response. Both differential gene expression and ELISA specific for IL-6 will be conducted to measure the expression of inflammation-related genes. Successful completion of this project will provide a framework for further exploration into targeted interventions for chronic diseases caused by gut inflammation.

By analyzing inflammation in Caco 2 cells, we seek to understand how obesity-related complications can affect the gut barrier integrity. A Caco-2 barrier 2-D model was exposed to SFA's, and the permeability of the barrier was measured using paracellular permeability assay. The relationship can be understood in vitro via exploring the role of inflammation and

metabolic dysregulation in the context of Caco-2 barrier function will help in understanding the relationship between obesity-related complications and gut barrier integrity.

This study is significant as it helps to understand negative effects of High Fat Diet (HFD) foods on the gut barrier. By using inflammation Caco 2 cell in vitro, this research can inform development of low-fat food production.

Abstract # 115

Water Quality Assessment of the Prevalence and Persistence of Fecal Indicator Bacteria in the Indian Creek Watershed

Jalen Whisenhunt, A. Brooks, and E. Moss

Mentor(s): Dr. Elica Moss

Department of Biological and Environmental Sciences

Water pollution is a critical issue with significant implications for biodiversity, human health, and the economy. Water quality in the State of Alabama is of great concern due to population migration as industries move into the state and agricultural lands are irrigated to increase production. This could further exacerbate the State's polluted surface waters, thus limiting their usefulness to humans and ecological systems. To better monitor and protect the water quality of waterways, we use water quality standards to monitor impaired and improved waterways. This includes monitoring physiochemical parameters such as pH, Dissolved Oxygen (DO), turbidity, temperature, and specific conductivity, which may serve as indicators of the presence of fecal indicator bacteria, (Escherichia coli, Enterococcus faecalis, and Pseudomonas aeruginosa) and threaten overall health of the water system. This study evaluates the water quality of the upper and lower Indian Creek Watershed in the Tennessee River Basin which is listed on the EPA's §303d list for impaired waterbodies, specifically for pathogens. The sources of the impairment are collection system failures, pasture grazing, and urban runoff/storm sewers. Results indicated that the concentration of physiochemical parameters as well as seasonal climatic factors had significant impacts on the presence of E. coli, E. faecalis, and P. aeruginosa, which were enumerated using the IDEXX method. This analysis contributes to studies conducted by the Alabama Department of Environmental Management and provides more insight into understanding the prevalence and persistence of pathogens in the Indian Creek Watershed.

Abstract # 116

Analysis of AKT2 Gene associated with Type 2 Diabetes and its Severity

Osionela Ogiogwa, and Ebony I. Weems

Mentor(s): Dr. Ebony I. Weems

Department of Biological and Environmental Sciences

Type 2 Diabetes mellitus(T2D) is an inflammatory disorder characterized by insulin resistance in target issues and relative deficiency of insulin secretion from pancreatic β-cells. T2D is the most

common type of diabetes and is the 8th leading cause of death in the United States. Prolonged consumption of a dietary regimen of high amounts of glucose is associated with the early onset of T2D and obesity. In addition, mutations in various genes have been associated with its development. AKT2, RBPJ, WFS1, and CAPN10 are some genes associated with Type 2 diabetes when mutated.

The purpose of this study is to identify and characterize AKT2 mutations(variants) associated with Type 2 diabetes. Using bioinformatic prediction tools such as SNPs-GO, PolyPhen-2, CADD, and PhD-SNP, a variant analysis was performed to characterize genetic variations within the AKT2 gene. The analysis examined single nucleotide substitution (SNV), also known as single nucleotide polymorphisms (SNPs), to predict the potential impact of variants on protein structure and function. Four variants out of over 49 were chosen: R274H, R15H, D94D, and P370P. Results show that the gene variant R274H can potentially be pathogenic and disease-causing, while P370P is benign. Further analysis to advance our understanding of the genetic aspects of type 2 diabetes will provide insights into its clinical manifestations and pave the way for developing more targeted therapies and improved patient care.

Abstract # 117

Birds of Prey at Alabama A&M's Winfred Thomas Agricultural Research Station: Insights into Ecological Roles and Dietary Habits

Ashley Woods, Stone, W., Terry, D., and Woods, L.

Mentor(s): Dr. William Stone

Department of Biological and Environmental Sciences

Alabama A&M's Winfred Thomas Agricultural Research Station (WTARS) is home to diverse bird species that inhabit grassland ecosystems. While it is recognized as a stop along the North Alabama Bird Trail, it is underappreciated for its unique avifauna, especially birds of prey like hawks, owls, and eagles. In an ecosystem, the balance of animal communities relies heavily on the relationships between predator and prey. If a specific bird species prey on a particular insect or small animal and there is a decrease in the bird population, it can lead to overpopulation of the prey species, resulting in damaging consequences for the environment. By understanding these dynamics, we can better manage and protect our natural resources.

During my three-month research project at WTARS toward the end of 2023, I had the opportunity to observe and document various bird species with the help of my mentor and a fellow student. We observed several species of birds of prey, including kestrels, red-tailed hawks, northern harriers, and bald eagles. We witnessed several of these birds capturing and feeding on prey. To more accurately document the types of prey these raptors were using, I also analyzed the contents of apex predator pellets found on the property. Regurgitated pellets are masses of undigested food, including bones, hair, and feathers, that birds regurgitate after eating. Pellets can provide valuable information about a bird's diet, frequency of feeding, and habitat. We found that birds of prey at WTARS fed on rodents, rabbits, and birds. This allowed

me to gain valuable insights into the diets and ecological roles of the predatory birds we observed at WTARS.

Abstract # 118

Enhancing plant performance in grafted tomato through inoculation with plant growth promoting rhizobacteria

Dionne Trinidad, Dionne Trinidad, Leopold M. Nyochembeng, Njideka Adeniyi, and Sampson Hopkinson

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Vegetable crops in Alabama and the southeastern US are subject to biotic and abiotic stresses orchestrated by soilborne and foliar pathogens, high temperatures, and drought. The goal of this project is to determine the role of plant growth-promoting rhizobacteria (PGPR) in strengthening tomato plant resilience against biotic and abiotic stresses. Specific strains of three species of PGPR, including Bacillus amyloliquefaciens, B. pumilus, and B. subtilis, will be screened in the laboratory as direct inoculations on tomato seed followed by seed germination and as root inoculations on grafted tomato plants. Inoculated plants will be further evaluated in the greenhouse against imposed biotic (Alternaria, Verticillium) and abiotic (drought) stresses. PGPR effects will be assessed through analyses of antioxidant enzymes and enzymes associated with induced systemic resistance, including phenylalanine ammonia-lyase (PAL), peroxidase, catalase, and superoxide dismutase. All data (disease incidence, plant height, flowering, and fruit yield) will be subjected to the analysis of variance procedure (ANOVA) of the general linear model (GLM) using the SAS statistical software. Significant treatment means will be separated using Tukey's HSD at p = 0.05.

Graduate

Abstract # 119

Effects of Atmospheric Pressure Plasma vs. Plasma Activated Water on Seed Germination, Seedling Growth and Biomass of Microgreens.

Sravan Kumar Sanathanam, Pham, T., Thakur, S. K., Ghimire, B., Xu, G., Mentreddy, S. R

Mentor(s): Dr. Srinivasa Rao Mentreddy

Department of Biological and Environmental Sciences

Microgreens, harvested within 7-21 days of planting, are rich in nutrients and health-beneficial phytochemicals. Considered functional foods, microgreens reduce inflammation, oxidative stress, and chronic diseases. However, poor germination leading to poor plant stands, seed-borne diseases, and high-water consumption, often limit their production. Atmospheric pressure plasma (APP), a partially ionized gas consisting of unbound electrons, ions, and neutral particles, produces reactive nitrogen species (RNS), reactive oxygen species (ROS), ultraviolet

(UV) photons, and other excited molecules, making it a viable non-chemical tool for seed priming to break dormancy, hasten germination, and disinfect seeds. In this study, 'Amara' mustard greens seeds were exposed to Argon (Ar) or Helium (He) APP and/or Plasma Activated Water (PAW) for T0=0 s, T1=30 s, T2=60 s, and T3=90 s at 7kV, 1µs pulse width, 5Hz and planted in seed germination trays at density of 6 seeds/tray after appropriate treatment. Days to germination and total germination percentage were recorded daily until germination ceased. Seedling height, root length, and biomass were recorded until harvest. Seeds directly exposed to APP or PAW had no significant impact on germination, except for PAW-Ar 90 s, which increased the seed germination percentage by 36% compared to the Control. Plant height significantly increased by direct APP seed treatments by approximately 98% in Ar 30 s and by 50% in all other treatments compared to the Control. He and Ar plasma-exposed seeds increased seedling biomass. He 30 s, He 60 s, He 90 s, and Ar 90 s treatments increased biomass by 250%, 200%, 215%, and 120%, respectively, over the Control. In contrast, PAW treatments had no significant impact. Thus, this study demonstrated that direct seed treatment using Argon or Helium APP improved plant stand, biomass, and potentially reduced water consumption due to quicker seedling growth rates.

This research was supported by NSF-EPSCoR-OIA-2148653 and NASA-EPSCoR 80NCCS21M0139.

Abstract # 120

Bacterial Community Microbiology of Surface and Subsurface Irrigation Water at the Winfred Thomas Agricultural Research Center.

Ajani Brooks, and E. M. Moss

Mentor(s): Dr. Elica M. Moss

Department of Biological and Environmental Sciences

The microbial quality of irrigation water is impacted by wildlife and human inputs including runoff from manure and pasture lands, fecal deposition from wildlife, and discharge from sewer infrastructure. Due to these factors, irrigation water has been identified as a potential source of contamination in several disease outbreaks. Limited databases on microbial quality of irrigation water have been compiled, most notably in the southeastern United States, however, excluding the state of Alabama. Historically, irrigation water has not been monitored as closely as drinking and recreational water unless there is an outbreak. The objective of this study was to identify the potential relationships between pathogenic and indicator bacteria and physiochemical properties such as pH, dissolved oxygen (DO) and temperature in both the surface and subsurface water at the Winfred Thomas Agricultural Research Station. The pond analyzed for this study could be used as irrigation water for the various crops and vegetation grown at the research station. When the irrigation water is monitored, indicator organisms such as Escherichia coli and total coliforms are measured via the most probable number (MPN) using the IDEXX Colilert System. High concentrations of these indicator bacteria potentially indicate significant fecal contamination and, therefore, facilitate an elevated probability that potential pathogens are present. The presence of pathogens E. coli 0157 and Salmonella enterica were then monitored for their prevalence in the water via quantitative PCR (qPCR).

Results revealed relatively low MPN for both total coliforms and E. coli, while temperature and pH remained constant and DO varied significantly.

Abstract # 121

Assessment of DNA Damage and DDR Gene Expression in the Gut: Implications of Chronic High Glucose Exposure

Raven Allen, and Ebony Weems

Mentor(s): Dr. Ebony Weems

Department of Biological and Environmental Sciences

The prevalence of metabolic diseases, including diabetes and obesity, poses a significant public health challenge. Previous studies demonstrate a strong association between the consumption of increased amounts of glucose and the development of these metabolic disorders. The influence of high glucose on molecular and genetic responses in the gut has been investigated in many studies. The modern Western lifestyle, characterized by increased access to highly processed foods and elevated sugar content in diets, has led to a surge in daily glucose intake. High glucose consumption is positively correlated with adverse metabolic responses in the cell. This study aims to investigate the effects of chronic exposure to high glucose levels on the expression of genes associated with glucose absorption and DNA damage response. Recently, the following genes: TXNIP, LCN15, ABCA1, IRX3, G6Pase, GLUT2. GLUT5, GLUT4, and DDR genes were shown to be expressed during high glucose exposure. We hypothesize that chronic exposure to high glucose levels leads to an upregulation of DNA damage response (DDR) genes in the gut. Caco-2 intestinal cells will be exposed to varying concentrations of glucose over an extended period of time. qRT-PCR will be used to measure the expression levels of DDR genes and the GLUT receptor genes 2 and 5. DNA damage will be assessed using a comet assay. Results from this study have the potential to provide valuable insights into the impact of the Western diet on DNA damage in the gastrointestinal tract.

Abstract # 122

Rhizosphere Microbiome Profiling of North Alabama Soils for Understanding the Reciprocal Relationships

Sowndarya Karapareddy, Sowndarya Karapareddy., Varsha C. Anche., Sowjanya R. Tamatamu. and Venkateswara R. Sripathi

Mentor(s): Dr. Venkateswara R. Sripathi

Department of Biological and Environmental Sciences

Plant roots and soil microorganisms interact in the rhizosphere. The rhizosphere microbes promote plant growth, development, and stress tolerance through various processes. Next-generation sequencing is one of the most widely used and cost-effective ways of determining the composition and diversity of microbiomes in numerous samples. In this study, we employed amplicon sequencing (16S ribosomal RNA (rRNA) gene for bacteria and Internal transcribed spacer (ITS2) region for fungi) to profile the soil microbiome in the rhizosphere of major crops

grown in North Alabama. This study included soil samples collected from 16 counties of North Alabama, including Limestone, Morgan, Cullman, Winston, Marion, Franklin, Colbert, Lauderdale, Lawrence, Madison, Jackson, Dekalb, Cherokee, Etowah, Blount, and Marshall. These locations were divided into four groups based on the level of Reniform Nematode (RN) Infestation: Group A-RN Not Detected (ND), Group B-RN Low Infestation (LI), Group C-RN Medium Infestation (MI) and Group D-RN High Infestation (HI). In total, 48 soil microbiome samples (16 counties x 3 replicates) were chosen for microbial DNA extraction (ZymoBIOMICS). Microbial diversity was assessed by sequencing (Illumina® NextSeq) paired-end libraries of amplified 16S rRNA genes and ITS2 genes from respective microbiomes and later analyzed with Qiime 2, Mothur, and Phyloseq. We used comparative analyses to determine alpha- and beta-diversity indices, microbial composition by bar plots, and taxonomic and absolute abundance estimation. The most abundant rhizospheric bacterial communities belonged to nine phyla: Actinobacteria, Proteobacteria, Acidobacteria, Thaumarchaeota, Chloroflexi, Firmicutes, Gemmatimonadetes, Fibrobacteres, and Unclassified. Moreover, four abundant fungal phyla belonging to Ascomycota, Basidiomycota, Mucoromycota, and Unclassified fungi were identified. Our findings will aid in understanding the complex and reciprocal interactions among microbes, crops, and nematodes in the rhizosphere.

COMMUNITY AND REGIONAL PLANNING

Undergraduate

Abstract # 123

Spatial Analysis of Trauma Center Deserts: Examining the Relationship between Trauma Center Locations (and their Service Areas) in Alabama and Disadvantaged Census Tracts Using GIS

Austin Djan

Mentor(s): Dr. Jordan Yin and Dr. Florina Dutt

Department of Community, and Regional Planning

The purpose of this study is to assess access to trauma centers in Alabama, with a specific focus on disadvantaged census tracts. In previous studies of access to trauma centers across the US, only five states had less access than Alabama. Ensuring equitable access to trauma centers is essential for improving public health and reducing disparities in healthcare outcomes. Through the application of Geographic Information Systems, the study examines the relationship between trauma center locations (and their service areas) and disadvantaged census tracts. A mixed-methods approach was employed. Quantitative analysis (linear regression) combines insights from interviews with public health professionals. Data sources included the Alabama Department of Public Health and the federal Climate and Economic Justice Screening Tool (CEJST). The spatial analysis results indicate that disadvantaged census tracts have limited

access to trauma centers. Optimal locations for trauma centers are identified, and the concluding propositions prioritize federal investments in improving access to trauma centers in underserved communities.

Graduate

Abstract # 124

Strategies to Help Provide Adequate and Affordable Housing

Nigeria Jones

Mentor(s): Dr. Deaden Rukmana

Department of Community and Regional Planning

With serious ramifications for both persons and communities, housing and homelessness are important concerns in modern civilization. The complexity of these difficulties is a result of the complex interactions of social policies, economic variables, and human circumstances. Affordability becomes a primary concern when it comes to housing. Rising housing costs and stagnant incomes exacerbate the divide, making it more difficult for many people and families to find permanent housing. This dilemma is not limited to large cities; it is also affecting suburban and rural communities, casting doubt on the idea that housing is a fundamental human right.

Simultaneously, the need to address housing inequities is made more pressing by homelessness. The homeless population is made up of many different types of people, such as families, veterans, and people who are struggling with mental health problems. Their situation is made worse by inadequate support systems, which feeds a vicious cycle that is difficult to stop. The terrain of housing and homelessness is significantly shaped by policy initiatives. A comprehensive plan must include social programs that address the underlying causes of homelessness in addition to adequate funding for affordable housing efforts. In addition, it is crucial to promote cooperation between public agencies, nonprofit groups, and the corporate sector in order to optimize the results of interventions.
These problems have many facets, thus creative solutions are needed. Employing technology can provide hopeful paths forward. Examples of this include employing data analytics to identify groups that are at-risk and utilizing smart design principles to create affordable homes. Furthermore, in order to decriminalize homelessness and foster widespread support for structural change, it is imperative to foster community knowledge and empathy.

Abstract # 125

Examining the relationship between income disparities, housing market dynamics, and homelessness in census tracts within Los Angeles City

Aneisha Ingram

Mentor(s): Dr. Jacob Oluwoye

Department of Community and Regional Planning

This study explores the intricate relationship between income, housing market conditions, and homelessness in Los Angeles City. It addresses the role of income in influencing the vulnerability of low-income individuals to homelessness and examines how housing market conditions impact homelessness rates. Based on 2020 census tract data, the research underwent rigorous cleaning and matching processes to ensure consistency across variables. In 2016, a weak negative correlation (-0.186) hinted at an association between increased income in the lowest quintile and decreased homelessness on average, though tract-level variations added complexity. In 2020, a weaker negative correlation (-0.129) highlighted the nuanced nature of the income-homelessness relationship, with instances where higher income did not correspond to lower homelessness. While income in the lowest quintile emerged as a significant predictor of homelessness in 2020, the model's overall explanatory power was limited. Non-significant p-values for the occupied units and vacant units variables underscored the multifaceted nature of homelessness. The 2016 regression revealed income in the lowest quintile as a statistically significant predictor of homelessness, with a negative coefficient. The 2020 regression showed income in the lowest quintile remaining a significant predictor with a negative coefficient, while occupancy and vacancy rates were again non-significant. The study emphasizes the need for a comprehensive approach, considering local policies, housing market conditions, and social services. Recommendations include future research using regression analysis with several predictor variables to capture better the multifaceted factors driving homelessness. Qualitative methodologies are suggested for a deeper understanding of the challenges faced by individuals at risk of homelessness.

FAMILY AND CONSUMER SCIENCES

Undergraduate

Abstract # 126

Students Eating Behaviors

Jasmine Carmichael

Mentor(s): Dr. Brandan Wheeler

Department of Family and Consumer Sciences

The purpose of this study is to explore the eating behavior of Alabama A&M University students, including their choices of healthy vs. unhealthy foods based on accessibility, affordability, and preference or too busy with schoolwork. Overall, students from the previous studies agree that it is difficult to have healthy eating habits as students because of being too busy with class and or/work, not able to afford it, there aren't enough options, or adjusting to a new lifestyle. The analysis shows that students often grab more convenient options that are affordable to them. Data will be collected from Alabama A&M University students using an online survey. This study is voluntary and anonymous, and students will agree to an informed

consent statement before responses are collected. There will be 20 questions included in the survey based on accessibility, affordability, and preference.
Data will be collected and analyzed in time to be presented on STEM Day.
It is important for students to have a healthy diet. A healthy diet improves energy, memory, and focus, it also helps your body stay attentive and productive.

Abstract # 127

Awareness of Intimate Partner Violence: A Cross-Sectional Study of HBCU Students in Alabama

Nia Freeman, and Brandan Wheeler

Mentor(s): Dr. Sadguna Anasuri,

Department of Family and Consumer Sciences

Individuals, aged 18-24, are the most at-risk age groups for experiencing intimate partner violence (IPV; citations available upon request). Previous researchers have suggested college students do not report abuse because they may not realize at the time they are being abused. Fifty-seven percent of IPV victims said it began in college, and fifty-seven percent reported difficulty identifying when IPV was happening around them. Some researchers also believe IPV is a silent problem plaguing Historically Black Colleges and Universities (HBCUs). Finding out current awareness of IPV amongst students can prompt the implementation of IPV education, prevention, and intervention efforts across HBCU campuses. For this reason, the purpose of the current study is to assess student's awareness of intimate partner violence on HBCU campuses, as students may not realize the circumstances until it is too late. An adapted version of the "Abuse Rating" scale will be used to assess students' awareness and knowledge of IPV at HBCUs. This cross-sectional survey will be administered to students attending HBCU's across the state of Alabama through digital media (social media, QR codes), and word-of-mouth. The survey will consist of around thirty questions that range from demographic information to rating how a given scenario relates to IPV. The goal is to collect at least 100 completed surveys for the spring 2024 semester. Data will be analyzed using SPSS. Results regarding students' awareness of IPV will be discussed and necessary recommendations will be suggested. These recommendations can guide university administrators in developing relevant education materials, as well as prevention and intervention practices to improve the safety of individuals.

Abstract # 128

Examining the Medical Mistrust Among Alabama A&M University Students and their Perception of the Health Care System

Alaylia Brown, Emrald Culbreath, and Alia Wlliams

Mentor(s): Dr. Rhona Miller-Cebert

Department of Family and Consumer Sciences

The ability to access healthcare and related resources is directly related to the trust, mistrust, or distrust individuals have in the systems that promote and maintain health and well-being.

Despite the scientific evidence that supports and encourages healthcare among young adults, African Americans may be less likely to seek early healthcare. This may result in higher incidences of chronic diseases and mortality in this minority group compared to its white counterpart. Evidence also suggests that mistrust of the healthcare system may be a key factor that influences the noticeable racial disparity observed in health-seeking behavior. The current study examines the medical mistrust among Alabama A&M University students and their perception of the healthcare system. We hypothesize that (1) the higher the mistrust, the more likely students will avoid medical treatment, and (2) parents' educational level will impact students' attitudes towards the healthcare system. For this study, a survey instrument will be developed using validated survey questions from peer-reviewed studies. Approximately five hundred (500) students from Alabama A&M University will be solicited to participate in the study. Following Institutional Review Board (IRB) approval, the survey with informed consent will be uploaded to a platform that protects the confidentiality of AAMU students. Students who acknowledge their participation in the study will be given full access to the survey. Data from the survey will be collected and pooled for statistical analysis.

Graduate

FOOD AND ANIMAL SCIENCES

Undergraduate

Abstract # 129

Investigating the ability of natural antimicrobials in combination with surfactants to control Salmonella in a broth system

Kaylyn Green, Kira Christian, Aaron Dudley, Lamin Kassama, and Armitra Jackson-Davis

Mentor(s): Dr. Armitra Jackson-Davis

Department of Food and Animal Sciences

Salmonella enterica is a pathogen that is a major food safety concern throughout the food industry. This pathogen has been implicated in many foodborne outbreaks and is commonly found in the intestinal tract of animals. Although many studies have evaluated the ability of various antimicrobials to control Salmonella, few studies have evaluated their use in combination with other surfactants. Therefore, the objective of this study was to evaluate the ability of select natural antimicrobials in combination with select surfactants to control Salmonella in a broth system. Four serotypes of Salmonella enterica were used in the study. A loopful of each serotype was inoculated into a 10 mL tube of Tryptic Soy Broth (TSB). After 24 h incubation at 35°C, the culture was streaked on Xylose Lysine Deoxycholate (XLD). Colonies characterized as Salmonella enterica were inoculated into 10 mL of TSB. Cultures underwent two successive 24 h transfers and then were centrifuged and suspended in saline. The Bio

Screen C Automated Microbiology Growth Curve Analysis System was used to evaluate various concentrations of select natural antimicrobials alone and in combination with select surfactants. Samples were run on the Bioscreen over a 24 hour period at 35°C at a wavelength of 600 nm. Data was expressed, in triplicate, as mean ± standard deviation (n=3). Statistical significance was evaluated by ANOVA, P≤0.05 was considered significant. After 24 h the average percentage of growth inhibition ranged from 23.38 ±5.4% to 77.15.± 26.32% (water and thyme oil). Ending optical densities ranged from 0.17±0.001 to 1.32 ±0.008 (Thyme oil 25% and Salmonella control). Results suggest that natural antimicrobial agents can be effectively used against foodborne bacteria. Future research will explore the use of similar essential oils in the food safety of juice beverages.

Abstract # 130

Effect of Time and Temperature on Flavor Perception of Lavender

Kamaia Hall-Edwards and Paige Martin, Montgomery II, N., Boyle, K., Herring, J., Verghese, M.

Mentor(s): Dr. Martha Verghese

Department of Food and Animal Sciences

Flavor perception dictates the acceptability of many products by consumers. Aroma and taste impact the overall flavor perception of individuals; however, the initial flavor concentration, bake time and temperature may impact the thresholds of whether the consumer can perceive a difference in products or identify unique flavor compounds in products. For many years, the aroma of lavender has been widely used and accepted for its therapeutic properties displaying its functional benefits. Lavender has been shown to have antimicrobial and antioxidant properties as well; therefore, it may be even more advantageous to add it as an ingredient and gain those already, lavender devoted consumers in the food sector. The objective of this study is to determine the taste detection threshold, variation to sensitivity, and identification threshold of lavender when the bake time and temperature are adjusted in two baked goods, lavender cupcakes and cookies. Recipes for both, cupcakes and cookies, were a basic angel food cake and plain sugar cookie. The physiochemical properties (pH, water activity, and color) of this product were taken to display changes over time that will coincide with sensorial properties. A descriptive sensory analysis, with untrained panelist, will be conducted to determine the consumer's preference for lavender at varying concentrations, texture, color, and overall acceptability. The sensory analysis will also determine the impact of heat exposure to the concentration of lavender at varying times of exposure.

Abstract # 131

Development of a Functional Food Product utilizing selected Spices (Garlic, Turmeric and Ginger)

Trinity Shipman, D. Nash, R. Kaur, N. Montgomery II, J. Herring, and M. Verghese,

Mentor(s): Dr. Martha Verghese

Department of Food and Animal Sciences

Research suggests spices can prevent chronic diseases such as type 2 diabetes and obesity. The objective of this study was to formulate a functional food (Spiceola bites) using selected spices along with the chemical analysis being conducted on the product. Total phenolic content (TPC), total flavonoid content (TFC), free radical scavenging activity by 1,1-diphenyl-2- picrylhydrazyl (DPPH), Trolox equivalent antioxidant capacity (TEAC), ferric reducing antioxidant power (FRAP) and inhibition of lipase and α-glucosidase activities were evaluated on the Spiceola Bites extracted with water (SBW) and ethanol (SBE). Spiceola bites were made using oats, almonds, honey, brown sugar, grapefruit juice, white chocolate, rice puffs, pea fiber, vanilla, turmeric, garlic, ginger, and coconut oil/flakes. Spiceola bites ethanol extracts (SBE) had significantly higher TPC compared to water extracts (SBW). SBE had a 60% higher total flavonoid content compared to the water extracts. Approximately, 46% higher DPPH inhibition was seen by SBE compared to SBW. Inhibition of α-glucosidase enzyme by Spiceola bite extracts was more than 40%. Whereas inhibition of Lipase was approximately 14% and 38% by SBW and SBE. Results suggest Spiceola bite extracts exhibited antioxidant potential and inhibition of metabolizing enzymes suggesting incorporation benefits of garlic, turmeric, and ginger into a functional food product (Spiceola Bite) may improve consumers' antioxidant status. Recently, spices have gained a lot of attention in the food industry due to their health benefits. Therefore, further investigations are needed to provide implications of spices based functional food products towards improving chronic diseases.

Abstract # 132

Determination of Rheological properties of formulations of meat analogs for 3D-printing

Imani Smith, Madala, V., Kassama, L. S.

Mentor(s): Dr. Lamin Kassama

Department of Food and Animal Sciences

Plant-based meat alternatives are made from soy protein isolate and texturized vegetable protein to simulate the texture and appearance of meat. 3D printing technology is a promising, fast, and emerging technology for improving product formulations, textures, and shapes. 3D printing prints the food products layer by layer. However, further advancements are needed to satisfy consumer demand for more intricate plant-based meat analogs. This study aims to improve the 3D printing process for meat alternatives by evaluating different ink formulations and their rheological characteristics, specifically looking at the correlation between shear stress, shear rate, and viscosity. The formulations of meat analogs are made through the ingredients of soy protein isolate, texturized soy protein, water, salt, vinegar, coconut oil, beet juice extract, monosodium glutamate, and sunflower lecithin. Three distinct formulas incorporated differing ratios of soy protein isolate and texturized vegetable protein, including 100% isolate, 50:50 %, and 100% texturized. Formulations were blended using a high-speed blender. Viscosity was measured using a Brookfield viscometer. The shear rate and viscosity correlation of printing ink were determined using a Brookfield-Rheometer. Statistical analysis was conducted with SPSS 27 software, and ANOVA was conducted at a 5% significance level. The apparent viscosity of the sample was determined over a range of shear rates extending from 30 to 240 s-1. The results indicate that the sample's viscosity displays a shear-thinning

behavior. No significant differences ($p > 0.05$) were observed between samples SPI: TVP are 100:0 and 50:50. The sample SPI: TVP = 0:100 showed a significant difference ($p < 0.05$) among all three samples. The 100% soy protein isolate sample showed a better shear-thinning than the remaining samples. The shear-thinning behavior is ideal for the quality printing of meat analogs using a 3D printer.

Abstract # 133

Evaluation of Pulsed UV Light Technology on the Inactivation of Escherichia Coli O157:H7 on the Chicken Breast Meat

Whitney Spencer, Manikanta Sri Sai Kunisetty, Aaron Dudley, Lamin Kassama, and Armitra Jackson-Davis

Mentor(s): Dr. Lamin Kassama

Department of Food and Animal Sciences

Escherichia coli serotype O157:H7 is a leading cause of foodborne illness worldwide. It is often transmitted through contaminated food or water sources and produces Shiga-like toxins I and II, leading to severe foodborne illnesses in humans. Pulsed UV light (PUL) treatment is an emerging non-thermal technology for food safety and is increasingly used for the sanitization of food and contact surfaces, demonstrating efficacy in the elimination of foodborne pathogens within food systems. This study aims to determine the efficacy of PUL treatment against E. coli O157:H7 in chicken breast meat. Boneless, skinless chicken breast meat was purchased from a local store in Huntsville, Alabama. Prior to treatment, the sample was divided into 12 filets, and each filet was inoculated with E. Coli O157:H7 (ATCC 43895) inoculum. The inoculated chicken samples were then treated with the PUL system using 3 kV and a PUL energy of 600 J/Pulse with three energy levels of 30 (T_1), 60 (T_2), and 120 (T_3) pulses. All the samples were analyzed in triplicates, and statistical analysis was conducted at a 5% significance level. The results showed that the T_3 samples had the most significant reduction, with a microbial count of 1.2 CFU/g. Similarly, T_2 and T_1 treated samples also showed notable reductions to 0.47 CFU/g and 0.53 CFU/g, respectively. All treatment groups demonstrated decreased microbial loads compared to the untreated control group, which had a higher count of 6.2 CFU/g. Specifically, the treated groups showed counts of 5.7 CFU/g for both T_1 and T_2 and 5.0 CFU/g for T_3. This study demonstrates the effectiveness of PUL treatment in inactivating E. coli O157:H7, indicating the potential use of pulsed UV light technology for enhancing food safety in the poultry industry.

Abstract # 134

Determination of Chemopreventive Potential of Dried Lavender Flower Extracts on Colon Cancer Cells

Alexis Watson, R. Kaur, H. Singh, N. Montgomery II, and M. Verghese

Mentor(s): Dr. Martha Verghese

Department of Food and Animal Sciences

Essential oil from Lavender has been studied for its health benefits, but the whole Lavender flower has not been researched widely. This study focuses on determining antioxidant potential of whole lavender flowers and its implication in preventing chronic diseases. Objective of study was to evaluate chemo preventive effects of Lavender ethanol and water extracts on Colon Cancer cells CaCO2 based on their effect on cell viability 3 4,5 dimethyl'thiazol 2yl 2,5diphenyltetrazolium bromide MTT, cytotoxicity Lactate Dehydrogenase LDH and Malondialdehyde Glutathione and selected antioxidant enzymes including Catalase, and Superoxide Dismutase. CaCo2 cells were grown in EMEM media with 20 percent fetal bovine serum. Cells were treated with Lavender extracts and incubated at 37 degrees Celsius for 24 hours. Selected concentrations of Lavender extracts were added 1.25, 2.5, and 5 µg per ml to colon cancer cells. Oxidative stress, cell viability, cell morphology, cytotoxicity, and antioxidant enzyme assays were conducted. Concentration of Thio-barbituric acid-reactive substances was lower in cells treated with Lavender Flower extracts compared to H2O2 treated cells. Results suggest that LF exhibited antioxidant potential. Future research will involve detailed investigation to delineate the mechanism of action of Lavender to develop it as therapeutic target. Data from this study will be used to determine the health benefits of Lavender sp. whole flowers with implications in developing functional food products. Lavender flowers may be utilized for their antioxidative and chemo-preventive effects by food and pharmaceutical industries.

Abstract # 135

Product Development, Antioxidant Potential, and Acceptability of a Functional Lavender Doughnut

Amirah El-Amin, T. Berkemeyer, R. Kaur; N. Montgomery II, H. Singh, K. Boyle, J. Herring, and M. Verghese

Mentor(s): Dr. Martha Verghese

Department of Food and Animal Sciences

Lavender can be considered a functional ingredient due to its antimicrobial, antioxidant, and therapeutic properties, and it is gaining attention from the food industry for its functional benefits. The objective of this study is to develop a healthier alternative to a classic snack, the doughnut, using lavender and gluten-free flour to determine its antioxidant potential and overall consumer acceptance. Total Phenolic and total Flavonoid contents and antioxidant activity were measured using 2,2-diphenyl-1-picrylhydrazyl radical solution (DPPH), and ferric reducing antioxidant power (FRAP) was determined according to standard protocols. The product was prepared using lavender and all-purpose and gluten-free flour. The doughnut was prepared using a lavender-infused batter that was baked for 10 minutes at 400° F. The final product's physiochemical characteristics that will be analyzed include color, texture, pH, and water activity. Results suggest that lavender flowers exhibited antioxidant potential (DPPH-50-60% and FRAP-60-80%). TPC and TFC were 8576mg Gallic Acid Equiv./100g and 158.42mg Catechin Equiv./100g). The L*, a*, and b* values will be compared to store-bought, which will be used as a control. Lavender has the potential to be used as a functional ingredient in baked goods and confectionery products for added health benefits. Alternative flours may also be

useful in developing gluten-free products with higher protein content. Sensory analysis will be conducted to determine the acceptability of the doughnut when compared to similar products.

Abstract # 136

Development of functional muffins incorporated with papaya powder

Kennedy Ward, Montgomery, N., Verghese M.

Mentor(s): Dr. Martha Verghese

Department of Food and Animal Sciences

Carica papaya L contains many polysaccharides, vitamins, minerals. Papaya fruits are good source of vitamin C, carotenoids. It is most commonly consumed as fresh fruit but has a short shelf life and therefore development of a functional food product would increase its consumption. The objective was to develop papaya muffins with 5%, 10%, 15% and 20% freeze dried papaya powder. Proximate analysis of muffins was determined according to AOAC Methods. Physical parameters and water activity of muffins were determined on day 0, 4, 8 and 12. Weight and height, Color (L*, a*, b* CIE color scale), texture values of top of muffins were measured using a colorimeter and texture analyzer. Sensory analysis (n=45) of muffin samples was carried out for attributes such as texture, flavor, color, sweetness and overall acceptability of muffin samples were measured using a 5-point hedonic scale. Muffin's color remained consistent over 12 days. Overall height, volume, texture, and water activity remained consistent from day 4 to day 12. Overall, individuals preferred muffin with 20% PP. However, 10% PP had a more acceptable texture and color. Functional papaya muffin remained consistent over 12-day period in color, texture and size. Fresh papaya fruits are highly perishable resulting in loss of vital nutrients and revenues from sales. Post-harvest losses can be reduced to some extent by processing papaya into food products thus making it available year-round.

Abstract # 137

Characterization of Hemp Loaded-PVA (Polyvinyl alcohol) Nanofibers

Emille White, Dudley, A., Jackson-Davis, A., Kuang, X., and Cebert, E.

Mentor(s): Dr. Lamin Kassama

Department of Food and Animal Sciences

The potential of Cannabis sativa, specifically focusing on the extraction and encapsulation of its bioactive compounds and emphasizing the electrospinning technique, can contribute to improving the food packing industry. The study meticulously examines incorporating hemp extract into electrospun nanofibers, using polyvinyl alcohol (PVA) as a carrier material. Hemp inflorescences cultivated at the Alabama A&M University's Winfred Thomas Agricultural Research Station in Huntsville, Alabama, were processed by maceration for 24 hours at 25°C. The resulting ground hemp material underwent centrifugation and filtration and was stored at 4°C until utilized for analysis. Subsequently, polyvinyl alcohol solutions incorporating varying concentrations of hemp extract were subjected to electrospinning. The physicochemical

attributes of the electrospun nanofibers were assessed through SEM and FTIR. In contrast, the viscoelastic properties of the electrospinning solutions and characteristics of the nanofibers, including electrical conductivity, were also examined. Nanofibers electrospun using PVA exhibited consistent morphology with bead-free and smooth fibers. The diameter of these fibers varied, having an average diameter of 586.86±63.31nm. The electrical conductivity values of the various concentrations (13%, 17%, and 19%) spanned from 472±10.67µs/cm to 714.76±27.41µs/cm (PVA neat). The findings contribute valuable insights, address a literature gap, suggest Northern Alabama hemp varieties as effective bioactive agents for future food safety studies, and potentiate their use in nanofiber-loaded materials for food packaging applications.

Abstract # 138

Development of a Savory Functional Food Snack Product Utilizing Alternative Flours: Chickpea Flour

Taylor-Nicole Tate, T. Tate*, K. Boyle, T. Curtis, T. Berkemeyer, K. Smith, R. Kaur, N. Montgomery II, and M. Verghese

Mentor(s): Dr. Martha Verghese

Department of Food and Animal Sciences

The food industry is constantly looking for innovative products to fill many gaps within the consumer market. The idea behind this project was to take the snack food industry by storm, changing the trajectory of one of the most loved snack food products, doughnut holes, by adding a savory aspect with reduced calories and higher protein. This study aims to develop an innovative savory doughnut hole product with alternative flour to meet consumers' needs and fill the market gaps in the snack industry. Filling-O's (savory doughnut holes) were made with commonly available ingredients that provide the perfect crunch on the outside and a gooey cheese center, resulting in a desirable texture and burst of flavors that will keep consumers coming back for more. Sensory tests were performed to evaluate consumer preferences in the real-world market with 31 participants. Filling-O's attributes assessed were color, texture, and flavor. 87% of the participants liked the overall texture of the product, 64% accepted the overall color, and 84% liked the product's flavor.The overall product acceptability was ranked 5 by 84% of the participants. Filling-O's is a fully cooked product that will be sold frozen in resealable freezer bags utilizing Polyethylene (PE) film, with 12 doughnut holes provided in each bag, totaling 6 servings per bag (2 doughnut holes per serving size). It has been concluded that Fantasy Fillings, Inc. has a tremendous and
desirable protocept that is ready to be launched onto the market to be enjoyed by all walks of life.

Abstract # 139

Evaluation of the Bioactive Properties of Two Macerated Northern Alabama-Grown Hemp Varieties

Tiffany Swinton, Dudley,A., Cerbert, E., Jackson-Davis, A., and Kuang, X.

Mentor(s): Dr. Lamin Kassama

Department of Food and Animal Sciences

Plants are an excellent source of bioactive components. For centuries, throughout the world, they have been for antioxidant properties to benefit human health with their chemopreventive and anti-inflammatory properties. One such plant that has well-noted bioactivity is Cannabis sativa due to the presence of various phytochemical components such as flavonoids, phenolic acids, and cannabinoids. These bioactive properties are used in applications for food quality. The extraction of phytochemicals is an important step in unlocking bioactivity and it can be manipulated through the control of extraction solvents. The purpose of this research is to evaluate the physicochemical properties of two varieties (Queen Dream (QD) and Rogue (R)) of hemp extracts with specific objectives to assess the antioxidant activity and physicochemical properties of the two varieties macerated in different solvents (ethanol, distilled water, and ethanol/water mixtures). This study used the methodology determining these phytochemical and physicochemical characteristics that included 2, 2-Diphenyl-2-Picrylhydrazyl (DPPH) free radical scavenging activity and extraction yield. Data was expressed, in triplicate, as mean ± standard error (n=3). Statistical significance was evaluated by ANOVA, $P \leq 0.05$ was considered significant. RSA data from the extraction yield from lowest to highest 5 to 40% (R 20:80 and QD 100:0) indicated there were some significant differences in the treatments. Compared to the extraction yield ranged from 19.4 to 25.4% there were no significant differences between treatments ($p \geq 0.05$). Based on our results, the Northern Alabama varieties of hemp may be investigated more for food quality improvement due to demonstrated antioxidant activity for future studies.

Abstract # 140

Evaluation of antimicrobial efficiency of Pulsed UV light treatment against Salmonella Typhimurium in Alfalfa sprouts

Nyeima King, Manikanta Sri Sai Kunisetty, Aaron Dudley, Lamin Kassama, Armitra Jackson-Davis

Mentor(s): Dr. Lamin Kassama

Department of Food and Animal Sciences

The Consumer demand for plant sprouts has increased. However, the short shelf-life and the risk of foodborne diseases are inherent to ready-to-eat (RTE) sprouted foods. Alfalfa sprouts are primarily consumed as RTE products and are frequently involved in foodborne disease outbreaks worldwide. Eating raw or undercooked sprouts may lead to food poisoning, this is because the warm, humid conditions needed to grow sprouts are also ideal for microbes to multiply. Non-thermal processing technologies are seen as promising options to enhance food safety while maintaining quality properties to reduce the risk of foodborne illness. Pulsed UV light (PUV) treatment is a non-thermal approach to inactivate foodborne pathogens. It damages microbial DNA and RNA and can inhibit their reproduction ability, which leads to cell death. This treatment effectively reduces microbial load, making it ideal for use as a disinfectant and sterilization in food systems. This study aimed to determine the antibacterial effect of PUV treatment against S. Typhimurium on alfalfa sprouts. Fresh alfalfa sprouts will be purchased

from a local store in Huntsville, Alabama. The sprouts will be washed in an 8% (w/v) sodium bicarbonate solution for 5 min. Then, they will be washed twice in sterile distilled water for 1 min, gently swirled, and dried in a bio-safety cabinet for 30 min. The dried sprouts will then be dip-inoculated in S. Typhimurium inoculum for 15 min and dried in a bio-safety cabinet for 1 hour. The inoculated alfalfa sprouts will be treated with a PUV system using an energy level of 400 J/Pulse and three energy levels of 40, 80, and 160 Pulses. All the samples will be analyzed in triplicates, and statistical analysis will be conducted at a 5% significance level. The PUL treatment is expected to inhibit S. Typhimurium and improve the microbiological safety of alfalfa sprouts.

Abstract # 141

Molecular cloning, expression, and characterization of 5GT, a flavonoid glycosyltransferase gene from Vitis rotundifolia

Oluwatimileyi Ogundele

Mentor(s): Dr. Anthony Ananga, and Dr. Martha Verghese

Department of Food and Animal Sciences

Glycosylation of flavonoids affects solubility, stability, and bioavailability and is mediated by the glycosyltransferase (GT) family. The majority of the structural genes involved in flavonoid biosynthesis have been isolated in grapes, but an important gene encoding UDP-glucose: anthocyanin 5-O-glucosyltransferase (5GT) remained to be identified in muscadine grapes. 5GT is responsible for modifying anthocyanins to more stable molecules in complexes for co-pigmentation, thus resulting in a purple hue. Based on protein sequence data and RT-PCR, a full-length cDNA encoding 5-GT was obtained from a cDNA library. The 5-GT cDNA displayed homology to previously published glucosyltransferase sequences. The open reading frame encodes a polypeptide of 464 amino acids with a calculated molecular mass of 51.4 kDa. A phylogenetic tree based on amino acid sequences of the family of glycosyltransferases from various plants shows that Vr5GT is closer to the Vitis vinefera 5-GT. The mRNA expression of both 5GT increased in the veriason stages of berry development, reaching the maximum at the physiologically mature stage. To our knowledge, this is the first time the 5GT gene is cloned in V. rotundifolia. This study will help to improve metabolic engineering in muscadine grapes.

Abstract # 142

Characterization of Antioxidant Activity and Phenolic Compound Profile of Extracts from Seeds and Skins of Muscadine Grape (Vitis rotundifolia) Pomace

Lauren Moyer

Mentor(s): Dr. Martha Verghese, and Dr. Anthony Ananga

Department of Food and Animal Sciences

Phenolic compounds, including flavonoids and phenolic acids, are plant's secondary metabolites. Due to their ability to act as antioxidant agents, there is a growing interest in using those components in food products and traditional medicine for cancer prevention or

treatment. Seeds and skins of Vitis vinifera (European grape) have a high content of bioactive compounds and are valuable by-products from grape pomace. However, little is known about the bioactivity of seeds and skins from Vitis rotundifolia (American grape, also called muscadine). Muscadine grapes are renowned for their health-enhancing properties, attributed to their abundant polyphenolic content. This study aimed to measure the amounts of total phenolics and flavonoids and compare the phenolic composition and the antioxidant activity of extracts from seeds and skins of two muscadine varieties, Carlos and Noble. Antioxidant activities were assessed as ferric-reducing antioxidant power (FRAP), 2,2-diphenyl-1-picrylhydrazyl radical (DPPH•) scavenging activity, and oxygen radical absorbance capacity (ORAC). The seed extracts had higher contents of most individual phenolics compared to the skin extracts. They also showed a higher total phenolic content, DPPH• scavenging activity, ORAC, and overall antioxidant capacity. Total phenolic content significantly correlated with antioxidants. The principal component analysis (PCA) showed discrimination between extracts from seeds and skins and clustered aqueous solvent extracts and ethanol extracts with respect to variables. This research demonstrates that seeds from Noble and Carlos cultivars are sources of molecules with antioxidant activities that can be used in different sectors, such as in the food, cosmetic, and pharmaceutical industries.

Graduate

Abstract # 143

Effect of natural and probiotic fermentation on the biopolymer techno-functionalities in lemon yellow sorghum (sorghum bicolor L.)

Ama Adadzewa Eshun, Eshun, A.A.A., Tasie, O., and Boateng, J.

Mentor(s): Dr. Judith Boateng

Department of Food and Animal Sciences

Sorghum-based food products undergo processing to retain their beneficial properties while becoming appealing edible foods. However, their appreciation in Western societies are limited due to the scarcity of such foods compared to commonly consumed wheat or corn derived products. Lemon yellow sorghum (LYS) offers potential as a sustainable, health-enhancing ingredient, rich in dietary bioactive compounds. This study assessed the impact of natural fermentation (NF) using the grain's indigenous bacteria or fermentation with probiotic Lactobacillus paracasei (LP) on LYS flour's proteins, starch, and techno-functional properties. These properties included water absorption capacity, oil absorption capacity, emulsification capacity and stability, foaming capacity and stability, and bulk density for durations of 24, 48, 72, or 96 hours. SDS-PAGE analysis indicated that at 72-hour incubation period it was optimal for protein hydrolysis. Both NF and LP fermentation resulted in reduced pH levels and improved sorghum color. Micro-structural analysis through scanning electron microscopy (SEM) and x-ray diffraction (XRD) revealed that fermentation did not significantly impact the starch granule structure. However, both NF and LP fermentation led to improved techno-functional properties

in LYS flours. These findings provide valuable insights for enhancing the properties of functional formulations derived from sorghum and diversify the use of sorghum grains in food systems.

Abstract # 144

PHYTOCHEMICAL COMPOSITION OF PHASEOLUS VULGARIS L.

Mariam Yakubu, Cebert, E., Kuang, X., and Boateng, J.

Mentor(s): Dr. Judith Boateng

Department of Food and Animal Sciences

Phaseolus vulgaris L. (common bean) is of great economic importance to the economy of the United States. Black and pinto beans are the most cultivated and consumed. Beans are rich in polyphenols which boost their functional properties and are also renowned for antinutrients. Antinutrients inhibit nutrient availability and cause bloating and abdominal discomfort when consumed, deterring the use of beans in food formulations. Black and pinto beans contained significant quantities of polyphenols and flavonoids. The polyphenol content of black beans was higher than total flavonoid content, while pinto beans contained higher flavonoid content than black beans. Liquid Chromatography-Mass Spectra analysis indicated high quantities of quaercetin-3-galactoside and vanillic acid in black beans while pinto beans contained more of catechins, kaempferol and procyanidin B2. Both beans contained high amounts of ferulic acid and significant amounts of p-coumaric and cinnamic acids. Black beans however, showed significant levels of highly potent flavonoids - resveratrol, genistein, and daidzein. Black beans also showed 1.3-fold higher content of tannic acid compared to pinto beans. Both beans, however, contained similar quantities of phytic acid. Raffinose family oligosaccharides was 7.9% higher in black beans than pinto beans. Results from this work will aid food research and plant-based sustainable food product development and ultimately contribute to emphasizing dry beans as a functional food.
KEYWORDS: Beans, Polyphenols, Flavonoids, Raffinose family oligosaccharides, Antinutrients

Abstract # 145

Development of a Functional Food Snack Product Utilizing Underexplored and Underutilized Ingredients: Spirulina Microalgae and Bilberry

Katelyn Boyle, R. Kaur, N. Montgomery, M. Verghese

Mentor(s): Dr. Martha Verghese

Department of Food and Animal Sciences

Spirulina is a protein-rich cyanobacterium. Bilberry is a dark berry known for its medicinal purposes. The overall aim was to use two underutilized ingredients in the food industry to develop an adolescent-friendly functional snack food product in light of food industry trends.

Stages of product development, shelf life/physiochemical analysis (texture, pH, color, and water activity), and sensory evaluation were utilized in developing a functional snack muffin. Aqueous (AQ) and 80% ethanol (ET) extracts of muffin formulations (control, 1% Spirulina (S) + 4%

Bilberry (B), 2% Spirulina + 8% Bilberry) were prepared using a standard protocol. Antioxidant potential was determined using 2,2-diphenyl-1-picrylhydrazyl (DPPH) and Ferric Reducing Antioxidant Potential (FRAP) assays, and inhibition of metabolizing enzymes (α-Amylase, α-Glucosidase, and Lipase) were determined using standard protocols.

Utilizing a 5-point hedonic scale (1 - Dislike very much, 2 - Dislike a little, 3 – Neither like nor dislike, 4 – Like a little, 5 – Like very much), three muffin formulations (chocolate, 1%S + 4%B, 2%S +8%B), were tested among consumer panelists, with 1%S+4%B being the most acceptable based on taste, texture, color, aroma, appearance, etc. The texture (post-peak (N)) of the muffin did not vary between control and 1S%+4%B formulations; however, 2%S+8%B was 1.09 times higher compared to its counterparts. pH, color, and water activity remained constant over the 9-day shelf-life. DPPH % inhibition by the muffin extracts ranged from 2.47% - 33% with the highest inhibition from 2%S+8%B extract. Similarly, the highest FRAP (mM F.E. (II)/100g DW) was seen in the 2%S+8%B (117.63) compared to control (49.00) and 1%S+4%B (83.47).

Spirulina and Bilberry are underexplored and underutilized in the food industry. Therefore, the significance of this research is to further use Spirulina and Bilberry in functional food product development targeted to adolescents due to their health-promoting properties.

Abstract # 146

Determining the antioxidant potential of selected spices (Ginger, and turmeric) and their impact on carbohydrate and lipid metabolizing enzymes

Tejasri Thatipamula, D. Nash, V. Ward, R. Kaur, N. Montgomery, and M. Verghese

Mentor(s): Dr. Martha Verghese

Department of Food and Animal Sciences

Spices have demonstrated their potential to decrease chronic diseases which may be linked to flavonoids, a bioactive compound. Inhibition of carbohydrate and lipid metabolizing enzymes by the bioactive compounds in spices may outline one of the mechanisms related to their anti-diabetic and anti-obesity properties.

Spices have been used for centuries due to their known health benefits and antimicrobial activities. Compounds found in spices provide additional health benefits, beyond their nutritional value. Health benefits attributed to spices stem from medicinal properties including hypocholesterolemia, anti-atherogenic, and anti-obesity/thermogenic influence. Objectives were to determine selected health benefits of spices: ginger, and turmeric (individual and in combination).

Total phenolic content (TPC), total flavonoid content (TFC), free radical scavenging activity by 1,1-diphenyl-2picrylhydrazyll (DPPH), Trolox equivalent antioxidant capacity (TEAC), ferric reducing antioxidant power (FRAP) and inhibition of α-glucosidase, α-amylase, and lipase enzymes by ginger and turmeric extracts were evaluated using standard protocols.

Ethanolic ginger extract yielded over a four (4)-fold higher TFC compared to turmeric and extracts. Among aqueous extracts, the extractability of flavonoid compounds was observed to be higher in ginger extracts followed by turmeric extracts. The highest inhibition of DPPH radical was seen by ethanolic extracts of ginger (87.09%), followed by turmeric ethanol extracts (65.09%). There was no significant difference in the inhibition of DPPH radical by aqueous extracts of ginger and turmeric. Spices (Ginger, and Turmeric) did not show any α-Amylase Inhibition. Ethanol extracts of spices (Ginger, and Turmeric) showed α-Glucosidase Inhibition which ranged from 40- 70% inhibition.

Results suggest that spices have great potential in decreasing chronic diseases due to their bioactive compounds. Future recommendations involve delving into the effect of non-thermally and thermally treated spices on chronic diseases utilizing an animal model and determining their synergistic effects (in combination) for implications in functional food product development.

Abstract # 147

Development of a Vegan Cheesecake Bite Product Utilizing Tropical Ugly Fruits: Pineapple, Kiwi, and Mango: Focus on Sustainability

Khalid Smith, Montgomery, N

Mentor(s): Dr. Martha Verghese

Department of Food and Animal Sciences

Processing leads to many fruit by-products often being discarded as waste. Interest and demand for more sustainable options resulting from an upsurge in food waste has indirectly increased programs involving food upcycling. As perfectly fresh and edible fruits age over time, they become visually undesirable, becoming ‘Ugly Fruits’. The urgent need to make use of these ‘Ugly Fruits’ is a means to respond to the costly and unnecessary waste created by bruised and discolored fruit (ugly fruit) being thrown out. ‘Ugly Fruits’ may be used to develop value-added fruit products to enhance sustainability, decreasing food wastage. Whole fruits, including by-products or waste, yielding a higher nutritional value in combination is the reasoning behind its selection as a snack product to develop. Development of vegan cheesecake bites utilizing pineapple, kiwi, and mango (powdered and pureed) was used to create the crust and filling, along with coconut oil for the crust and cashews, coconut milk, maple syrup, and natural flavors for the filling. Shelf-life/physiochemical analysis (color, texture, pH, and water activity) and proximate analysis were determined using standard protocols. Changes observed from a 15-day shelf life for each fruit-based cheesecake bite product remained around the same L*a*b*, pH, and aW values; however, the load for texture over time has softened on bite force. Trends of utilizing by-products are increasingly on the rise as sustainability becomes the approach of many industries, specifically fruit, due to inedible portions having more of a concentrated version of bioactive compounds (Lau et al., 2021). Therefore, the significance of this research is to show the applicable use of fruit by-products in the food industry to aid in alleviating food waste. Overall, vegan cheesecake bites were developed with a texture mimicking current

market cheesecake or cheesecake bite products. Further analysis will be conducted to determine its antioxidant potential.

Abstract # 148

Effect of processing on selected antioxidant activities and metabolizing enzyme inhibition by Murraya Koneigii (Curry Leaves) extracts.

Karthik Medabalimi, R. Kaur, N. Montgomery, and M. Verghese

Mentor(s): Dr. Martha Verghese

Department of Food and Animal Sciences

Curry leaves (Murraya koenigii) are used in culinary preparations due to their robust aroma and flavor. They are also recognized for their potential health benefits, including anti-oxidative, anti-inflammatory, and antidiabetic properties. The objective is to determine the effects of processing on curry leaves by evaluating phytochemicals [Total phenolic content (TPC) and Total flavonoid content (TFC)], antioxidant [2,2'-diphenyl picryl hydrazyl (DPPH), Nitric oxide radical scavenging (NORS), Ferric reducing antioxidant potential (FRAP), and Trolox equivalent antioxidant capacity (TEAC)] and inhibitory effects on selected metabolizing enzymes (α-amylase, α-glucosidase, and lipase).

Fresh curry leaves (CL) were subjected to three different processing treatments: Freeze-dried (F), oven-dried (OD) at 60°C, and air-dried (AD) at 25°C for 2 weeks. The curry leaf extracts were prepared using ethanol (EtE) and water (AQE) solvents. The phytochemicals, antioxidant properties, and inhibitory effects on selected metabolizing enzymes were evaluated using the standard protocols.

Among the treatments (Aqueous solvent) TPC was highest for Oven-Dried at 60°C (322.66mg GAE/100g), followed by Fresh curry leaves extracts (113.95mg GAE/100g) and Air-Dried treatment (79.09mg GAE/100g). For Ethanol curry leaves extracts TPC was highest in Air-Dried (5132.65mg GAE/100g), followed by Fresh (3605.91 mg GAE/100g) and Oven-Dried (3288.13 mg GAE/100g). Curry leaves showed more than 40% α-glucosidase enzyme inhibition by both ethanol (range-43% to 65% and aqueous (range- 41% to 80%) extracts. Oven-dried aqueous curry leaf extracts (82.22%) showed higher inhibition of α-Amylase enzyme followed by Air-Dried (77.93%) and Freeze-Dried (25.28%) aqueous samples. For ethanol extracts, all the treatment methods exhibited more than 70% inhibition of α-Amylase enzyme. Inhibition of lipase enzyme by the curry leaf extracts ranged from 13.75% to 80%.

Data from this research will provide a comprehensive evaluation of processing effects on curry leaves, and offer a multidimensional perspective encompassing health, culinary, and industrial applications.

Abstract # 149

Health Benefits of Dates; antioxidative & selected enzyme modulation

Harpreet Singh, Singh, H., Kaur, R., Montgomery, N., and Verghese, M.

Mentor(s): Dr. Martha Verghese

Department of Food and Animal Sciences

Dates have been used for centuries to treat illnesses and lower oxidative stress. They are rich in dietary fiber, vitamins, and minerals and have antioxidant properties due to their ability to scavenge free radicals. The study aims to assess the in vitro antioxidant potential and inhibitory effects of date fruit on the activity of selected metabolizing enzymes.

Freeze-dried and oven-dried dates were extracted using two solvents, 80% ethanol (Et) & water (Aq). These extracts were analyzed for total phenolics, flavonoids, antioxidant potential [2,2'-diphenyl picryl hydrazyl (DPPH), Nitric oxide radical scavenging (NORS), Ferric reducing antioxidant potential (FRAP), and Trolox equivalent antioxidant capacity (TEAC)] and inhibitory effects on selected metabolizing (α-glucosidase, α-amylase, and lipase) enzymes using standard protocols.

Moisture content removal after freeze-drying was 8% & oven drying removed 15% moisture. For both Freeze-dried and Oven-Dried date fruits, Aqueous extracts (FDA & ODA) of Medjool dates showed the highest TFC (611.85 and 783.1 mg GAE/100g DW) compared to Oven-dried and Freeze-dried Ethanol extracts (ODE & FDE). Similarly, TFC was significantly higher in aqueous extracts (FDA- 193.11 & ODA- 184.02 mg CE/100g DW) than ethanol extracts (FDE-126.22 & ODE- 170.81 mg CE/100g DW). DPPH inhibition ranged from 25% to 68% for all samples. NORS values were 59.93% higher by ODE and 18.17% by ODA extracts compared to freeze-dried samples. Date fruit extracts showed 50% inhibition of α-glucosidase (26.84 – 114.75 µg/mL), α-amylase (4.61 – 22.53 µg/mL), and pancreatic lipase (45.47 – 80.24 µg/mL) at different concentration ranges.

The inhibitory effects of Dates on selected enzymes make it suitable for monotherapy or in combination with other therapies to prevent or manage chronic disorders. Future studies include using cell models to delve into the neuroprotective effects of Dates.

Abstract # 150

Evaluation of Rheological Properties of the 3D-Printable Ink Formulation of Plant-based Meat Analogs

Vinay Madala, Kassama, L. S.

Mentor(s): Dr. Lamin Kassama

Department of Food and Animal Sciences

Plant-based meat analogs are typically made from soy protein isolate (SPI) and texturized vegetable protein (TVP). Meat analog refers to a meat-like compound or substance derived from plant sources. The Additive Manufacturing (AM) process is a fabrication technology called 3D printing that has sparked interest across various industries. Additive Manufacturing is a manufacturing procedure that creates intricate solid (or semi-solid) forms layer by layer. The rheological properties, like the viscoelastic properties of the pre-printing meat analog formulation, are critical information needed to design the 3D printing of meat analogs. This study aims to determine the rheological properties of the 3D-printable ink formulation of plant-

based meat analogs. The ingredients used for the meat analogs are soy protein isolate, texturized soy protein, water, salt, vinegar, coconut oil, beet juice extract, monosodium glutamate, and sunflower lecithin. Three formulations were made in this research. The percentages of soy protein isolate and texturized soy protein vary in each formulation: Soy Protein Isolate: Texturized Soy Protein (100:0, 50:50, 0:100). The formulation was blended using a blender. A Brookfield viscometer was used to measure the viscosity of the formulation. The printing ink's viscosity and shear rate relation were determined using a rheometer. Data analyses were conducted with SPSS 27 Software, and the analysis of variance (ANOVA) was based on a statistical significance of 5%. The apparent viscosity was observed at the shear rate ranging from 40 to 230 s-1. Hence, the viscosity showed a shear-thinning behavior. The three concentrations of SPI: TVP (100:0, 50:50, 0:100) did not significantly influence ($P > 0.05$) the viscosity of the formulated ink to 3D-print the plant-based meat analogs. The shear-thinning behavior is ideal for forming continuous filaments and smooth extrusion. The additive formulation is crucial for high-quality 3D-printed meat analogs. A strong shear-thinning behavior is necessary for uninterrupted filament formation.

Abstract # 151

Effect of hemp (Cannabis sativa) on stress biomarkers in weaned beef calves

Monya Simpson, Abdelrahim. G, Ogunkunle, N., Jones, K., and Kuang, X.

Mentor(s): Dr. Gamal Eden Abdelrahim

Department of Food and Animal Sciences

Hemp research is growing rapidly due to its health benefits in animals, however, there is no information on its effects on weaning stress. The objective of this study was to determine the effects of hemp supplementation on stress biomarkers in weaned beef calves. Twelve calves were completely randomized into Control (CC: received commercial concentrates before and after weaning), Treatment 1 (CH: received commercial concentrates before weaning and hemp diet after weaning), Treatment 2 (HC: received hemp diet before weaning and commercial concentrates after weaning) and Treatment 3 (HH: received hemp diet before and after weaning). The study lasted for 28 days; blood samples were collected for immunoassay every 7 days from the start of the research. Plasma was analyzed for Heat shock protein 70, Cortisol, and haptoglobin and total antioxidant capacity. There was a significant ($p<0.05$) difference in Cortisol levels with hemp-treated groups showing the least concentration of cortisol. Also, Hemp group showed a significantly higher total antioxidant. We concluded that hemp supplementation could reduce weaning stress in beef cattle thereby improving productivity and performance of beef calves.

Abstract # 152

Regulation of gene expression involved in flavonoid and anthocyanin biosynthesis during flowering and blooming stages of muscadine grapes (Vitis rotundifolia)

Manideep Busarapu

Mentor(s): Dr. Anthony Ananga, Dr. Martha Verghese

Department of Food and Animal Sciences

The production of anthocyanins in flowers and fruit tissues is highly controlled at the developmental level. We have studied the expression of flavonoid biosynthesis genes during the flowering and blooming stages of muscadine grapes in relation to the accumulation of anthocyanins as they possess various biological functions, such as defense against pathogens, scavenging free radicals, etc. The cDNA fragments of seven genes from the flavonoid pathway, chalcone synthase (CHS), flavanone 3-hydroxylase (F3'H), dihydroflavonol 4-reductase (DFR), Leucoanthocyanidin dioxygenase (LDOX), v-myb myeloblastosis viral oncogene homolog (v-MyB), flavonoid 3-O-glucosyltransferase (F3'GT), 5Oglucosyltransferase (5GT), and anthocyanidin synthase (ANS), were isolated during flowering and blooming stages. The primers designed were used to determine the expression of the flavonoid pathway genes. We successfully isolated and characterized seven structural genes from muscadine grapes and analyzed their expression profiles during flower formation and berry development. The outcome of our study shows that nearly all genes evaluated exhibited an expression in the flowers or blooms of all cultivars. However, the genes for 5GT, ANS, and F3H, were upregulated in all varieties analyzed. This data was directly correlated with the production of anthocyanins in Fry, Carlos, Ison, and Noble varieties. We have investigated the genes involved in flavonols and anthocyanins synthesis in different cultivars of muscadine grapes to elucidate gene regulation before the accumulation of anthocyanins in the berry. Overall, our findings set the groundwork for improving grape quality in addition to offering novel views on quality control during grape development and ripening.

ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Undergraduate

Abstract # 153

CS 386 Project

Jackson Cooper, Cameron Mahand, Arissa Nolley, Dewayne Maye, and Rashad Harris

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

STEM Day is an event in which the subjects of science, technology, engineering, and mathematics are celebrated annually to highlight their importance. STEM Day aims for students pursuing the fields above to apply what they have learned and create a presentation of their academic research. In CS 386 - Cryptography, students will form a group and create a project requiring the group to design and implement their enciphering algorithm. The team's algorithm must combine the two operations, substitution, and transposition, into your unique encryption algorithm. Substitution is an encryption algorithm in which each element in the plaintext (bit, letter, group of bits, or letters) is mapped into another element, and transposition is how

elements in the plaintext are rearranged. The team will then need to give the algorithm a unique name to the encryption technique. The group can choose any programming language to implement this program. Once the program is complete, the group will present their project on STEM Day, March 28th, 2024. In conclusion, this project will give students a better understanding of encryption. In turn, it provides an insight into what cybersecurity entails, thus making it a great topic to cover on STEM Day.

Abstract # 154

Harvest Link

Nikara Taylor, Kiara Stiles , and Nikara Taylor

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

Our Stem Day project will focus on zero hunger. Our vision for achieving zero hunger is to eliminate hunger on an international scale. Our app serves as a beacon of hope in the battle against hunger, bringing together communities and individuals in a collective effort to address food insecurity. Through innovative features such as food donation platforms, meal-sharing functionalities, and volunteer opportunities, we empower users to make a tangible difference in the lives of those in need. By providing educational resources, fostering collaboration with local food banks, and organization fundraising campaigns, we enhance efforts to combat hunger and promote food equity. With each shared meal, donation made, and volunteer hour contributed, we take significant steps towards a future where no one goes to bed hungry. Together, we are creating a world where access to nutritious food is a fundamental right, not a privilege.

Abstract # 155

Building a Digital Twin Dashboard in AWS

Monique Woodson, Maenza, A., Chowdhury, S., and Zhao, X.

Mentor(s): Dr. Showkat Chowdhury

Department of Computer Science

Environment Control and Life Support Systems (ECLSS) are vital for sustaining long-term human spaceflight, with a key focus being the removal of carbon dioxide from the air, accomplished through carbon dioxide scrubbers. The Four Bed CO2 Scrubber (FBCO2), developed at NASA's Marshall Spaceflight Center (MSFC) and deployed to the International Space Station in 2021, employs a series of sorbent beds to ensure breathable air by effectively removing carbon dioxide. This year, MSFC has launched a project to develop a cloud-based digital twin of the FBCO2 system, a significant advancement facilitating real-time monitoring, predictive analysis, and optimization.

As part of this project, I designed and implemented a comprehensive Grafana dashboard using AWS Twinmaker, integrating crucial data from the digital twin of the FBCO2 system. This involved establishing seamless connections to retrieve and visualize cloud-stored data using DynamoDB, enhancing understanding through immersive visualization experiences. This initiative aims to bridge the gap between real-world observations and virtual simulations, facilitating insights into system behavior and optimization, and showcasing the benefits of cloud-based data storage and analysis.

Abstract # 156

Journal Health

Dylan Dailey, and Jada

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

Using journaling and other mechanisms to help mental health. The research performed on these mechanisms will be presented and discussed in the poster.

Abstract # 157

Uncrewed Aircraft System Detection Utilizing Hyperspectral and Multispectral Imaging

Michael Ervin Jr.

Mentor(s): Dr. Kaveh Heidary, and Dr. R. Barry Johnson

Department of Electrical Engineering and Computer Science

This work explores the application of Gaussian Mixture Models (GMMs) for detecting moving objects in multispectral video streams. Detecting moving targets in video surveillance is crucial for various applications in security and defense. Multispectral data offers richer information compared to traditional RGB videos, potentially improving object detection accuracy. One common approach is to model the background of the video to distinguish foreground objects. In this study, we are investigating the use of Gaussian Mixture Models (GMMs) to accurately model the background of a video file. GMMs offer flexibility in representing complex backgrounds by capturing the statistical distribution of pixel intensities over time. By adapting and updating the model over successive frames, the GMM can effectively adapt to gradual changes in the background caused by illumination variations, camera movements, and environmental factors. We demonstrate the effectiveness of our approach through experiments on real-world video datasets. Our initial results show that GMM-based background modeling achieves superior performance in detecting moving targets compared to traditional methods. Additionally, we are exploring techniques for parameter optimization and model selection to enhance the robustness and efficiency of the detection process. Overall, our study highlights the potential of Gaussian Mixture Models as a reliable tool for background modeling

in video surveillance systems, paving the way for improved moving target detection in various practical real-time scenarios.

Abstract # 158

Eco-Conscious

Nasir Hill, Nasir Hill, and Dorien, J.

Mentor(s): Dr. Jian Fu

Department of Electrical Engineering and Computer Science

UN sustainable development goal 12.Responsible Consumption & Production: create app to keep track of a person's waste and recyclables to show how much impact a person has on the environment by connecting to a person's home lights and connecting to a person's billing history the app can tell you an estimate how much waste you are producing to make you the user more mindful of not only spending habits but you and everyone else's impact on the world around us.

Abstract # 159

Investigating Motion Capabilities and Practical Uses for Quadrupedal Robots

Daniel McCarthy

Mentor(s): Dr. Yujian Fu

Department of Electrical Engineering and Computer Science

Robots and AI in media are frequently used as a world-building element in Sci-Fi, and are typically seen in futuristic settings with societies much more technologically advanced than our own: The Jetsons took place in 2062, Wall-E in 2805, and Interstellar took place from 2067 to 2156. All of the aforementioned media includes interpretations of how robots and AI will be implemented in the future. However, a reality in which they're commonplace may already be upon us. Roomba's, Alexa, and AI software like Chat GPT are as accessible as ever, while companies like Boston Dynamics are making groundbreaking advancements in the field with their quadrupedal robot dogs. Similarly, in this project, I seek to make my own technical contribution. Using a Luwu Dynamics XGO Mini 2 robot dog, I seek to create a service robot companion that is more accessible to the general public.

Luwu Dynamics XGO Mini 2 is very lightweight and capable. This latest model offers great mobility, computational power, and adaptability. The XGO Mini2 robot's dynamics are captured in a planar model, with the rear and front legs moving as unified pairs. The model includes a seven-dimensional state space representing positions, pitch, and joint angles. Ground interaction is modelled via leg springs and a vertical ground spring, with friction handling horizontal movement, ensuring a practical approach to simulating terrain traversal.

Substantial research has been done on the aspects of motion controls for quadrupedal robots, giving context on how to complete the desired movement objectives. Voice commands shall be implemented to provide real world practicality through efficient execution. It's expected that

the robot is able to employ various actions and motion gaits when prompted by a voice command. For this, the robot will employ OpenAI to translate speech audio into an executable command.

Abstract # 160

Python Implementation of Remote-Controlled Drone

Amber Jamison

Mentor(s): Dr. Yujian Fu

Department of Electrical Engineering and Computer Science

Has your delivery taken longer than expected? Are you upset at the amount of extra charges for your delivery? With inflation constantly on the rise and a fast-paced economy, people are always looking for efficient and inexpensive ways to transport goods. Would it not be great if one could send a drone to transport goods? This project involves programming a drone to efficiently transport goods between locations, aiming to reduce delivery costs.

Programming on drone navigation and routing from place to place is challenging research. AI and machine learning algorithms play a critical role in sophisticated and/or unknown environment. In this project, we will adopt an AI-based efficient heuristic searching algorithm for the mission finish. This project is identified by several elaborated steps. The first step is to develop an algorithm that will pick up a delivery from one location to deliver at another location. Once the logic is outlined we will develop the program. The objective of the code is to take any two locations as input, navigate the drone through the path to pick up the item, and traverse the drone to the destination to deliver the item. The mission is completed in a fully automatic mode without human interaction.

To successfully communicate commands to the CoDrone Pro for execution, the appropriate commands need to be parsed via a wireless link utilizing Bluetooth. To achieve this interaction, it was necessary to install and configure several software applications on a laptop. These applications will allow a user to write and execute the appropriate commands for the drone's movement.

Abstract # 161

Enhancing water quality monitoring utilizing Artificial Intelligence for York, AL

Da'Quandalon Daniel, Girma, E., Rivers., K, and Smith, T

Mentor(s): Ms. Terry Miller

Department of Electrical Engineering and Computer Science

The desperate need for an improved and efficient water quality monitoring method for York, AL, has prompted this deep-dive exploration of artificial intelligence. York, AL, utilizes a facultative lagoon System with three lagoons to cleanse and dispose of wastewater. Lagoon

systems use aerobic and anaerobic processes to purify wastewater. The system has been in operation since 1991 and is estimated to have only 11-14 years left of successful operation. This research aims to identify technically advanced devices to remotely monitor chemical components such as pH, O2, CO2, and suspended solids. The significance of exploring this solution is that York, AL, currently needs the technical capability to support remote water quality monitoring. York, AL, utilizes pen and paper to record chemical readings and submits those readings to the Alabama Department of Environmental Management. They need to comply with the reading requirements specified by the ADEM. The expected results are that through this research, York, AL, will be provided with technical suggestions utilizing Artificial Intelligence to implement and comply with the state of Alabama. In addition, they will apply modern upgrades and technology for sustainability in their wastewater management system.

Abstract # 162

Using substitution and transposition tactics to encrypt code

Jordan Wren, Jordan Fleming, Tyson Wren, and Alton Wiggins

Mentor(s): Dr Ed Pearson

Department of Electrical Engineering and Computer Science

Group Project (Jordan Fleming, Alton Wiggins, Jordan Wren, Tyson Wren)
Name of Project: Algorithm Combination
The “Algorithm Combination” will use substitution and transposition tactics. We would use the algorithm combo for encryption throughout the program. The substitution would transform characters within the plaintext to prevent attacks. The transposition tactic would reposition the text to add more security. The “Algorithm Combination” will be a good security method against attackers due to the versatility of it. Also, this process can be used in different programming languages.

Abstract # 163

Self Driving Cars

Myah Magwood, and Yujian Fu

Mentor(s): Dr. Yujian Fu

Department of Electrical Engineering and Computer Science

The evolution of transportation is undergoing a radical transformation with the advent of Artificial Intelligence (AI). This offers a glimpse into a future where vehicles operate autonomously, fundamentally reshaping the mobility landscape.

At the forefront of this revolution is the application of AI in self-driving cars. These vehicles leverage algorithms to interpret and respond to their surroundings, navigating intricate road systems with an unprecedented level of autonomy. The true strength of AI in this domain lies in

its real-time data processing capabilities, allowing self-driving cars to make split-second decisions based on a comprehensive understanding of ever-changing road conditions.

This research project, "Zumi," stands as a testament to the transformative potential of AI in transportation. Zumi, a self-driving car, intricately integrates the power of AI to autonomously navigate its surroundings. Through the strategic placement of six Infrared (IR) sensors, Zumi gains a heightened ability to sense and respond to its environment. Powered by Python programming, Zumi executes intricate algorithms that enable the interpretation of data from the IR sensors in real-time. This seamless interaction between Python and the AI system facilitates swift decision-making, allowing Zumi to adapt to various scenarios encountered on the road. The six IR sensors effectively act as Zumi's eyes on the road, providing crucial input to the AI algorithms dictating its movements.

Zumi stands as an embodiment of how research projects are pushing the boundaries of innovation. Through the fusion of Python programming and IR sensor technology, Zumi not only showcases the potential of AI in autonomous navigation but also contributes valuable insights to the ever-evolving landscape of intelligent transportation systems.

Abstract # 164

DC Microgrid Utilizing Artificial Intelligence and Phasor Measurement Unit Assisted Inverter

Shanice Gray, Mohamed Ali, and Hassan Ali

Mentor(s): Dr. Raziq Yaqub

Department of Electrical Engineering and Computer Science

Community microgrid implementations are increasingly prevalent in cities worldwide. However, scaling up presents three primary challenges: initial synchronization with utility grids, slip management caused by faults in grids, and the mitigation of distortions caused by electronic gates in the inverter. This paper introduces an innovative solution named Phasor Measurement Unit Assisted Inverter (PA-Inverter) to address these challenges comprehensively.

The PA-Inverter continuously receives real-time data from a Phasor Measurement Unit (PMU) situated in the utility company's distribution system. This real-time data is utilized to construct a dynamic reference signal for the inverter modulator. Consequently, the PA-Inverter generates an output AC sinusoidal waveform that closely mimics the utility company's waveform, facilitating seamless synchronization, slip management, and distortion mitigation.

To validate the effectiveness of the PA-Inverter, we present a DC microgrid with an intelligent grid-tied PA Inverter. The DC microgrid harnesses energy from community-shared resources such as community electric vehicle batteries and rooftop solar installations. It is also integrated with a cloud-based Artificial Intelligence (AI) agent to determine the need for connection with the utility grid. Results demonstrate that the proposed system yields high-quality output with an impressive efficiency of 98.5%, suggesting strong commercialization potential. The ongoing project aims to develop a working prototype.

Abstract # 165

Electronic authentication for secure Identification

Isaac Anokye, Dr. Mohan Aggarwal, Dr. Marius Schamshula, Dr. Paul Gueye

Mentor(s): Dr. Mohan Aggarwal

Department of Electrical Engineering and Computer Science

Electronic authentication refers to the process of verifying the identity of a user who is accessing an electronic system or service. It ensures that only authorized individuals can access sensitive or confidential information or perform specific actions within an electronic system. Electronic authentication is crucial to modern digital systems, enabling secure identification and access control in an increasingly interconnected world. This abstract provides a concise overview of electronic authentication methods' critical aspects and challenges, highlighting their significance in ensuring data security and user privacy.

In recent years, electronic authentication has witnessed remarkable advancements, driven by the proliferation of online services, e-commerce, and the digitization of sensitive information. This paper reviews the various electronic authentication techniques and technologies, including but not limited to biometrics, smart cards, one-time passwords, and multi-factor authentication. It explores their strengths, weaknesses, and applicability in different contexts, shedding light on the trade-offs between security and user convenience.

Electronic authentication has yet to be widely used; there is little published research on its effects on various end-users. We still do not know enough about gender, age, and experience level. However, there has been a significant amount of research on e-authentication in recent years, focusing on developing new authentication methods and improving the security and usability of existing methods.

Abstract # 166

N.I.C Algorithm

Chemica Griffin, Isaiah Nwokenkwo , and Nasir Hill

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

The project aims to implement two encryption techniques, the Playfair cipher and the Row Transposition cipher, using C++. These techniques provide a foundation for understanding encryption and can be useful for basic cryptographic applications. The Playfair cipher is a substitution cipher that encrypts pairs of letters at a time. It involves creating a 5x5 matrix key table from a keyword and then encrypting plaintext by substituting pairs of letters according to specific rules. The Row Transposition cipher, on the other hand, is a cipher that rearranges the characters of a message according to a predefined key. It involves writing the message in rows of a certain length and then reading the columns in a specific order to create the ciphertext.

In this project, we will provide implementations for both encryption and decryption processes for both the Playfair and Row Transposition ciphers. Users will be able to input plaintext messages and encryption keys, and the program will output the corresponding ciphertexts. Likewise, users can input ciphertexts along with decryption keys, and the program will output the corresponding plaintexts. The project will demonstrate the fundamental concepts of classical encryption techniques, including key generation, encryption, and decryption processes. It will provide a hands-on learning experience for understanding basic cryptographic algorithms and their applications in information security.

Abstract # 167

AAMU-RISE Foundation Artificial Intelligence (AI) Machine Learning (ML)

Malcolm Echols, Kobe Berkley, Keanu Carter, Corion Holloman, Earnest Jordan, Blake Martin, Z'kijah Smith, and Nia Thompson

Mentor(s): Dr. Kenneth Sartor, and Dr. Gabe Birch

Department of Electrical Engineering and Computer Science

In this research project we set out to extend and grow Alabama A&M University RISE Foundation research capabilities. We are working with Sandia National Laboratory on an AI/Machine Learning project using tomographic-based sensing for large area monitoring. The purpose of this project is to help develop new sensing capabilities which allows detection and localization of humans, vehicles, and ground robotic systems within a large area. By using low-cost sensors and pseudo-tomographic reconstruction, which can be related to how MRIs are performed, we are using AI/Machine Learning techniques to help improve target detection and localization. Using techniques such as Radon transform, image processing, sinograms, and image reconstruction we are able to develop ML algorithms to detect objects of interest. Also, in this project we will be learning how to apply ML techniques in both Python and MATLAB coding languages. The importance of this project is not only to grow AAMU research capabilities, but also to allow students to gain real world work experience with a real problem to solve. With weekly meetings with the sponsor, it allows students to gain experience with giving PowerPoint presentations to an actual sponsor of a project.

Abstract # 168

xAI: Revolutionizing Military Operations through Intelligent Autonomy and Soldier Support

John Adeyemo

Mentor(s): Ms. Terry Miller

Department of Electrical Engineering and Computer Science

How might I empower soldiers in making critical decisions on the war base, acknowledging the challenges posed by the traditional approach to military operations and the rapid advancements in autonomous technologies by introducing an intelligent system such as xAI?

Solution Statement: xAI serves as a revolutionary solution to empower soldiers on the war base by providing real-time, data-driven intelligent suggestions enhancing decision-making processes in a dynamic military environment to help their squad.

My solution involves several components, including:
Bluetooth device communication
Software: Local interface on the computer and backend server communicating with the remote AI model
AI model on the remote server
Accessories include wristbands, a drone for sifting through images
AI Model Multimodal architecture:
Collection of different modalities of data: text data, image data, audio data, video data
Feature Extraction
Modality Fusion
Model Training
Inference
Evaluation and Iteration

Potential Impact on the Soldiers:
Integration with existing military technology e.g. military personal computer
Analyzing increasing amounts of mission data in real-time, creating opportunities for autonomous cognitive electronic warfare
xAI band will help communicate the Soldier's strength

Abstract # 169

Revolutionizing communications in the U.S Army using speech recognition, artificial intelligence and pulse sensing technologies (Soldier Buddy)

Sunday Ochigbo

Mentor(s): Ms. Terry Miller

Department of Electrical Engineering and Computer Science

Currently, there is difficulty in establishing an efficient communication system between different domains in the army and ensuring situational awareness for the warfighter. The goal is to create a centralized network where forces on land, sea, and air can inter-operate and communicate. With this vision in mind, I propose the use of a system. I call it the 'Soldier Buddy' system. The aim of such a system is to: Empower the warfighter with smart communication and rescue technology. grant information about dangers via an AI-generated alert system. Enhance communication while performing duty with minimum distractions.
Enable immediate help after serious injury to achieve these, the system: Employs Internet of Things Sensors to monitor war situations like explosives, signal interferences, etc. Displays situational awareness maps using the ArcGIS servers. Connects to Unmanned Air Systems (UAS) via encrypted IP addresses to enable ground surveillance. Utilizes Artificial Intelligence tools like Isolation Forests to process information from the sensors to identify potential threats. Finally,

warns the soldier via a smart device in the form of a wristwatch. In addition, the Soldier Buddy device is able to monitor vital health signs and alert the medical system in critical conditions. It is also equipped with speech recognition abilities to enhance voice control and voice authentication for security.

Abstract # 170

Theoretical and Comparative Analysis of Nanotechnology for Water Purification

Solomon Agyire, Solomon Agyire, and Terry Miller

Mentor(s): Ms. Terry Miller

Department of Electrical Engineering and Computer Science

Having access to clean drinking water is essential for all living things on Earth. Even in areas with sufficient water resources, there is still an inadequate water supply because of several causes, including agricultural practices and population increase. Solving the challenge of safe water access demands extensive research to develop cost-effective water purification technologies, with due consideration for energy requirements and environmental impacts. When it comes to water purification, environmental factors should be critically analyzed to make the process efficient and environmentally friendly. Nanomaterials have a larger surface area, with an affinity for specific target contaminants and compounds, making them suitable for water purification. This paper analyzes the use of nanotechnology to improve the standard of water. By critically assessing recent publications in nanotechnology-based water treatment, this review paves the way for future research endeavors, offering insights into the potential of nanotechnology to revolutionize water purification methods and contribute to global efforts in ensuring access to clean and safe drinking water.

Abstract # 171

Photoluminescence Spectroscopy Study of Cesium Hafnium Chloride

Ibrahim Bello, Elijah Adedeji, Nehemiah Ibi-eletta, Stephen Babalola, and Marius Schamschula

Mentor(s): Dr. Stephen Babalola

Department of Electrical Engineering and Computer Science

We report a photoluminescence study on Cesium Hafnium Chloride (CHC) grown using a modified Czochralski method via a Cary Eclipse Fluorescence Spectrophotometer with an excitation wavelength of 250nm. The modified Czochralski is a technique in which the crystal is melted and maintained at a temperature slightly above the melting point (820OC), and a pulling rod containing the seed crystal is lowered to touch the melt. The crystal is pulled slowly while the seed crystal is rotated to keep the crystal uniform and cylindrical. The investigation focuses on the first-grown CHC crystal and its seed crystal. Through a comparative systematic analysis, the photoluminescence properties of these crystals are explored, shedding light on their optical characteristics and potential applications.

The study explores the crystals' emission characteristics and spectral features under the specified excitation conditions. This research also aims to use our findings to determine the crystal's purity through a comprehensive analysis of the photoluminescence spectra.

Abstract # 172

Smart Energy-consumption Management System Considering Consumers' Spending Goals (SEMS-CCGS)

Daniel Lambo, and Sadiq Ahmad

Mentor(s): Dr. Raziq Yaqub

Department of Electrical Engineering and Computer Science

Issue: In the United States, electricity prices fluctuate based on demand throughout the day. For example, prices soar during peak times like 6 pm, when demand is high. Conversely, prices drop during off-peak hours like 12am due to lower demand.

Solution: Leveraging this understanding, we developed a system that factors in time, utility prices, and weather conditions to create personalized schedules for household appliance usage. Our research demonstrates that by following the recommended schedule generated by our system, users can reduce their home electricity costs by an impressive 25.6%.

Methodology: We have devised a comprehensive hardware/software solution known as the Energy Consumption Scheduler (ECS). The ECS serves as the central component, allowing users to input their preferences and priorities regarding household appliance usage. Through an intuitive interface, users can set their spending goals, preferred usage times, and other relevant parameters.
The ECS further functions as the control hub, managing the operation of appliances in accordance with the generated schedule. It communicates wirelessly with the circuit breaker of the house, enabling the intelligent switching on or off of appliances based on real-time factors such as electricity prices, time of day, and weather conditions. The system continually monitors and learns from usage patterns, refining the schedule over time to optimize energy consumption further.
By incorporating the ECS, users can actively participate in energy management, making informed decisions to achieve their spending goals while contributing to the stability of the energy grid.

Abstract # 173

Design and Implementation of a Door Monitoring and Security System

Shemaiah Mbetwa, Aaron Gibbs, Melvin WItten, Eric Lee, and Cameron Barnes

Mentor(s): Dr. Phil Bording

Department of Electrical Engineering and Computer Science

Addressing the increasing demand for enhanced security solutions in educational institutions and even government institutions, this research focuses on developing a comprehensive door monitoring and security system. Educational environments, such as college campuses, often grapple with unauthorized access, resource management, and real-time monitoring challenges. Specifically, the research hopes to achieve a hidden surveillance system that cannot be easily tampered with by bad actors.
To address this issue, a door monitoring system is proposed. This research endeavors to conceive, formulate, and implement a functional door security system capable of communicating with the property owner. The central objective involves the creation of computer hardware code to facilitate tasks encompassing object detection and processing. The primary focus of the code development is to enable the system to discern and identify objects traversing the door, subsequently conveying pertinent information to the user through a notification system.

Abstract # 174

Deep Learning for detection of diseases in CT scans

Koby Draper, Terriron Fields

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

With the egregious amount of misdiagnoses in the CT department leading to death and disabilities We thought the best way to remove human error is to remove humans almost entirely. I
propose we use AI methods to classify diseases and can be used as a tool to warn the doctor to test for it or be very cognizant of the possibility of the disease being present. Challenges that can come with this project include first finding the data and also formatting the projection data to be imaged correctly, as well as resolution and other things being consistent across different images. My work will give insight into this idea which many people have tried to delve into as well. Me and my partner hope to come from a different angle and from the help of some professors.

Abstract # 175

System Design for VLSI ASIC Chip Test

Ariel Croswell, Scott, C., Jones, P., and Craft, C.

Mentor(s): Dr. Zhigang Xiao

Department of Electrical Engineering and Computer Science

The objective of this project is to design and build a test system for testing a very large scale integration (VLSI) application specific integrated circuit (ASIC) chip. The system could be incorporated into the microelectronics introduction laboratory course on discrete amplifier stages and discrete amplifier design, and it could also be used to test the amplifiers made by

the VLSI tapeout course. A discrete amplifier refers to an electronic amplifier that is built using individual discrete components rather than integrated circuits (ICs) or other integrated modules. Integrated circuits often contain multiple components (transistors, resistors, capacitors, etc.) in a single package, providing a compact and space-efficient solution. In contrast, a discrete amplifier is constructed by assembling individual transistors, resistors, capacitors, and other components on a circuit board. The amplifiers under test would be mounted on a vertical SIP with 0.1" spacing so standard surfboards can be interfaced with it. One can also put amplifiers on custom made surfboards, also fabricated via OshPark. The VLSI students would make their own surfboard that they would mount their ASIC on. The 2023 Spring tapeout class design chip which was fabricated using the TSMC 180 nm technology will be tested using the system. Specifically the senior design project documents include: pcb cad that can be uploaded to Osh Park's 2-layer prototype service, bill of materials that can be uploaded to digikey's upload tool for easy purchase, a pdf document that explains the system, the test procedures, how to use it, and how to fabricate it at home/school, software to drive the analog discovery 3 and implement the various test, and a very simple discrete amplifier design that can be used with the system. It would require the students using the system to: own a laptop, have a digilent analog discovery 3 (provided by the project), and have a solder kit.

Abstract # 176

SeismoRover Project

Tyler Hale, Bentley Garner, Devin Jackson, Terry Reese, and Mohamed Barrie

Mentor(s): Dr. Bording

Department of Electrical Engineering and Computer Science

The SeismoRover project is dedicated to developing a versatile robotic platform equipped with seismic instrumentation for terrestrial exploration and seismic analysis. The name "SeismoRover" reflects its emphasis on exploring and mapping terrestrial environments while focusing on the study of seismic activity derived from "seismology" and highlighting its mobility and exploration capabilities inherent in "Rover." The primary objective is to enhance understanding of geological structures, fault lines, and seismic activity in remote or inaccessible regions.

State-of-the-art geophones integrated onto the mobile rover facilitate precise data collection of ground vibrations and seismic waves. Rigorous calibration and engineering efforts ensure accuracy in seismic data capture, contributing to advancements in geophysics, seismology, and geological research. The SeismoRover project aims to push the boundaries of exploration by fostering innovative solutions for mapping and analyzing terrestrial environments.

Key requirements include environmental adaptability, remote communication for seamless interaction with operators, precise sensor calibration, accurate seismic instrumentation, efficient data acquisition and transmission systems, sustainable power management, reliable navigation and control mechanisms, and durability to withstand harsh conditions. Scalability is crucial to accommodate future upgrades and customization.

Components such as Talon Tires, Yellow Jacket Planetary Gear Motor, Printed Circuit Boards (PCBs), Voltage Regulators, and a Remote Controller are integral to the SeismoRover's

functionality. By integrating these components and meeting the outlined requirements, the SeismoRover project promises to revolutionize seismic exploration, paving the way for deeper insights into Earth's dynamic processes and geological features.

Abstract # 177

Crafting a Unique Encryption Algorithm: The Fusion of Substitution and Transposition

De Tavein Walker, Lyric Sampson, Eyerusalem Girma, Da' Quandalon Daniel, De Tavein Walker, Lyric Sampson, and Da' Quandalon Daniel

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

Our group endeavors to develop a pioneering encryption algorithm by integrating substitution and transposition principles learned in a cryptography course taught at Alabama A&M. Our algorithm promises a fresh approach to data protection, as it is an encryption that has never been seen before and is completely unique. Utilizing the Python programming language, we demonstrate its functionality and anticipate showcasing our creative new encryption algorithm at STEM Day. Join us as we unveil our innovative encryption technique, set to make a mark and potentially impact cybersecurity.

Abstract # 178

Creating a new Encryption Algorithm

Preston Bolton, Whitney Fraizer, Mack White, and Dylan Dailey

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

There are many encryption algorithms in the world. My team and I are on a mission to create a new algorithm that incorporates substitution and transposition aspects into this algorithm. We have gotten a lot of basic research on the many wonderful algorithms out there, and it has inspired us to try and create our own. Hopefully, we can create a prototype version of our algorithm. We want to create another unique way for people to help secure their data, personal information, etc. STEM Day is a month away, and we can't wait to present the prototype to the public.

Abstract # 179

Protecting Data from Unauthorized Attacks: Cipher-based Solutions for Key Management

Makiya Bunch, Evan Jules, Kylah Williams, and Saron Dubale

Mentor(s): Dr. Ed Pearson III

Department of Electrical Engineering and Computer Science

Although there are many various reasons for a security breach we found a common variable being human error, and their ability to always leave room for violations. Previous findings suggest that around 80% of data breaches are due to human error. This is the case ranging from a student sharing their password(s) to an employee at a big tech company making an unfortunate mistake. During our research, we came across the issue of SSH keys being exploited due to them not being properly and regularly monitored along with the given keys not coming with an expiration date. When an attacker gains access or breaches the lackluster safeguards it opens an opportunity for them to use any important data to their advantage. To help mitigate these risks, we used our found data as a guide to help create a cipher-based protection apparatus using key encryption and authentication within a two-step verification process. Using transposition and substitution ciphering methods we're able to enhance the integrity and confidentiality of SSH key management. We hope by using this cipher, organizations can prevent any potential future impact of unauthorized attacks. By integrating these safeguards corporations, along with the normal citizen, can significantly reduce the likelihood of unauthorized access.

Abstract # 180

Self-Driving Cars

Chloe' Lee, Lee, C., and Fu, Y.

Mentor(s): Dr. Yujian Fu

Department of Electrical Engineering and Computer Science

As self-driving technology advances, addressing challenges such as obstacle avoidance and complying with traffic signals becomes crucial for safe and efficient navigation. Exposure to AI in self-driving systems is a new trend for current research. The Zumi AI car is used to simulate and address these challenges to increase the interaction and experience of real-world systems. Our project implements a traffic light recognition system using the front camera and decision-making logic for prioritizing obstacle avoidance and traffic light recognition. Machine learning plays a vital role in self-driving cars, recognizing and responding to environmental factors like traffic signals. A key aspect is color recognition, where machine learning algorithms enable the system to learn, identify, and respond to different colors based on training. This involves using the camera to take pictures of each color; then, the image is converted from RGB to the HSV colorspace, and a model is created using all this data. The model is then used to predict the color based on the images captured by the camera in real-time and make certain decisions for specific colors. Equipped with six IR sensors, output LEDs, and an audio device, Zumi AI can navigate paths while simultaneously responding to obstacles and traffic signals using sensor data processing, machine learning algorithms, and decision-making logic. This project shows how machine learning and AI technologies contribute to advancing self-driving systems. This project also prepares students for future careers and navigating AI-driven technologies.

Abstract # 181

Ensuring Availability and Sustainability Management of Water and Sanitation

Trinidy White, Brandon Edwards, Edwards, B., and White, T.

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

United Nations sustainable goal 6.3, ensuring availability and sustainability management of water and sanitation for all, primarily focuses on improving water quality and reducing pollution by 2030. The goal emphasizes the importance of safeguarding water resources and ecosystems to ensure sustainable development. It aims to halve the proportion of untreated wastewater and substantially increase recycling and safe reuse globally. By addressing water pollution and promoting efficient water usage, this goal seeks to enhance the well-being of communities primarily in vulnerable regions. A viable solution to this goal is to create a tool that efficiently measures the amount of waste in water and informs the individual if the water is safe to use. This tool will detect various pollutants such as heavy metals, chemicals, and microbial contaminants to assess water quality accurately. This tool will be paired with a web application allowing individuals and communities to access real time water quality information easily. Overall, this solution empowers individuals and communities to make informed decisions about water usage.

Abstract # 182

Temperature Sensor for Individual with Paralysis

Dillan Finley, Finley, D, Smith, D., and McMillian, M.

Mentor(s): Dr. Raziq Yaqub

Department of Electrical Engineering and Computer Science

Background: Individuals who experience limb loss or paralysis are often challenged by diminished tactile sensation, making it difficult to detect dangerous temperatures upon contact. This vulnerability significantly increases their risk of injury from exposure to excessively hot or cold surfaces, which they might inadvertently encounter during daily activities.

Issue: The inability to perceive extreme temperatures upon contact poses a significant risk, leading to severe injuries such as burns or frostbite. This limitation severely restricts their ability to engage in a broader range of activities safely, impacting their quality of life and independence.

Proposed Solution: In partnership with BAE Systems, we propose to develop a cutting-edge sensor-based monitoring system, complemented by a user-friendly smartphone application. This system is specifically designed to alert users and their caregivers when they are in proximity to surfaces that could pose a risk of extreme heat or cold, thus preventing potential harm.

Methodology: Our solution employs advanced sensors capable of detecting extreme temperatures and proximity to hazardous surfaces. These sensors communicate directly with a user's smartphone app via Bluetooth, providing real-time feedback and alerts. If a potentially

dangerous surface is detected, the system immediately notifies the user and their designated caregiver or instructor, allowing for prompt action to avoid contact.

Bottom Line: By integrating advanced technology with proactive monitoring and alerts, our initiative aims to significantly enhance the personal safety of individuals with sensory and mobility challenges. This project not only seeks to protect them from potential thermal hazards but also to empower them with greater confidence and freedom to engage in daily activities without fear of injury.

Abstract # 183

Machine Learning Model for Understanding EEG Brain Signals and Human Activity

Riley Roberts, and Venkata Atluri

Mentor(s): Dr. Venkata Atluri

Department of Electrical Engineering and Computer Science

Throughout the rise of Artificial Intelligence (AI) and Machine Learning (ML), analyzing brain waves and signals to determine the subject's emotional state has caused numerous studies worldwide. Despite the emphasis of study on the electrical currents that brains emit, there is yet to be a study that can confirm the patient's emotional condition with a hundred percent accuracy. This research aims not to reach this hundred percent accuracy but to learn how AI/ML techniques can be used to read these signals and how to fine-tune this algorithm to achieve increased accuracy. Python, a premier programming language for designing AI algorithms and programs, is used to build this research's AI model. The data used to train and test the AI was open-source data. Additionally, open-source data allows repeatable studies and others to check the dataset quickly. The chosen data set consists of EEG data collected when the subject was at rest, performing activity1, or activity2. A Random Forest (RF) model was used for this research. The dataset was preprocessed for the chosen RF model. The results showed that the RF model was able to classify the person's activity from the EEG signals with a precision of 85%. The model performance metrics and discussion will be presented.

Abstract # 184

AI Assisted Barrier Detection and Automatic Braking Systems

Javon Jones, Javon Johnson, and Christopher Johnson

Mentor(s): Dr. Raziq Yaqub

Department of Electrical Engineering and Computer Science

Background: Cycling provides a vital pathway for recreation and transportation for individuals with physical disabilities, offering a means to enhance fitness and mobility, especially for those who are unable to drive.
Challenge: The cycling experience is greatly affected for individuals with compromised hand function due to conditions such as amputations or reduced motor skills. This impairment

complicates essential tasks like gear shifting and braking, thus potentially compromising safety. Building on our previous achievements in implementing speech-recognition technology for gear shifting, we now aim to further enhance safety through the introduction of barrier detection and automatic braking systems.

Innovative Solution: We propose an innovative solution that employs a dual-layered safety system, combining sensor-based automatic braking with an advanced artificial intelligence (AI)-powered voice command system to act as a fail-safe. In the event that the primary automatic braking system fails, the AI-enabled speech recognition system activates, allowing the cyclist to command braking through voice, thereby ensuring a seamless and secure interaction between the cyclist and the bicycle.

Methodology: The foundation of our project is the synthesis of sophisticated AI algorithms with state-of-the-art sensor technology. These components work together for real-time environmental scanning to preemptively detect potential obstacles and engage the automatic braking system. If this primary system fails, or in scenarios requiring immediate manual intervention, the cyclist can instantly activate the braking system through voice commands, providing a comprehensive dual-tiered safety mechanism.

Bottomline: This project aims not only to enhance the accessibility and enjoyment of cycling for individuals with physical disabilities but also to be at the forefront of integrating AI and sensor technology into adaptive sports equipment. By focusing on user safety and autonomy, we seek to significantly empower disabled individuals with greater independence and confidence in their mobility and leisure activities.

Abstract # 185

Implementation of Finite Difference Method to solve generalized unsteady state Heat Equation in Non-Homogeneous Materials

Emmanuel Aina, and Emmanuel Aina

Mentor(s): Dr. Alakanada Bandyopadhyah

Department of Electrical Engineering and Computer Science

Abstract: Finite Difference and Finite Volume are well-established numerical methods widely used in solving scientific and engineering problems. These methods are used to solve partial differential equations in a physical and temporal domain by dividing the domain into a set of nodal points or control volumes. The problem becomes numerically complex due to non-linearity in material properties and also for complex geometries. In the current study, both 1-D and 2-D heat equations with generation and transient terms are solved using the finite volume method. A computer program in C++ is being developed to implement numerical algorithms. The results are validated against analytical solutions for relatively simple problems for which analytical solutions are available such as one-dimensional heat equations (steady and unsteady) without any generation term. The various aspects of numerical solutions such as grid independence and time step independence will be considered. Once the solution method is developed and validated for constant material properties non-homogeneous material properties will be tested as well. The solution method is also extended for solving 2-D Laplace

and 2-D Poisson's equation. Some of the real-life application problems in Engineering, Science, and Computer Science will be discussed.

Abstract # 186

Creating a Healthbots, to enhance healthcare accessibility, improve patient engagement, and support healthcare professionals in delivering more efficient and personalized services

Zoe Galloway, Galloway, Z and Denham, W.

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

Creating HealthBot involves combining conversational interfaces, artificial intelligence, and health-related functionalities to assist users in managing their health. The primary objective is to provide users with personalized health information, answer health-related questions (FDA approved), and offer general well-being tips. There will be 3 different versions of HealthBot; HealthWatch, Impant and AtHomeBot, which can all be monitored through the mobile app. Allowing users to create accounts, providing basic information like age, gender, and any existing health conditions. This AI generative HomeBot allows users to describe their symptoms, and the bot, utilizing natural language processing (NLP), provides preliminary information about potential health issues. It recommends seeking professional medical advice for accurate diagnosis. Each user that is registered within the mobile app will have connecting results to nearest health care facility, so they're able to monitor emergent patients. They can contact critically ill patients, give them health care advice, and send help if needed in a no-response situation. The user can use the mobile app to schedule and manage appointments with healthcare professionals. Integrates with existing healthcare systems or provides contact information for local clinics.

With the mobile app, users can set medication reminders by entering details such as medication names, dosage, and schedules. The bot sends timely reminders to take prescribed medications. The app offers personalized nutrition advice based on user profiles and dietary preferences. Users can ask the bot about the nutritional content of specific foods or get healthy recipe recommendations. Also, providing personalized fitness suggestions based on user preferences, fitness levels, health goals. Therefore, tracking daily physical activity. Not only is the HealthBot here for your physical health but we've incorporated features for stress management and mental well-being. Offers guided relaxation exercises, motivational messages, and resources for seeking professional mental health support. The healthbot primary use is to give general health tips, preventive measures, and information on various health topics. Users can ask questions about health conditions, medications, or lifestyle choices. Would require collaboration with healthcare professionals, adherence to legal and ethical standards, and thorough testing to ensure accuracy and user safety.

Abstract # 187

Developing a novel cryptographic algorithm for secure, efficient encryption and decryption of data

Arissa Nolley

Mentor(s): Dr. ED Pearson

Department of Electrical Engineering and Computer Science

The Blinding Basics Cipher, a novel cryptographic algorithm presented in this abstract, is a secure and efficient method for encrypting and decrypting data. This cipher leverages two fundamental cryptographic operations, substitution and transposition, to guarantee confidentiality and integrity of sensitive information. The substitution operation involves the use of a unique key to replace plaintext letters with ciphertext letters, while transposition involves rearranging the order of characters in the message to further enhance its security. Our team's implementation of this cipher is based on the Python programming language, which ensures a robust and customizable encryption solution. With its strong cryptographic properties and ease of implementation, the Blinding Basics Cipher is a promising solution for secure data communication and storage.

Abstract # 188

Smart Academic Advisor

Olayiwola Ajibode

Mentor(s): Dr. Yujian Fu

Department of Electrical Engineering and Computer Science

Academic advising has been found to be highly beneficial for college students. The ability to ensure accurate college degree progression, transition assistance, and professional assistance with academic challenges are some vital roles that academic advising has provided over the years, leading to better college trajectories for students and higher graduation rates. However, the quality of academic advising in colleges has been significantly affected by several factors, including unrealistic student-to-advisor ratios. To address this problem, the main aim of this project is to develop a platform that increases the quality of academic advising in institutions by reducing the workload placed on advisors per student. This Smart Academic Advisor web application will accomplish this task by performing the following four functions: 1) Providing continuous advising based on Performance monitoring, 2) Checking if Prerequisite courses have been completed successfully before new courses are advised, 3) Running course enrollment possibilities with database of university rules, including maximum and minimum credit hours per semester, course availability per semester, Credit hours required for graduation, and Major Concentration Track requirements, and 4) Generating recommended students' schedules for the upcoming semester based on the current course completion. As a result, this project will significantly drive students' success toward graduation, reduce advisors' workload, increase continuous advising, and increase accurate advising, thereby increasing graduation rates and

reducing rates of delayed graduation. Overall, this project will increase the institutions' academic advising quality.

Abstract # 189

EternalEase: A Comprehensive Approach to Promoting Mental Health and Well-being Through an Online Platform

Monique Woodson, and Dixon,S

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

Our project, EternalEase, addresses United Nations Sustainable Goal 3: Ensure healthy lives and promote well-being for all at all ages, with a focus on Target 3.4: reducing premature mortality from non-communicable diseases while promoting mental health and well-being. Through the development of a website using HTML/JAVA, we aim to create a comprehensive online platform dedicated to mental health awareness and support.
The website will serve as a hub for informative content, resources, and strategies aimed at raising awareness, promoting prevention, encouraging treatment, fostering a supportive community, providing education and resources, collaborating with professionals, ensuring accessibility, maintaining regular updates, measuring impact, and forming partnerships and advocacy efforts.
By aligning our website's goals with the broader target of reducing premature mortality from non-communicable diseases, EternalEase seeks to play a pivotal role in promoting mental health, providing support, and contributing to overall well-being. Join us in our mission to create a healthier and more resilient society.

Abstract # 190

Giving Non-Violent Offenders a Second Chance

KC Eziomume, and Cam William

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

Our project focuses on giving second chances to non-violent offenders released from jail. We are mainly focusing on charges that are marijuana-related because we feel due to changes in time and the legalization of it, offenders should not have their lives affected by something like this. We believe everyone deserves a second chance because no one is perfect. We plan on making a website to get waivers to get files expunged. Recently released convicts would get on it and answer questions and also would have to have a video conference with an official from the Judicial system for this to happen. We also are trying to make an online program for small crime offenders to get on their feet. It would be like a class they would have to take and at the end of it, they would get certification to be able to do anything in the workforce without discrimination.

Abstract # 191

Poverty Free

Jaylan Smith, and Rogers, A.

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

In a world grappling with the pervasive challenge of poverty, our project emerges as a beacon of hope—a mobile app poised to revolutionize the fight against deprivation and destitution. Inspired by the United Nations' audacious mandate to end poverty in all its forms by 2030, our endeavor aligns seamlessly with this global imperative. Leveraging cutting-edge technology, our app serves as a lifeline, connecting individuals in need with critical resources, job opportunities, and support services. This transformative initiative embodies the collective commitment of 189 nations, as enshrined in the 2015 Millennium Development Goals Report, which lifted over a billion souls from the clutches of extreme poverty.

At its core, our app is a catalyst for change, poised to redefine the socioeconomic landscape by empowering marginalized communities and fostering inclusive prosperity. Through a robust framework powered by Flutter Flow, coupled with comprehensive data structures, user authentication, and location services, we ensure seamless access to tailored assistance. By harnessing APIs from reputable sources like Indeed, Feeding America, and Google Maps, our platform offers a one-stop solution to address fundamental human needs—shelter, food, technology, clothing, and transportation.

Anticipated outcomes are as ambitious as they are essential: a substantial reduction in poverty rates, improved access to sustainable livelihoods, and heightened social inclusion. By facilitating communication between users and service providers, our app fosters a sense of community and solidarity, amplifying the impact of collective action. Furthermore, through rigorous testing and deployment, we ensure the reliability and efficacy of our platform, maximizing its reach and relevance.

The significance of our project transcends mere technological innovation; it epitomizes a paradigm shift in our approach to poverty alleviation. By intensifying international cooperation, empowering marginalized populations, and addressing gender disparities, our app charts a course towards a more equitable and prosperous future. As we embark on this transformative journey, we invite stakeholders from all walks of life to join hands in realizing our shared vision of a world free from poverty's scourge.

Abstract # 192

Poverty Free

Asa Rogers, Jayla Smith

Mentor(s): Dr. Pearson

Department of Electrical Engineering and Computer Science

In response to the challenge of poverty, this project endeavors to develop a mobile application that connects individuals in need with vital resources, job opportunities, and support services. Aligned with the United Nations' ambitious goal to eradicate poverty by 2030, this initiative seeks to leverage technology as a catalyst for socioeconomic empowerment and inclusive growth.

The primary aim of this project is to address the issue of poverty by providing a user-friendly platform that facilitates access to essential resources and support services. Through strategic partnerships and innovative features, the mobile app aims to bridge the gap between those in need and available assistance, ultimately fostering greater economic inclusion and social equity.

The development process will be guided by a comprehensive framework, utilizing Flutter as the platform for app development. Data structures will be defined to efficiently manage user information, job opportunities, and support services. User authentication and location services will be implemented to personalize content and connect users with local resources.

The app will integrate various APIs, including those from Indeed, Feeding America, and Google Maps, to provide real-time data and services. Rigorous testing will ensure functionality and usability before deployment.

Anticipated outcomes include increased access to resources, improved job opportunities, and enhanced support services for users. By fostering communication and collaboration, the app aims to promote social inclusion and community engagement. Long-term impacts include a reduction in poverty rates, improved livelihoods, and economic empowerment for marginalized populations, contributing to the realization of the Sustainable Development Goals. This project represents a paradigm shift in poverty alleviation efforts, emphasizing collaboration, inclusivity, and empowerment. Through technology and international cooperation, we aim to make meaningful strides towards ending poverty and creating a more equitable society, offering hope for a brighter future for all.

Abstract # 193

Research Studying Student Engagement for Active Learning in Synchronous Online Learning

Toluwani Esan, and Yujian Fu

Mentor(s): Dr. Yujian Fu

Department of Electrical Engineering and Computer Science

As a result of the COVID-19 Pandemic, institutions had to move their teaching online. This move was to prevent the spread of the virus amongst their students and employees. With this innovation, student engagement is one of the most researched topics. According to research, the average attention span of a student is 10 to 15 minutes, yet this time reduces further when having online classes. As a result of the lack of human interaction, the mind is more susceptible to distractions, and this causes students to become less engaged in online class activities. Much research has investigated how to engage students in the synchronous online environment so that the lesson stays on track actively. There are four main parts of student engagement:

1. The student's cognitive engagement is how the student relates to the things they learn in class.

2. Their behavioral engagement talks about how they communicate and relate with their peers and instructors during class sessions.
3. Their emotional engagement depicts how eager they are to want to learn.
4. Their Social engagement allows us insight into how they relate with their peers outside their class about what they did in class.

By looking into this, we are able to decipher what causes students to be distracted during classes and how to create teaching techniques that can counteract the effects of the distractions.

Abstract # 194

Smart Course Scheduler

Zizwe Mtonga

Mentor(s): Dr. Yujian Fu

Department of Electrical Engineering and Computer Science

The ever-increasing complexity of academic schedules, coupled with the needs of students, poses a significant challenge to efficient course management and academic success. In response to this challenge, our project introduces a Smart Course Scheduler website designed to ease the processes of profile management, course scheduling, and time management for students.

This project not only addresses the immediate scheduling concerns of students but also contributes to the broader subject of utilizing technology to enhance educational experiences. The Smart Course Scheduler Website represents a promising step towards optimizing academic efficiency and fostering a conducive environment for student success. As education continues to evolve, this innovative tool stands to make a meaningful impact on the landscape of higher education.

In the future of this endeavor, we plan to implement different algorithms and features that allow for the website to determine whether a user (student) is on the right track with on their journey towards obtaining his/her degree. It will incorporate features that will be able to create a comprehensive graduation plan that allows for a student to know what he/she must do to obtain a college degree. In addition, it will be able to track the user's progress to that effect. Additionally, the Smart Course Scheduler will allow for academic advising to be done through the website. It is a project that has the potential to reduce the ambiguity that comes with advising as it pertains to large groups of students and helps both students and teachers work on registration remotely.

In conclusion, the goal of our project is to provide a comprehensive solution to the task of course scheduling, offering students a user-friendly platform that not only optimizes the allocation of courses based on individual preferences but also integrates with their broader academic journey.

Abstract # 195

Unveiling Oceanic Garbage Patches: A Dynamic Mode Decomposition Approach

Ogheneobukome Ejaife

Mentor(s): Dr Kanaththa Priyankara

Department of Electrical Engineering and Computer Science

The term “garbage patches” designates oceanic regions where marine debris, particularly plastic, accumulates under the influence of ocean currents. These patches are consequences of oceanic gyres, which converge marine debris from diverse locations into concentrated areas. This convergence leads to the formation of a distinct garbage patch. The garbage patch consists of suspended debris, predominantly plastics, with the potential for significant environmental consequences and impacts on marine life.

The primary objective of this project is to ascertain the emergence of newly forming garbage patches and to uncover any concealed gyres. Additionally, we aim to identify tidal patterns that facilitate the movement of debris into each gyre. We employ a well-established method known as Dynamic Mode Decomposition to accomplish these objectives.

Abstract # 196

Developing Python Code Applicable to Cybersecurity

Thabo Ibrahim Traore, Dr. Alak Bandyopadhyay

Mentor(s): Dr. Alak Bandyopadhyay

Department of Electrical Engineering and Computer Science

This research paper delves into the realm of cryptography algorithms, specifically focusing on the implementation and evaluation of two widely used techniques: the Caesar Cipher and public key cryptography algorithm (RSA algorithm). The study employs the Python programming language to demonstrate the practical application of these cryptographic methods and provides a comprehensive analysis of them. The findings of this study contribute to the broader understanding of cryptography, offering valuable insights for practitioners, researchers, and educators. The Python implementations provided in this research serve as practical resources for those interested in hands-on exploration and experimentation with cryptographic algorithms. In conclusion, the paper underscores the importance of informed algorithm selection in designing secure communication systems and encourages further research into emerging cryptographic techniques.

Abstract # 197

Investigating Black Holes and Imaging Methods

Ruvarashe Nyabando, Nyabando, R.

Mentor(s): Dr. Kenichi Nishikawa

Department of Electrical Engineering and Computer Science

Albert Einstein's discovery of the general theory of relativity of matter first introduced the concept of infinitely dense pockets of matter in the scientific community. As the force of gravity is still under investigation, black holes are considered a novelty in the scientific community. With Roger Penrose accurately proving the theoretical idea of black holes, the fascination with this unknown phenomenon has grown over recent decades. This research delves into an introduction to black holes and the imaging techniques developed to date, including the Hubble Space Telescope and Event Horizon Telescope. As an introduction to the study, we briefly investigated Einstein's general theory of relativity and the Standard Model of Particle Physics. The research project will equip students with a base-level understanding of the mystery of black holes and discuss the recent developments of this emerging topic.

Abstract # 198

Implementation of Numerical methods to solve Linear System of Equations and its Application in Electric Circuit Analysis using C++

Mauyon Wusu

Mentor(s): Dr. Alak Bandyopadhyay

Department of Electrical Engineering and Computer Science

Electric circuit analysis is the process of solving all the voltages and currents in a network of connected circuit components. Like every other analysis, potential problems arise when conducting an Electric Circuit Analysis. One of these problems is finding the current or voltages in each circuit branch when the circuit includes more than one battery or DC Component and consists of only resistors- no capacitors or inductors included. However, it is essential to note that this problem can be solved. In this study, the Gaussian Elimination and Gauss-seidel methods were utilized using C++ to solve a linear system of equations for the current value in each circuit node. This solution was determined by the relationship of V=IR (Ohm's Law) and some other basic laws like Kirchoff's Current and Voltage Law. In this research, circuits were designed to solve for the current and voltages, and particular test values were used to satisfy some conditions of the methods and establish the solution's credibility. Based on the data, codes, and calculations, implementing numerical methods and applying linear systems in Circuit analysis using C++ proved efficient and authentic.

Abstract # 199

Particle-In-Cell Simulations of Relativistic Jets

Tatenda Joseph

Mentor(s): Dr. Kenichi Nishikawa

Department of Electrical Engineering and Computer Science

Plasma Physics encompasses the study of plasma and its fundamental governing principles, which hold relevance across various domains, including astrophysics. Relativistic jets, observed as streams of plasma emanating from black holes, propelled at velocities nearing the speed of light, represent an intriguing phenomenon in the cosmos.
In this study, I employ Particle-In-Cell Code, a computational methodology well-suited for modeling relativistic jets, to investigate their propagation dynamics from black holes. Leveraging Fortran for code development, simulations were executed on the Frontera platform, with subsequent visualization and analysis facilitated through VisIt.
My findings provide insights into the intricate physics governing the behavior of relativistic jets, shedding light on their origin, propagation mechanisms, and interaction with surrounding environments. Through meticulous analysis of simulation results, I uncovered nuances crucial for advancing our understanding of relativistic and related phenomena.

Abstract # 200

Thermal Treatment Effects on the Efficiency of the Thin Film Solid State Batteries

Keanu Carter, Malcolm Echols, Jerrval Legette, and Jordan Love

Mentor(s): Dr. Satilmis Budak

Department of Electrical Engineering and Computer Science

Thin film solid state rechargeable lithium batteries are ideal micro power sources for many applications requiring high energy and power densities, good capacity retention for thousands of discharge/charge cycles, and an extremely low self-discharge rate. For many thin film batteries, the cathode is usually made of a lithium-oxide complex such as LiCoO2. The anode material is commonly made of a carbon-based material such as graphite, although lithium and other metals can be used. Thin film batteries are commercially available and can be used for many applications, including in renewable energy storage devices, smart cards, and radio frequency identification (RFID) tags, portable electronics, neural stimulators, pacemakers, wireless sensors and car batteries nowadays.
Thin film solid state Li-ion batteries were fabricated using a DC/RF Sputtering system. Thermal annealing was introduced to improve the efficiency of the fabricated thin film solid state batteries at 50 oC for one hour. Senior Design Project Team used SiO2 as a substrate, LiCoO2 as a cathode, Li3PO4 (LIPON) as buffer layer, Sn+Si thin films as anodes, and Cu+Al as current collectors for cathode and anode electrodes. The following characterization techniques were used: Seebeck coefficient, van der Pauw four probe resistivity, mobility, charge carrier concentration, charge density, Hall Effect, type of carrier concentration, thermal conductivity, open and loaded circuit measurement, Impedance measurements, AC and DC measurements, I-V measurements at room temperature.

MECHANICAL AND CIVIL ENGINEERING AND CONSTRUCTION MANAGEMENT

Undergraduate

Abstract # 201

Remote Core Clamping Senior Design Project

Jalen Mosely, Kobe Thomas, Chidubem Nnadozie, Marquaris Jones-Smith, and Javon Walker
Mentor(s): Dr. Aaron Adams
Department of Mechanical and Civil Engineering

The Idaho National Laboratory (INL) is involved in developing various nuclear testing technologies at the Transient Reactor Test Facility (TREAT), including remote-controlled core clamping. The reactor is designed to test prototyped-sized reactor fuel pins and bundles under transient power conditions. There is a set of actuators located between each face (8 total). Faces include the North, South, East, and West Faces.

The Core Clamping System consists of four horizontally mounted clamping bars that are utilized to ensure the alignment of fuel assemblies within the core. Each clamping bar is actuated by two push rods that operate through horizontal penetrations in the concrete shield. North and East clamping bars are flanged and bolted into position (operated to a hard stop) while South and West clamping bars are spring-loaded to ensure even, consistent force on fuel assemblies. The current operating tool used is a ½ inch hex/Allen socket welded to a long-reach tool and socket wrench (81 inches).

This project focuses on constructing a manual and remote apparatus that will allow INL to clamp and unclamp these actuators safely and more effectively. New operators should be capable of the required torque of 20 ft-lbs to operate the clamps. These operators shall also provide a means for visual verification (remote or local) of clamp position and should attach to existing clamps with only minor modifications. In addition, a backup method of operating the clamps in the event of remote operator failure should be constructed.

Abstract # 202

Design and Fabrication of a precision linear motion stage

Nehemiah ibi-eletta, Elijah Adedeji,Oluwole success, Marius Schamschula, Claudiu Muntele
Mentor(s): Dr. Stephen Babalola
Department of Mechanical and Civil Engineering

The design and fabrication of a custom precision linear motion stage for the Bridgman setup used to grow radiation detectors will be reported in this poster. The precision linear motion stage is a crucial apparatus utilized as a lowering mechanism for the ampoule containing the melt from a higher to a lower temperature region for effective nucleation. Our custom linear motion stage is tested to be as effective and 90% cheaper than the commercially available one.

Abstract # 203

Radiation-Detecting UAV Drone Initiative (Project RUDI)

Jada Bonner; Tavaris Beal, and Mebougna Drabo,
Mentor(s): Dr. Stephen Egarievwe
Department of Mechanical and Civil Engineering

Radiation is the release of energy as electromagnetic waves or moving subatomic particles. Environmental radiation comes from many radioactive substances found in soil, water, air, and the body. Humans inhale and ingest various types of radiation every day from air, food, and water. High doses of radiation can cause adverse symptoms such as nausea, vomiting, hair loss, acute radiation syndrome, radiation burns, and even death. In a nuclear or radiation emergency, first responders and workers in affected areas (e.g., nuclear power plant workers) are at risk of exposure to radiation.

The emergence of unmanned aerial vehicles (UAVs) equipped with advanced sensing technologies will revolutionize the fields of environmental monitoring, hazard detection, and nuclear emergencies, preventing the exposure. This UAV-based system will include two key components: a scintillation detector and multi-channel analyzer (MCA). The scintillation detector will measure ionizing radiation (i.e., alpha, beta, and gamma rays), convert that radiation into flashes of light (scintillations), and amplify the scintillations, converting them into electrical signals. Those signals will the transferred into the multi-channel analyzer, which serves to measure, categorize, and store those signals, offering real-time data monitoring. This system aims to demonstrate an energy range between 20 keV and 3 MeV and provide real-time data analysis with less than one second of delay on data measurements. As we progress towards our goals, we remain cognizant of the broader implications of our work. By addressing challenges associated with nuclear radiation detection, our project contributes to global efforts in environmental protection, public health, and safety. Moreover, our innovative approach underscores the potential of UAV technology to revolutionize hazard detection and monitoring, paving the way for enhanced capabilities in disaster response, emergency management, and scientific research.

Abstract # 204

Building a sustainable city utilizing renewable, economic methods

Sarah Olocha, Jayden Thornton, and Arissa Nolley
Mentor(s): Dr. Pooja Preetha

Department of Mechanical and Civil Engineering

The objective of Sustainable Solutions is to create a fictional, Sustainable city. It will be configured using the provided design report of "The City of ASCE's waterfront." The site includes several historic buildings, including a chocolate factory, two restaurants, and forty housing units. The design also incorporates 160 multi-family dwelling units, three large (5000 sqft) commercial spaces, six small (1200 sqft) commercial spaces, an accessible parking infrastructure, and one fitness facility. The design framework will be brought to fruition using the programming tools, AutoCAD and Sketchup. The city design requirements include calculations for stormwater runoff volume. The plan suggests that the water quality should capture the first 1.4 inches of rainfall. A drainage control plan to protect all property for ten years and a 6-hour precipitation event of 3.2 inches of rainfall managing a peak flow of 2.2 inches/hour should also be considered. Additional considerations include (1) Parking access with a minimum of 1 and a maximum of 1.5 parking spaces per 1000 ft^2 of residential and commercial mixed-use—sidewalk pedestrian space to support commercial activity and (2) excavation and severe weather conditions management plan should be implemented. The study outcomes contribute to effective planning and implementation strategies for all emergency types while determining the procedure for each emergency type, gathering points for safety areas, and exit routes appropriate for the emergency type. The study results will be utilized to advance sustainable solutions in city planning and management.

Abstract # 205

Analysis of Hypersonic flow past a Spherically Blunted Conical Nose Cone with and without a Crater Defect: A Numerical Study

Jibrail Muhammad Jr, Callens, A., Blake, W., and Nelson, A.

Mentor(s): Dr.Aaron Adams

Department of Mechanical and Civil Engineering

This study presents a numerical investigation of hypersonic flow past a spherically blunted conical nose cone, focusing on characterizing airflow and temperature. Conducted at a Mach number of 7 and a fineness ratio of 1.5, the analysis explores the impact of drag and temperature on the nose cone's geometry at a zero angle of attack. A vital aspect of the study is the comparative analysis of the aerodynamic performance of the nose cone with and without a crater defect. The findings reveal that a crater defect increases the nose cone's drag force and surface temperature. This insight is further supported by a detailed comparison of pressure and surface temperature distributions near the nose cone, highlighting the crater defect's impact on aerodynamic behavior. The study emphasizes the importance of considering defects, such as craters, in designing and analyzing hypersonic vehicles to optimize aerodynamic efficiency and thermal management at high speeds. In conclusion, this research underscores the critical role

of numerical analysis in understanding the complex interactions of airflow and temperature in hypersonic flow, particularly in the presence of defects. Such insights are crucial for advancing the design and performance of hypersonic vehicles, ensuring their safety and effectiveness in extreme operating conditions.

Abstract # 206

Senior Design Capstone Project: Flash Neutron Radiography Shielding

Jordan Reynolds, M'Kenna Albert, McKenzie Hunter, Lemuel Hudson, Chyna Ross, Hunter, M., Hudson, L., Ross, C., and Albert, M.,

Mentor(s): Dr. Aaron Adams

Department of Mechanical and Civil Engineering

The Idaho National Laboratory (INL) is involved in developing various nuclear testing technologies at the Transient Reactor Test Facility (TREAT), including flash neutron radiography for reactor fuel purposes. Understanding potential unforeseen conditions in an active reactor environment is vital to INL's mission for the future of nuclear studies and performance.

This project focuses on developing a radiation shielding design for neutron radiography testing in the TREAT facility at the Idaho National Laboratory. It will permit efficient and immediate protection from key types of radiation, such as neutron and gamma radiation, for a safe testing environment within the facility. The shielding will consist of multiple layers accounting for different radiation material interactions, meet the design constraints expected of INL, and follow any engineering code of ethics regulations. Designs will be consistent with industry-leading research and development, and computer-based analysis will be conducted through online programs. The expected radiation inside our region of concern is 1500 mrem and is planned to be reduced to less than two mrem. The expected outcome of this effort will be an enhanced capability for nuclear testing at INL.

The results of this project will provide insight into the understanding of radiation control systems and the principles of mechanical engineering design.

Abstract # 207

Fault Analysis and Simulation of Attitude Control System Thrusters

Colton Barnes, Terrance Daniels II, Niceson Ejem, Phillip Jones, Trevor Swanson, and Colton Barnes

Mentor(s): Dr. Colton Barnes

Department of Mechanical and Civil Engineering

The Attitude Control System (ACS) Thruster Project focuses on creating unique answers to a real-world problem. The ACS Thruster problem derives from a satellite malfunction in which the satellite's position moved out of alignment via a thruster malfunction caused by an unknown error. Slick Dynamics will perform an engineering inquiry into identifying the causation of failure and mitigate future risk. Our approach entails running MATLAB-based simulation code to determine the effects of thruster movement and completing a fault tree analysis to narrow down errors. We will employ our simulation code to analyze how the satellite will respond before a movement command is given. Our simulation is backed by simulation anchoring test cases (known code inputs and outputs) that we will use to ensure testing validity. ACS Thrusters are used with most satellites, so it is understood that our ability to solve this problem could lead to future implementation. Our presentation will illustrate the legitimacy and efficacy of our proposed solution in detail while also assuring our customers confidence to complete the project within specifications.

Slick Dynamics will work with Alabama Agricultural & Mechanical University (AAMU) and The Aerospace Corporation (ASC) to solve the problem. ASC is a company that offers military, commercial, and civil client's technical guidance, and assistance on every aspect of space missions. ASC provides "objective technical analyses and assessments for space-related projects that serve the national interest" and collaborates closely with institutions like the NRO and the SMC as well as the FFRDC for national security in space. AAMU is a public, historically Black, land-grant university in Normal, Alabama, founded in 1875.

Abstract # 208

Raytheon Drone Competition

Zaire Martino, Hall,J., Bolds,C., Martin,B., Anderson,E., Gholar,J., Malone,B., Bells,J., Turner,C., and Thomas,T.

Mentor(s): Dr. Aaron Adams

Department of Mechanical and Civil Engineering

The Raytheon Drone Competition (RDC) is an event sponsored by Raytheon, an RTX business. The purpose of the RDC is for students to use their creativity, innovation, and team-solving skills to research, develop, integrate, and assess Unmanned Vehicle hardware and software components to solve existing real-world problems.

The objective of this project is to design two vehicles, one UAV (Unmanned Aerial Vehicles) and one UGV (Unmanned Ground Vehicles). The competition consists of five challenges, four regular and one bonus. Each vehicle will behave autonomously while a single UAV from each team finds, identifies, and delivers water blast to all other UGVs except their own. The UGVs must travel in a specific direction and/or speed based on the challenges.

This collaborative effort is an opportunity for university students to engage and put into practice their project management and critical thinking skills on open-ended problems and allows them to work in an environment like industry professionals. For the corporate sponsor, it provides the opportunity to evaluate and assess top graduates, promote corporate branding, and explore the latest technologies.

Abstract # 209

Study Of Importance Of Epoxy Flooring

Jordy Nieto

Mentor(s): Dr. Mahbub Hasan

Department of Mechanical and Civil Engineering

Epoxy flooring consists of a combination of polymer resins and hardeners. When these components are mixed together, they undergo a chemical reaction, resulting in an unparalleled chemical bond with the floor surface. It is made from a mixture of resin and a hardening that forms a plastic-like coat. Most of the times you'll need more than one layer when dried, it creates a durable, stain resistant, and easy to clean up surface. The purpose of this study is to show how a epoxy will have more sustainable to waterproofing on concrete than without it. For this project there will be examples of mini squares of one with concrete and one with epoxy on top of the concrete and each one will have a slope in the middle as it will show how the concrete will hold water for a certain amount of time. The epoxy concrete will also have a slope in the middle as it will also show how it maintains water and has less leaks than the regular concrete.

Abstract # 210

AAMU-RISE Foundation Artificial Intelligence (AI) Machine Learning (ML) Project with Sandia National Laboratories

Keanu Carter, Malcolm Echols, Corion Holloman, Earnest Jordan, Blake Martin, Z'kijah Smith, and Nia Thompson

Mentor(s): Dr. Kenneth Sartor and Dr. Gabe Birch

Department of Mechanical and Civil Engineering

In this research project, we set out to extend and grow Alabama A&M University RISE Foundation's research capabilities. We are working with Sandia National Laboratory on an AI/Machine Learning project using tomographic-based sensing for large-area monitoring. This project aims to help develop new sensing capabilities that allow the detection and localization of humans, vehicles, and ground robotic systems within a large area. Using low-cost sensors and pseudo-tomographic reconstruction, which can relate to how MRIs are performed, we are

using AI/Machine Learning techniques to help improve target detection and localization. Using techniques such as Radon transform, image processing, sinograms, and image reconstruction, we are able to develop ML algorithms to detect objects of interest. Also, in this project, we will learn how to apply ML techniques in Python and MATLAB coding languages. The importance of this project is not only to grow AAMU research capabilities but also to allow students to gain real-world work experience with real problems to solve. Weekly meetings with the sponsor enable students to gain experience with giving PowerPoint presentations to an actual project sponsor.

Abstract # 211

Thermal Analysis on the 100mN Lunar Flashlight Thruster

Niceson Ejem, Teems, C., and Chowdhury, S.

Mentor(s): Dr. Showkat Chowdhury

Department of Mechanical and Civil Engineering

Lunar Flashlight (LF) was a secondary payload that flew on a Falcon 9 which was designed to map the lunar south pole for volatiles. A component failure caused the mission to be aborted early, however, if successful, LF would have been the first CubeSat to reach the Moon, the first mission to use lasers to look for water ice, and the first planetary CubeSat mission to use green propulsion. LF utilized four 100 mN AF-M315E propellant thrusters for pitch, yaw, and roll control. The original thermal analyses were conducted in Ansys Mechanical and consisted of two separate models: a test model and a flight model. The test model was intended to correlate to test data, whereas the flight model was intended to predict flight temperatures. For this project, only a test model was created and correlated to test data.

A Computer Aided Design (CAD) model of the Lunar Flashlight Thruster was provided to start the process of conducting a thermal analysis in the program Thermal Desktop (TD). The model was designed to represent the first stage or the "heater on" phase. Using the CAD as a reference, thermal geometry was constructed for each part, which also included assigning the appropriate material and optical properties. Boundary conditions were defined for the heater wire assembly and the flange interface, and contactors were set to indicate how energy would flow from one component to another. In addition, radiation analysis groups were created to model radiative heat transfer. After completing a steady state run on the model and observing the results, it was discovered that the model temperatures were too high. It was determined that there were losses that were not considered, and after more examination, the heater wire heat load was reduced by 1.96 Watts. Once all the model parameters had been established, the model was run for the full 1800-second duration. The results were then plotted against test results for comparison.

Abstract # 212

Enhancing Testing Capability in the V7012 Vacuum Chamber

Jordan Reynolds, Martin, A., and Chowdhury, S.

Mentor(s): Dr. Showkat Chowdhury

Department of Mechanical and Civil Engineering

The NASA Marshal Space Flight Center (MSFC) is involved in developing a variety of propulsion technologies, including EP or Electric Propulsion, which is increasingly used for in-space propulsion. Better understanding of thruster technologies such as EP for space applications is vital to NASA's mission to the Moon, Mars, and beyond. This project focuses on developing a three-dimensional diagnostic positioning system for use in electric propulsion testing in the 4205/101 9-foot diameter vacuum chamber at the Marshal Space Flight Center. It will permit rapid and precise positioning of plasma diagnostics (e.g. Faraday probe, Langmuir probe) for measuring properties in a thruster's plume. This system will be computer controlled and will use either proprietary software (based on acquired hardware) or other available programs such as LABVIEW (National Instruments, Inc.). The pressure inside the 9-ft chamber during testing ranges from 10-3 to 10-6 Torr. The expected outcome of this effort will be an enhanced capability for electric propulsion testing. The results of this project will provide insight into the understanding of automated motion, control systems, and the principles of aerospace mechanical design.

Abstract # 213

Integrated Systems Health Management and Automation Mission and Fault Management SLS Display

Anya Nelson, Lo, Y., and Chowdhury, S.

Mentor(s): Dr. Showkat Chowdhury

Department of Mechanical and Civil Engineering

Mission and Fault Management (M&FM) contributes to understanding, developing, and providing functions for the autonomous, nominal operation of a complex vehicle or spacecraft. Its elements and subsystems are by its flight computers in accordance with the planned mission profile and timeline. Fault Management focuses on fault/failure determination and response in support of redundancy management, caution and warning, safing actions, and aborts. Redundancy management facilitates fault tolerance, maintains operations of critical functions, and the ability to continue the mission during hardware failures. Caution and warning provide the crew with situational awareness with respect to the state of the vehicle or any developing conditions. Safing actions prevent failure propagation or halt the launch when a failure

increases the risk of the mission failing. The Space Launch System (SLS) mission explores the advancement of space exploration, by developing a vehicle capable of reaching the moon multiple times in the timespan of a few years. The Offnominal display of the SLS gives workers the ability to identify faults in the SLS so individuals involved stay safe. M&FM contains systems and functions. A system is a combination of interaction elements organized to achieve one or more stated purposes. These systems are only for engineered systems and not natural systems such as an ecology or living beings. Engineered systems have a purpose and their components/elements also have purposes. If a component has no purpose, it has no reason to be a part of the system. A function is a process that transforms or maps one or more input states to an intended output state. An activity or operation could be a passive function, such as a propellant tank providing a secure volume for propellants.

PHYSICS, CHEMISTRY AND MATHEMATICS

Undergraduate

Abstract # 214

Investigating the Impact of Cold Plasma Jet on Ferroelectric Polymer Thin Films and Nanofiber Membranes

Amari Williams, Amari Williams, Clyde Varner, and Padmaja Guggilla

Mentor(s): Dr. Padmaja Guggilla

Department of Physics, Chemistry and Math

There are many different Electro Active Polymers namely, polylactide aniline pentamercopolymer, poly (lactic-co-glycolic acid), and poly (vinylidene fluoride) (PVDF). Amongst them, PVDF exhibits the best electroactive properties, such as piezo, pyro and ferroelectricity, and optoelectronic. It is known to have good flexibility, exceptional chemical resistance, high mechanical strength, easy processing, and low cost, and when doped with perovskite materials exhibits good Optoelectrical properties. Perovskites are cubic crystal structured materials with chemical formula ABX3 where A and B represent “Cations” and represent an “Anion” that bonds to both, same as that of Calcium Titanate (CaTiO3) This is applied to the class of compounds that share the same crystal structure as that of CT. As a result, PVDF polymer doped with perovskites is of choice for the increasing number of possible microelectronics applications, such as electro-optic transducers and sensors, energy harvesting, biomimetic robotics, etc. This research focuses on developing perovskite polymer nanocomposite thin films using the Solution Casting technique and characterize their electrical, optical properties, and analyze their ability to work as efficient sensors.

Abstract # 215

Development of Contactless Fingerprints for Biometrics Identification

Bria Berry, Bria Berry, Dr. Jules Guei

Mentor(s): Dr. Jules Guei

Department of Physics, Chemistry and Math

Contactless fingerprint identification is a biometric technique for acquiring an individual's fingerprints without physical contact. For over a century, contact-based fingerprinting, where fingers are physically pressed against a collection medium, has been the staple in biometric identification by law enforcement. However, due to isolated reports regarding the inconsistency and distortion of contact-based fingerprint features resulting from the pressure associated with the collection technique, the advancement of technology and the availability of photographic and video cameras with sophisticated software on the market, and the advent of communicable diseases, have contributed to an increased interest of acquiring fingerprints free of any physical contact and pressure. As a result, businesses and law enforcement agencies are turning to contactless fingerprinting for identification and criminal investigations. Despite its growing popularity in the private sector, contactless fingerprinting has not gained popular acceptance by law enforcement in general and the FBI in particular for its use in criminal investigation. It has been hypothesized that contactless fingerprint images consecutively captured may be dissimilar. In addition, the different backgrounds of the images may contribute to their variability, making their comparison for identification challenging.

In this study, using iPhone 12 &13 equipped with iFING Scanner, contactless fingerprints were acquired in different environments, including water and air, and similarity comparisons were conducted. The results obtained helps understand how collecting real life 3-D fingerprints by contactless technique demonstrates higher accuracy than both traditional touch-based identification process, as well as the compared contactless technique used to collect 2-D fingerprints. As of today, fingerprinting by contactless technique has high user acceptance rates while the more traditional touch-based identification process still faces a few challenges.

Abstract # 216

Josephson Junctions and Superconducting Qubits

De'Angelo N. Bailey, and Dr. Tianxi Zhang

Mentor(s): Dr. Tianxi Zhang

Department of Physics, Chemistry and Math

Josephson junction is a device and can be used to construct quantum bit (qubit), which plays an essential role in the development of a superconducting quantum computer. It is formed with two superconductors separated by a thin insulating barrier. Super-electrons in superconductors can quantum-mechanically tunnel through the barrier and generate an electric current through

the junction or an electric voltage across the junction. The current or voltage is usually direct but can be alternative when an external influence is applied. Superconducting circuits with Josephson junctions can construct superconducting qubits,

which can be categorized into three different types, called the charge, flux, and phase qubits, respectively. In this quantum information and science study, we will investigate how superconducting qubits work and are controlled and how their performances are improved. We will analytically explore and numerically calculate the electric charge and magnetic flux, capacitance and induction, and frequency and energy of superconducting qubits. We will also investigate how perturbations of the superconductors generate superconducting pulses in Josephson junctions. The results obtained from this study about Josephson junctions and superconducting qubits will be presented. The work is supported by the IBM-HBCU Quantum Center awarded project.

Abstract # 217

Distribution of Mercury in Flint Creek Watersheds: Implications for Mercury Bioaccumulation

Destinee Simmons, Golson-Garner, K., and Moss, E.

Mentor(s): Dr. Paul Okweye

Department of Physics, Chemistry and Math

When mercury enters the environment, it converts to methylmercury (MeHg), which is biologically hazardous and is present in soil and aquatic microorganisms. Exposure to MeHg affects the central nervous system, causing neurological damage, mental retardation, blindness, deafness, kidney malfunction, and, in some cases, death. This research study will compare the bioavailability and toxic effects of mercury and its compounds in both fish and humans. It will also identify the distribution of mercury in Flint Creek watersheds and the implications for mercury bioaccumulation. Samples were taken along the Flint Creek watershed at Red Bank, Vaughn Bridge, and Highway 31. At these sites, composite surface water samples were collected. The water samples were analyzed for Total Organic Carbon, Dissolved Carbon, and Total Mercury. There were 36 fish, including 12 species of largemouth bass, bream, and catfish, and 102 other samples (36 for soil/sediment, 36 for surface water, and 30 for TOC/DOC). These samples were collected, cleaned, and pretested. The samples were preserved in hydrochloric acid bottles, while physiochemical parameters, including water temperature and pH, were measured. Surface water samples were tested for total Hg concentrations using Cold Vapor Atomic Fluorescence Spectroscopy at the Environmental Compliance and Testing Laboratory in Memphis, TN. Quantitation limits are also used to determine the concentration of total mercury (tHg). The determined tHg within Flint Creek revealed federal drinking water standard levels that are potentially hazardous to aquatic life. Highway 31 experienced elevated levels of methylation resulting from stagnant conditions. The findings of this study showed that tHg concentrations were consistent with the results of the Alabama Department of Public Health (ADPH) fish consumption advisories released in 2022. The concentrations exceeded certain human and public health standards, and it advised that people should refrain from eating largemouth bass or eat only two meals of fish per month from Flint Creek.

Abstract # 218

Quark-Antiquark Pair Emission and Annihilation in the Role of Formation of a Diproton System through p-n Scattering

Cornelius B. Salonis, and Tianxi Zhang

Mentor(s): Dr. Tianxi Zhang

Department of Physics, Chemistry and Math

In the Nuclear Physics, elementary particles are usually classified into two categories: 1) hadrons – subatomic particles that participate in the strong interactions such as protons and neutrons and 2) leptons – subatomic particles that do not participate in the strong interaction such as electrons and neutrinos. To model lepton formations, nuclear decays, and neutrino oscillations, Zhang developed a quark-antiquark pair emission and annihilation model. A quark or antiquark is a combination of mass, electric charge, and color charge. When an excited quark or antiquark jumps to its lower energy state, it emits a quark-antiquark pair. When a quark annihilates with an antiquark, a lepton is formed. Different qualities such as; Charge, Colour, Mass, and quark anti-pairs, can annihilate with one another to form leptons with different properties and generations. In this study, we will investigate how a diproton system is formed through quark-antiquark pair emissions and annihilations in the base p-n scattering p + n = (pp) + π- and its excited states. In addition, we will also search for other particle formations from n + n scattering. This research is supported by IBM_HBCU Quantum Center.

Abstract # 219

Approximation of Borel-Tanner distribution by using Gram-Charlier Poisson approximation

Kourtney Tabb

Mentor(s): Dr. Salam Khan

Department of Physics, Chemistry and Math

Borel-Tanner distribution is a generalized probability distribution. This is a compound probability distribution. The generalized Poisson distribution is becoming increasingly useful in many branches of science, but the functional forms of these generalized distributions are often complicated. Therefore, there arises a need to have some simplified or approximated form of this generalized distribution. In this study, we approximate the Borel-Tanner probability distribution function by using Gram-Charlier Poisson approximation.

Abstract # 220

Machine Learning Aplication for Antineutrino Event Selection with PROSPECT

Pablo Ruiz Crespo, Diego Venegas Vargas, and Andrea Delgado

Mentor(s): Dr. Padmaja Guggilla

Department of Physics, Chemistry and Math

The Precision Reactor Oscillation and Spectrum Experiment (PROSPECT) is a reactor antineutrino experiment consisting of a 4-ton liquid scintillator antineutrino detector divided into an 11x14 array of optically separated segments. The detector was designed to probe the existence of sterile neutrino oscillations and precisely measure the antineutrino spectrum resulting from 235U fission. Data was taken in 2018 and 2019 with a first-generation detector called PROSPECT-I located on the Earth's surface roughly 7 m from the 85 MW, compact, highly-enriched High Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory. With almost no overburden from the HFIR building, the PROSPECT detector is subjected to many sources of background. This makes precise background characterization essential for antineutrino detection. This poster presents the results from a study using machine learning techniques to distinguish between background and signal events. We trained several classifier methods such as Boosted Decision Trees (BDT) and Multilayer Perceptrons (MLPs) on the reconstructed inverse beta decay interactions from PROSPECT's data. We benchmark the classifier's performance on the reconstructed antineutrino energy spectrum from U-235.

This work is supported by the US DOE Office of High Energy Physics, the Heising-Simons Foundation, CFREF and NSERC of Canada, and internal investments at all institutions. This work is supported by the U.S. Department of Energy, Office of Science, Office of High Energy Physics, as part of the RENEW program at Oak Ridge National Laboratory under FWP ERKAP89.

Abstract # 221

Exploration of Acidified Pulp Films for Meixner Test in Phalloidin Toxin Detection

Joh'Mesha Pierre

Mentor(s): Dr. Cylde Varner

Department of Physics, Chemistry and Math

This study investigates the utilization of acidified pulp films for the detection of phalloidin toxin, employing the Meixner test, a classic method for identifying alkaloids. Given the significant health risks posed by phalloidin, found in Amanita phalloides mushrooms, there's a pressing need for effective and accessible detection methods. We developed a novel approach using films acidified with a 10% HCl solution, evaluated through exposure to rhodamine-phalloidin. This research is significant as it offers a cost-effective, straightforward, and accessible detection strategy, which could be particularly beneficial in resource-limited settings or for rapid field assessments. The findings not only demonstrate the method's efficacy but also its environmental sustainability, leveraging cellulose-based pulp, and propose a promising avenue for further investigation into toxin detection technologies.

Graduate

Abstract # 222

Strain engineering of nano-crystalline CaTiO3 and LiNbO3 in PVDF matrix for efficient smart material

Angela Davis, Dr. Clyde Varner, and Dr. Ashok Batra

Mentor(s): Dr. Padmaja Guggilla

Department of Physics, Chemistry and Math

Demand for thin films of various functional nano-crystalline 2D functional materials is increasing due to the miniaturization of electronic devices to nanometer scales. Nano-thin films can be defined as a thin layer of material where the thickness spans from a fraction of a nanometer to several micrometers in thickness in at least one dimension. Based on the specific characteristics the material exhibits, they are categorized as SMART materials. As the material gets to the size of a nanometer, the characteristics will behave entirely differently from the bulk in terms of their electrical and optical properties. Polyvinylidene fluoride (PVDF) is a flexible, stretchable, piezoelectric polymer. When a semi-conductive Nano-crystalline dopant is introduced into the PVDF matrix, the properties of the resulting material can be enhanced. The study will determine the ideal concentration of CaTiO3 or LiNbO3, semi-conductive nanocrystals embedded in a PVDF matrix that exhibit enhanced conductivity and optical properties under strain. Under the current investigation, PVDF thin films are fabricated with various concentrations of LiNbO3 and CaTiO3 and characterized for their electrical, optical, and physical properties as smart materials.

Abstract # 223

Development of a Low-SWaP Telescope for Stand-off Raman Detection of Explosives

Belther Monono, and Dr. Farley III, C.

Mentor(s): Dr. Carlton Farley III

Department of Physics, Chemistry and Math

There is a need for low-cost low-SWaP systems capable of detecting small explosives from stand-off distances ranging from 1-20m. In these efforts, AAMU works closely with Sandia National Laboratory to design and 3D print a Fresnel lens telescope, which is then attached to a portable Raman spectroscopy system. Blender was used to design the 4” diameter telescope, and a Voxelab 3D printer was used to print the telescope. The total cost of the Fresnel lens

telescope is about $25, and the weight of the telescope is 418g (15oz). The system is then used to take Raman measurements of sodium nitrate (nitrates are commonly used in improvised explosives) at distances up to 20m. Dwell times ranging from 0.5-60s were used to detect the powdered nitrate sample, and the portable Raman system has laser power of 400mW at laser wavelength of 785nm. The fidelity of the Fresnel lens design is validated via laboratory measurements. The Fresnel lens telescope outperforms the 2” diameter OEM telescope at distances of 15 and 20m. Future efforts will include designing a larger diameter Fresnel lens telescope for improved detection at distances up to 20m and detection at distances greater than 20m.

Abstract # 224

A Comparative Study of Virgin and Recycled Stainless Steel 316L Powder in Laser-melting Additive Manufacturing

Ajibike Joan Farounbi, Padmaja Guggilla, and Judith Schneider

Mentor(s): Dr. Padmaja Guggilla

Department of Physics, Chemistry and Math

This research focuses on the effect of recycled powder and its characteristics on fatigue strength of austenitic stainless steel 316L parts manufactured using Laser-Based Powder Fusion (LBPF). Additive manufacturing (AM) has emerged as a transformative technology, offering unparalleled flexibility and efficiency in producing complex metal components. The study examines the impact of powder origin on the final properties of components made from virgin and recycled powders. The experiments utilizing laser powder bed fusion (LPBF) analyses tensile strength, hardness, microstructural properties and overall print quality. The findings highlight the need for better understanding of powder characteristics for sustainable additive manufacturing practices.

Abstract # 225

Characterization of Radiation-Induced Defects in InAs for Space-Based Infrared Detectors

Alexandria Barnes, Dr. Evan Anderson, Dr Claudiu Muntele

Mentor(s): Dr. Satilmis Budak, Dr. Jonathan Lassiter

Department of Physics, Chemistry and Math

Irradiation of infrared detectors with ions degrades detector performance through the creation of atomic scale defects. With this effort we aim to characterize the defects generated in InAs and related materials caused by ion irradiation through a combination of experimental work and modeling to establish damage equivalence between various ion species present in radiation environments (e.g., space). We will use protons, He, C, Si, and potentially heavier ions. We will use Monte Carlo modeling packages such as SRIM to simulate the accumulation of damage in these materials to both guide irradiation experiments with these ion beams and interpret characterization results. For the experimental part, we are targeting fluences in the range of 10 10 - 10 12 ions/cm 2 , which are typical for III-V devices in literature. Materials characterization

before and after irradiation will be emphasized early in the project. For measuring the energetics of the induced defects of the crystalline lattice, Fourier Transform Infrared (FTIR) Spectroscopy and Raman Spectroscopy will be used, with the latter being sensitive to defects or added atomic species present in the material as received, and able to resolve defects at concentrations anticipated after irradiation. SNL is managed and operated by NTESS under DOE NNSA contract DE-NA0003525.

ORAL PRESENTATIONS

BIOLOGICAL AND ENVIRONMENTAL SCIENCES

Abstract # 501

Effects of Atmospheric Pressure Plasma vs. Plasma Activated Water on Seed Germination, Seedling Growth and Biomass of Microgreens

Sravan Kumar Sanathanam, K., Pham, T., Thakur, S. K., and Mentreddy, S. R.

Mentor(s): Dr. Srinivasa Rao Mentreddy

Department of Biological and Environmental Sciences

Microgreens, harvested within 7-21 days of planting, are rich in nutrients and health-beneficial phytochemicals. Considered functional foods, microgreens reduce inflammation, oxidative stress, and chronic diseases. However, poor germination leading to poor plant stands, seed-borne diseases, and high-water consumption, often limit their production. Atmospheric pressure plasma (APP), a partially ionized gas consisting of unbound electrons, ions, and neutral particles, produces reactive nitrogen species (RNS), reactive oxygen species (ROS), ultraviolet (UV) photons, and other excited molecules, making it a viable non-chemical tool for seed priming to break dormancy, hasten germination, and disinfect seeds. In this study, 'Amara' mustard greens seeds were exposed to Argon (Ar) or Helium (He) APP and/or Plasma Activated Water (PAW) for T0=0 s, T1=30 s, T2=60 s, and T3=90 s at 7kV, 1µs pulse width, 5Hz and planted in seed germination trays at density of 6 seeds/tray after appropriate treatment. Days to germination and total germination percentage were recorded daily until germination ceased. Seedling height, root length, and biomass were recorded until harvest. Seeds directly exposed to APP or PAW had no significant impact on germination, except for PAW-Ar 90 s, which increased the seed germination percentage by 36% compared to the Control. Plant height significantly increased by direct APP seed treatments by approximately 98% in Ar 30 s and by 50% in all other treatments compared to the Control. He and Ar plasma-exposed seeds increased seedling biomass. He 30 s, He 60 s, He 90 s, and Ar 90 s treatments increased biomass by 250%, 200%, 215%, and 120%, respectively, over the Control. In contrast, PAW treatments had no significant impact. Thus, this study demonstrated that direct seed treatment using Argon or Helium APP improved plant stand, biomass, and potentially reduced water consumption due to quicker seedling growth rates.

This research was supported by NSF-EPSCoR-OIA-2148653 and NASA-EPSCoR 80NCCS21M0139.

Abstract # 502

The role of gene variants in Systemic Lupus Erythematosus: A comprehensive genetic analysis

Ja'Kerria Jackson, and Weems, E.

Mentor(s): Dr. Ebony Weems

Department of Biological and Environmental Sciences

Currently, over 1.5 million people suffer from Lupus. Lupus is a chronic disease and is dominant in the Asian, African American, and Hispanic populations. These effects can cause long-term damage to major organ systems if not treated correctly. There are many types of lupus diseases, but the most commonly known one is Systemic Lupus Erythematosus (SLE). Symptoms normally present between 15-44 years old. Currently there is no cure for SLE. SLE symptoms are controlled with chemical and wholistoc therapies. Hydroxychloroquine, which is an immunosuppressive drug, is commonly used to regulate inflammation flares. Out of the 1.5 million people only 80-90% of the population will be able to live a normal life. Previous research studies show a significant role of genetic mutations in the development of SLE. Gene mutations in the TLR7 gene, located on the X chromosome as an influencer of SLE. Mutations in TLR7 cause the protein to be more sensitive to the nucleobase nitrogenous base guanosine. Resulting in an autoimmune attack. Sensitivity has also been shown in cancer and other inherited diseases. The purpose of this study is to identify additional genes with the potential to cause disease. Specific variants in the TREX1, SAMHD1, BLK, and IRF5 genes are associated with increased susceptibility to SLE. Using Bioinformatics databases, we identified ten genes associated with SLE. Genomic variant analysis and functional annotation identified increased pathogenicity in the genes TREX1, SAMHD1, BLK, and IRF5. Three variants for each gene will be analyzed using R to determine the significance of the associations. Understanding how these genetic variations influence the incidence of Lupus and their potential as genetic biomarkers can be important for early diagnosis and targeted therapeutics.

Abstract # 503

Evaluation of Diverse Hemp Germplasm in Northern Alabama for Submission to the National Plant Germplasm System

Abiodun Adeniyi, Xiao, X., Davis, J., Long, B., Whitehead, J., Kuang, X., and Cebert, E.,

Mentor(s): Dr. Xianyan Kuang

Department of Biological and Environmental Sciences

Hemp (Cannabis sativa L., THC <0.3%), recognized increasingly as a vital crop in the U.S. following the 2018 farm bill, faces challenges including limited genetic resources and deficient trait-specific genetic knowledge. To address this, the USDA-ARS Plant Genetic Resource Unit (PGRU) has launched a comprehensive initiative to amass, conserve, and evaluate hemp germplasm across diverse U.S. climates and environments. Uniform field management practices, experimental designs, and hemp accessions were employed across states, including AL, for consistent phenotypic trait assessments. In 2023, at the WTARS farm in Hazel Green, AL, 23 hemp accessions underwent evaluation under a randomized complete block design (5 plants for each plot, 3 replicates). Key phenotypic traits including plant stand, sex ratio, plant height,

maximum canopy diameter (MCD), maximum canopy diameter height (MCDH), trunk length, and stem diameter at floral maturity were assessed at individual plant and plot levels. Findings revealed substantial variation across all measured traits among the accessions: female plant percentages varied from 25% to 100%, plant height spanned 24 to 242 cm, stem diameters ranged from 3 to 43 mm, MCDs were between 24 to 190 cm, MCDHs from 20 to 127 cm, and trunk lengths from 4 to 22 cm. Flowering periods extended from May through September. A positive correlation was noted between plant height and variables such as stem diameter, MCD, and MCDH. The collected samples of flowers, seeds, and stems are undergoing further analysis to determine cannabinoid, terpene, fatty acid, protein, and fiber quality. This comprehensive data, combined with findings from other locations, enriches hemp genetic research and is available through the Germplasm Resources Information Network (GRIN-Global), a national plant germplasm system. This collaborative effort lays a crucial groundwork for future hemp breeding programs, enhancing the crop's genetic diversity and adaptability for sustainable agriculture.

Abstract # 504

Toward Genetic Mapping of Leaf Morphological Traits in Miscanthus Using an Interspecific F2 Population

Friday Zakari, Kuang, X., Xiao, X., and Cebert, E

Mentor(s): Dr. Xianyan Kuang

Department of Biological and Environmental Sciences

Miscanthus is an emerging bioenergy crop and offers significant potential for bioenergy production due to its high biomass yield and adaptability. However, while leaf morphological traits such as length, width, perimeter, and area are essential for photosynthetic efficiency and biomass productivity, the genetic underpinnings of these traits in Miscanthus remain unexplored. This study aims to address this gap by genetically mapping these leaf traits using an interspecific F2 population (14UI-026, 280+ entries) derived from Miscanthus sinensis and M. sacchariflorus, which exhibit diverse leaf morphologies. In this study, a well-established trial with an RCBD design (randomized complete block design, 4 replicates) for this population at Winifred Thomas Agricultural Research Station (Hazel Green, AL) was used for phenotypic data collection. A non-destructive laser leaf area meter was used to measure the largest fully extended leaf from each of 3~5 representative stems for each plot at the reproductive stage (or late vegetative stage for late-flowering entries). Initial phenotypic analyses reveal that great variations exist in leaf area, length, width, and perimeter across the population, with the range for area, length, and width being 20 to 394 cm2, 24 to 117 cm, and 1.0 to 26.7 cm, respectively. More data from an additional site/year will be collected, and correlation analysis with other leaf and yield traits will be performed. Genetic mapping will be conducted to connect the phenotypic data and pre-existing genomic data (high-resolution SNP markers and resequencing data) for identifying significant genetic loci and candidate genes. By integrating phenotypic characterization and genetic mapping, this study will offer insights into the genetic architecture governing leaf morphological traits in Miscanthus, facilitating marker-assisted selection for

enhanced leaf morphology, thereby improving biomass yield and environmental resilience in Miscanthus.

Abstract # 505

Enhancing agricultural diversity and sustainability in Alabama: a three-year field evaluation of dry bean and barley varieties for crop rotation

Andrion Erves, Kuang, X., Xiao, X., Williams, K., Schmutz, J., and Cebert, E.

Mentor(s): Dr. Xianyan Kuang

Department of Biological and Environmental Sciences

Crop rotation, the practice of alternating different crops on the same land to enhance soil health and sustainability, is vital for Alabama's diverse agricultural landscape. Our study focuses on introducing dry beans as a summer crop and barley as a winter crop to enrich Alabama's cropping options. Over multiple years, we assessed various bean varieties at the Winfred Thomas Agricultural Research Station in Hazel Green, AL. A randomized complete block design (RCBD; four replicates) was employed for testing both crops. For dry beans, yield, plant lodging, and maturity were the major factors we factored in decision-making for further testing. We examined 45 black bean and 96 pinto bean varieties in 2021, down to 24 varieties for each type in 2022, which was further narrowed to 12 varieties for each bean type in 2023. After three years of field evaluation, we identified 3 pinto and 5 black bean varieties that demonstrated consistently high performance in Northern Alabama's conditions. The statistical analysis of yield components is underway, which aims to identify crucial factors contributing to high yield.

Additionally, we evaluated 25 barley varieties in the 2020-2021 season, with the list readjusted to include more cold-resistant southern cultivars in subsequent years due to observed severe winterkill in northern varieties. Over the 2021-2023 seasons, 16 varieties were tested, revealing that cold tolerance is essential for successful barley cultivation in northern Alabama. An overall assessment of yield, cold tolerance, and pest/disease identified 4 top barley varieties (Avalon, Marouetta, Secretariant, and Thoroughbred). Scale-up production confirmed these findings, aligning with initial RCBD results. Ongoing post-harvest analysis will enhance our understanding of yield determinants. Overall, the three-year field trials indicate that integrating barley and dry beans into Alabama's crop rotation system holds significant promise for enhancing agricultural sustainability and diversifying the state's crop production.

COMMUNITY AND REGIONAL PLANNING

Abstract # 506

Cost Overruns in Highway Construction Project: Evidence from Texas DOT Contracts

Afolabi Adeniyi
Mentor(s): Dr. Jacob Oluwoye
Department of Community and Regional Planning

This study presents a thorough investigation into the impact of contract sizes and change orders on cost overruns within road construction projects, with a specific focus on data from the Texas Department of Transportation (TxDOT). The research aims to dissect and comprehend the intricate dynamics, relationships, and causal effects that these critical factors exert on project costs. Through an exhaustive analysis encompassing various project parameters—such as contract award cost, change orders, amount paid, under/over budget, contract days, charged days, days added, and under/over schedule —the study scrutinizes a dataset comprising Highway Construction Projects completed by TxDOT between March 1, 2023, and August 31, 2023. The chosen timeframe, from January 1, 2023, to August 31, 2023, reflects a period selected for its relevance and the contemporaneity of its data, aiming to capture the latest trends and obstacles encountered in road construction project management. By delving into the relationship between contract size, change orders, and their influence on project cost overruns, this research aspires to shed light on the complexities of managing financial efficiency and schedule effectiveness in public infrastructure projects. The findings are intended to significantly contribute to the field, offering insights that could enhance project management strategies, promote financial efficiency, and improve scheduling practices in the realm of public infrastructure development.

Abstract # 507

Analyzing the Change in Urban Heat Island Effects Over-Time in Alabama

Marvin Lotsah
Mentor(s): Dr. Florina Dutt
Department of Community and Regional Planning

The Urban Heat Island (UHI) effect refers to higher temperatures observed in urban areas than in surrounding rural regions. This phenomenon leads to higher temperatures in cities versus rural Alabama, posing health and environmental threats. The Urban Heat Island (UHI) effect is primarily driven by human activities like construction, transportation, and industry in cities. This study utilizes remote sensing and GIS techniques to analyze decadal changes in Alabama's UHI intensity based on Moderate Resolution Imaging Spectroradiometer (MODIS) thermal data. The National Land Cover Database will determine land use and land cover factors influencing UHI patterns. The census tracts will also identify communities vulnerable to UHI health risks. The goal is to identify whether escalating urbanization has intensified Alabama's UHI effect over the past decade. The outcomes of this research will provide insights into the built environment

drivers of local UHI effects. This understanding will inform targeted planning and heat mitigation strategies tailored to Alabama's climatic and development contexts. Overall, this timely spatiotemporal analysis will advance knowledge on the relationships between evolving land cover and heat impacts across urbanizing Alabama.

Abstract # 508

Implementing Cisterns to Harvest, Conserve, and Enhance Rainwater (Water Resource Management) in U.S. Local Communities

Oluwadamilare Daniel Akomolafe, Dr. Jordan Yin; and Dr. Pressley

Mentor(s): Dr. Jordan Yin

Department of Community and Regional Planning

Anticipated population growth and shifting climate patterns are heightening concerns about water scarcity in the United States. The issue has sparked interest in achieving "Water Security" and sustainable development goals. A strategic response to these challenges involves the widespread adoption of cisterns for water conservation and improved resource management in local communities. This research investigates the feasibility and benefits of implementing cistern systems across the United States, addressing water scarcity, and promoting sustainable resource utilization. Employing a multidisciplinary approach, the study combines hydrological assessments, economic analysis, and community engagement. Drawing from case studies, empirical data, and a comprehensive review of initiatives, it assesses cistern systems' suitability in diverse contexts, including urban and rural settings. Key objectives include evaluating cisterns' capacity to capture and store rainwater, reducing reliance on centralized water supply systems, and mitigating environmental impacts. The research explores the economic viability of cistern implementation, considering installation costs, water savings, and community incentives. Findings underscore cisterns' potential to enhance water resource management, conserve water, and bolster sustainability locally. The study emphasizes cistern adoption's promise in alleviating water stress, mitigating flooding, and improving community resilience. In addressing water-related challenges, adopting cisterns is a promising strategy for local communities. The research highlights the importance of policy support, public education, and community engagement in successfully implementing cistern systems. Ultimately, this study aims to inform and inspire efforts to harness cisterns' potential as a sustainable and localized solution for water resource management challenges in the United States.

Abstract # 509

Water Systems and Planning for Sustainable Development: An Evaluation of Local Comprehensive Plans and Local Water Master Plans for US Cities

Samuel Afolabi, and Samuel Afolabi

Mentor(s): Dr. Jordan Yin

Department of Community and Regional Planning

Comprehensive plans and water master plans play essential roles in the United States in terms of developing the nation's urban and rural landscapes and ensuring sustainable water management. Local governments depend heavily on comprehensive plans to regulate problems, including land use, transportation, infrastructure development, and environmental protection. On the other hand, water master plans are developed to optimize the region's water management, distribution, and conservation. Local and regional comprehensive plans provide a vision for sustainable community development. They plan future expansion by integrating land use, transportation, housing, and environmental protection. Comprehensive plans help balance economic growth, equitable society, and environmental responsibility (Smith, 2010). This study, therefore, aims by seeking to investigate how much effort and awareness U.S. cities put into making their local comprehensive and water master plans, as well as how well these plans follow the policies and guidelines of U.S. government agencies such as (APA) on water resource management issues. The objectives include examining how local comprehensive plans address water resource management and examining the level of coordination for water resource management between local comprehensive plans and water master plans; Examining how water resource management is addressed in local water master plans; Identifying best practices and gaps that can be used as the basis for recommendations to allow communities to develop better plans that coordinate planning with water resource management. The comprehensive plans and water master plans of certain selected cities in the U.S. will be reviewed and analyzed using content analysis. The qualitative results will be presented using inferential and descriptive statistics.

FOOD AND ANIMAL SCIENCES

Abstract # 510

Anti-Oxidative and Anti-Obesity Potential of Bioactive Compounds in Spirulina Microalgae and Bilberry

Katelyn Boyle, R. Kaur, N. Montgomery, and M. Verghese

Mentor(s): Dr. Martha Verghese

Department of Food and Animal Sciences

Spirulina (S), a protein-rich cyanobacterium and Bilberry (B), a dark berry, are known for their medicinal purposes. Aim was to identify potential anti-oxidative and anti-obesity properties of S & B. Objectives were to determine total phenolics (TPC) (mg G.A.E./100g DW) and total

flavonoids (TFC) (mg C.E./100g DW), antioxidant (2,2-diphenyl-1-picrylhydrazyl (DPPH), Ferric Reducing Antioxidant Potential (FRAP), Trolox Equivalent Antioxidant Capacity (TEAC), and Nitric Oxide Radical Scavenging Ability (NORS) assays and metabolizing enzymes (α-Amylase, α-Glucosidase, and Lipase) inhibition potential in S&B.

All assays conducted, using standard protocols, compared 100% Spirulina (100S) and 100% Bilberry (100B) to the following combination samples: 50% Spirulina + 50% Bilberry (50S+50B), 75% Spirulina + 25% Bilberry (75S+25B), and 25% Spirulina + 75% Bilberry (25S+75B) aqueous (AQ) and 80% ethanol (ET) extracts.

TPC (1987.57) and TFC (41.41) were highest in 100B ET. AQ TPC was highest at 25S+75B (1900.94), and TFC was highest at 50S+50B (15.68). DPPH % inhibition ranged from 67% - 95% (ET), and 20% - 60% (AQ). TEAC in 100S ET (148.68) was 1.23 to 7.66 times higher than other ET extracts. Highest NORS (mM NO/ 100g DW) in 100B ET (28.41), 75S+25B AQ (26.52). Highest FRAP (mM F.E. (II)/100g DW) in 100B ET (229.48) and AQ (113.51). Lipase inhibition ranged from 12% - 21% (ET) and 19% - 23% (AQ). Highest α-Amylase inhibition by 50S+50B ET (48.77%) and 100S AQ (48.82%). α-Glucosidase inhibition highest by 25S+75B ET (92.12%) and 100S (14.50%).

ET extracts had higher TFC, FRAP, DPPH, AQ extracts had higher TPC, NORS, and TEAC, suggesting hydrophilic and lipophilic bioactive components. Samples with higher levels of Bilberry had higher % inhibition of metabolizing enzymes, suggesting synergistic effects (S+B). They are underexplored and underutilized in the food industry with implications for further use in functional food product development.

Abstract # 511

A Comparative study for the inactivation of Listeria monocytogenes on Ready-to-eat Cold-Smoked Salmon using Atmospheric Cold Plasma and Pulsed UV Light

Manikanta Sri Sai Kunisetty, Manikanta Sri Sai Kunisetty, Armitra Jackson-Davis, Srinivasa Rao Mentreddy, Lamin Kassama, Gabriel Xu, and Bhagirath Ghimire

Mentor(s): Dr. Lamin Kassama

Department of Food and Animal Sciences

Cold-smoked salmon (CSS) is a popular ready-to-eat (RTE) seafood, but its consumption raises concerns due to potential Listeria monocytogenes (LM) contamination, which can cause severe foodborne illness. Non-thermal processing methods like atmospheric cold plasma (ACP) and pulsed UV light (PUL) are emerging as alternatives to reduce the risk of foodborne illnesses and maintain food quality. However, extensive research is needed to improve ACP and PUL processing effects on CSS products. This study aimed to evaluate the efficacy of ACP and PUL treatments in controlling LM on CSS. The CSS samples were purchased from a local store, processed into fillets, and inoculated with LM serovars inoculum:1/2a (ATCC-19111), 1/2b (ATCC-BAA2658), and 4b (ATCC-19115). The treatments included ACP for 0, 3, 6, 9, and 12 minutes using helium gas at a flow rate of 8 SLPM and 9.61 kV. and PUL using three voltages (0, 2, and 3 kV) at 300 J/Pulse with energy levels for 120 and 160 pulses. All the samples were analyzed in triplicates, and statistical analysis was conducted at a 5 % significance level. The samples showed the most significant LM reduction with ACP for 12 min by 1.13 (± 0.15) CFU/g.

Similarly, PUL treatment at 3 kV and 160 Pulses reduced LM by 1.15 (± 0.07) CFU/g. In both treatments, the microbial load was significantly lower in the treated samples compared to the control samples. The reduction of LM on CSS varied from 1.15 to 0.53 log, depending on the fluence. The study demonstrated that the efficiency of LM reduction was dependent on the voltage, pulses, and treatment times used in the process. The results indicated that the application of ACP and PUL was effective in inactivating LM in CSS. As a result, these non-thermal technologies hold great potential for application in the smoked salmon industry.

Abstract # 512

Development of Hemp loaded-PVA (Polyvinyl alcohol) Antimicrobial Nanofibers for Fresh Chicken Meat Packaging

Aaron Dudley, Jackson-Davis, A., Cebert, E., Kuang, X., and Xiao, Z

Mentor(s): Dr. Lamin Kassama

Department of Food and Animal Sciences

Polyvinyl alcohol (PVA) is a well-known synthetic biodegradable polymer used for encapsulating bioactive components in the pharmaceutical industry, thus its applications will be viable in food systems. The objectives of the study were to fabricate a functional nanofiber by electrospinning, and to characterize its morphological, rheological, and antimicrobial properties on food safety. Nanofibrous films were characterized in terms of SEM, FTIR, rheological and antibacterial trials. SEM and FTIR data indicated that hemp extract was encapsulated and incorporated successfully in PVA nanofibers with fiber diameters <1000nm ($p<0.05$). Electrospinning solutions exhibited thixotropic behavior and tensile strength of films indicating no significant differences between nanofilm treatments ($p>0.05$). Nanofibers exhibited bacteriostatic invitro antibacterial activity against both Salmonella enterica and Listeria monocytogenes. Furthermore, hemp loaded PVA nanofibrous films in situ activity at 4°C displayed bactericidal activity against Listeria monocytogenes and delayed decay of chicken breast meat during storage. These results suggest that packaging raw poultry in hemp nanofibers could help improve the shelf-life of poultry meat.

Abstract # 513

Investigating the ability of Pulsed UV Light to control Salmonella on media petri dishes through manipulation of various treatment parameters

Kira Christian, Dr. Lamin Kassama, Manikanta Sri Sai Kunisetty, and Kaylyn Green

Mentor(s): Dr. Armitra Jackson-Davis

Department of Food and Animal Sciences

In the United States, 1 in 6 people are affected by foodborne illness. Salmonella is the second leading pathogenic microorganism that causes foodborne illnesses. In order to ensure that consumers remain safe, ways must be developed to control these pathogens in various food systems. Pulsed UV Light is an innovative and cost-effective technology that treats food products through the use of intense pulses of white light combined with short periods of time.

The objective of this study was to investigate the ability of Pulsed UV Light to control Salmonella on agar petri dishes through manipulation of various treatment parameters. Selective and non-selective agar petri dishes were prepared prior to the study. To accomplish them, microbiological strains were prepared by extracting Salmonella cells that were cultured on Tryptone Soya Agar. After inoculating the cells into TSB twice, the cells were separated by centrifugation at 8,000 rpm for 10 min. The cells were then rinsed using phosphate-buffered saline. The concentration was reduced further by adding 2 mL of the Salmonella cells to 40 mL of PBS. After this, 0.1 mL of the prepared cells were spread onto the media and treated using different treatment parameters. The treatment parameters utilized varying combinations of voltage, energy, number of pulses, and distance from the probe. After treatment, the plates were placed in the incubator for 24 h at 37℃ and then analyzed for survival of pathogens. The plates that were treated using 2 kV, 200 J/P, and 40 Pulses displayed a significant reduction in Salmonella. The study was repeated 3 times. The plates that were treated with a higher voltage displayed a small amount of microbial growth on both the selective and non-selective media.

Abstract # 514

Effect of Industrial Hemp (*Cannabis sativa*) on Plasma Antioxidant Enzymes of Beef Cattle

Nathaniel Ogunkunle, Simpson, M., Cebert, E., and Boateng

Mentor(s): Dr. Judith Boateng

Department of Food and Animal Sciences

Industrial hemp is a good source of antioxidants, it's usage is increasing in animal research. However, there is little information known about how it impact antioxidant enzymes in beef cattle. The objective of this study was to determine the effect of industrial hemp supplementation on antioxidant enzymes of Angus cattle. Twenty Black Angus heifers were completely randomized into control (CON: n=10, receiving commercial concentrates) and hemp (HEMP: n=10, receiving 30g of hemp in 200g of commercial concentrate) in a six-week trial, each group was replicated twice. Hay and water were offered ad libitum, 500g of experimental diets were offered 7:00a.m daily. Blood samples were collected on days 0, 7, 14, 21, 28, 35 of the experiment for enzymelinked immunosorbent assay(ELISA) using standard kits. Data were analyzed using GLIMMIX procedure for repeated measure in SAS 9.4 with Toeplitz as covariance structure while means were separated with Tukey at 5% alpha. There was significant ($p<0.05$) difference in plasma antioxidant enzyme activity with hemp group showing better antioxidant activity. In conclusion, industrial hemp improved plasma antioxidant enzymes, which could prevent oxidative stress and subsequently reduce inflammation thereby improving the health, performance and welfare of beef cattle.

ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Abstract # 515

Innovating Encryption with Transposition and Substitution Techniques

Kiana Stiles, Kiara Stiles, Nikara Taylor

Mentor(s): Dr. Ed Pearson

Department of Electrical Engineering and Computer Science

Our algorithm, named HOP CYCLE CIPHER, will be implemented using C++. It employs hopping methods to move one character forward or backward in the alphabet for encryption and decryption. For instance, given the plaintext "HELLO" and a key of 3, the algorithm will encrypt the message by hopping forward one character three times, resulting in "MJQQT". Decryption follows a similar process, hopping backward one character three times to retrieve the original message. The core idea is to advance or regress by only one character in each movement, ensuring a secure and efficient encryption process.

MECHANICAL AND CIVIL ENGINEERING AND CONSTRUCTION MANAGEMENT

Abstract # 516

Enhancing Hydrological Modeling in the Wolf Bay Watershed through Integration of Remote Sensing Data

Kayla Maclin, Maclin, K., and Preetha, P.

Mentor(s): Dr. Pooja Preetha

Department of Mechanical and Civil Engineering

Rapid advancements in remote sensing technologies offer unprecedented opportunities to enhance the accuracy and spatial resolution of hydrological models. This research builds upon prior investigations into the Wolf Bay Watershed's hydrological dynamics, particularly the calibration of groundwater flow and surface runoff using ArcGIS and SWAT. The current study focuses on enhancing predictive accuracy through the integration of remote sensing data, including satellite imagery. Our results indicate that baseline predictions between the USGS database and the SWAT model suggest a noteworthy increase in groundwater flow correlation within the watershed, rising from 41% to 76% between 2010 and 2020. By incorporating remote sensing data, we aim to refine these predictions, considering factors such as evapotranspiration, land cover changes, and precipitation patterns. In this research, we present watershed-scale predictions, demonstrating that average precipitation and evapotranspiration values with SWAT alone are 0.85 to 1.00 in, respectively. With the integration of remote sensing data, these values are refined to fitted value of 0.910 inches, showcasing the potential for improved accuracy through data integration and model enhancement The study not only addresses technical challenges associated with data integration but also explores the practical implications for water resource management and environmental conservation. Through a comprehensive analysis of both groundwater flow and surface runoff, this research contributes

valuable insights to the broader understanding of watershed dynamics. The findings hold significance for informed decision-making and sustainable practices in the management of water resources in the Wolf Bay Watershed and analogous ecosystems.

Abstract # 517

Use of Advanced Sensing in Hydrological Modeling to Understand Climate Change

Autumn Moore, Tyrrell, B., and Preetha, P.

Mentor(s): Dr. Preetha Pooja

Department of Mechanical and Civil Engineering

In today's global landscape, the phenomenon of climate change is manifesting through shifts in weather patterns, partially driven by alterations in the hydrologic cycle. To comprehend and respond effectively to these changes, remote sensing technologies are pivotal in generating datasets and examining crucial hydrological parameters such as soil moisture, precipitation, and snow water equivalent (SWE). While hydrological data can be obtained through various local measurements, gauge observations, and automatic recorders, the focus is increasingly shifting towards remote sensing techniques for their ability to provide comprehensive and accurate information. Remote sensing offers valuable insights for predicting hydrological processes, managing water resources, and mitigating the impacts of natural disasters and climate change. In this context, our research objectives entail pinpointing deficiencies in existing technologies and exploring emerging innovations to address current data gaps. In this research endeavor, we are forging partnerships with esteemed institutions such as the Massachusetts Institute of Technology: Lincoln Laboratory and the National Aeronautics and Space Administration (NASA). We aim to test and advance technologies to generate efficient remotely sensed data. This data will be instrumental in our ongoing efforts to proactively monitor and respond to the challenges posed by climate change. Through collaborative innovation, we aspire to develop cutting-edge solutions that empower us to stay ahead of the evolving dynamics of our planet's climate. The advancement of hydrological modeling will significantly improve our understanding of water systems and their interactions with the environment and society. By providing accurate predictions, informing decision-making, and guiding sustainable water management practices, these models will contribute to the resilience and well-being of communities and ecosystems worldwide.

PHYSICS, CHEMISTRY AND MATHEMATICS

Abstract # 518

Characterization of Cesium Hafnium Chloride Radiation Detector grown using Czochralski Method

Elijah Adedeji, and Angel R
Mentor(s): Dr. Stephen Babalola
Department of Physics, Chemistry and Math

The research is a pioneering attempt to grow a Cesium Hafnium Chloride (CHC) scintillator using a modified Czochralski (CZ) method and a novel ampoule. CHC is a novel scintillator, discovered initially as a luminescent material and re-invented as an attractive scintillator for gamma-ray detection. The scintillator has a cubic crystal structure and is almost non-hygroscopic, with highly proportional scintillation better than thallium-activated sodium iodide, NaI (Tl), and comparable to lanthanum bromide. Unlike many other scintillator crystals, it requires no doping to achieve a high light yield and high energy resolution.

The employed ampoule incorporates a rotatable borosilicate stir rod for the controlled descent, and introduction of the seed crystal into the crystal melt. An O-ring maintains a controlled atmosphere for the hygroscopic starter materials and the melt, producing hafnium vapor within the ampoule. A distinct ampoule design with gas lines to feed inert gas into the top of the ampoule was also tested. The grown crystals and a seed crystal of CHC are characterized using photoluminescence spectroscopy for comparative study.

~~~~ STEM 2024 ~~~~


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On behalf of STEM Day 2024 Planning Committee, the Chair and Co-Chairs would like to extend a big, heartfelt 'thank you' to all the sponsors, chairs and coordinators of the various units, for their dedication, support and encouragement to the faculty in the respective units without whom this event would be hard to visualize.

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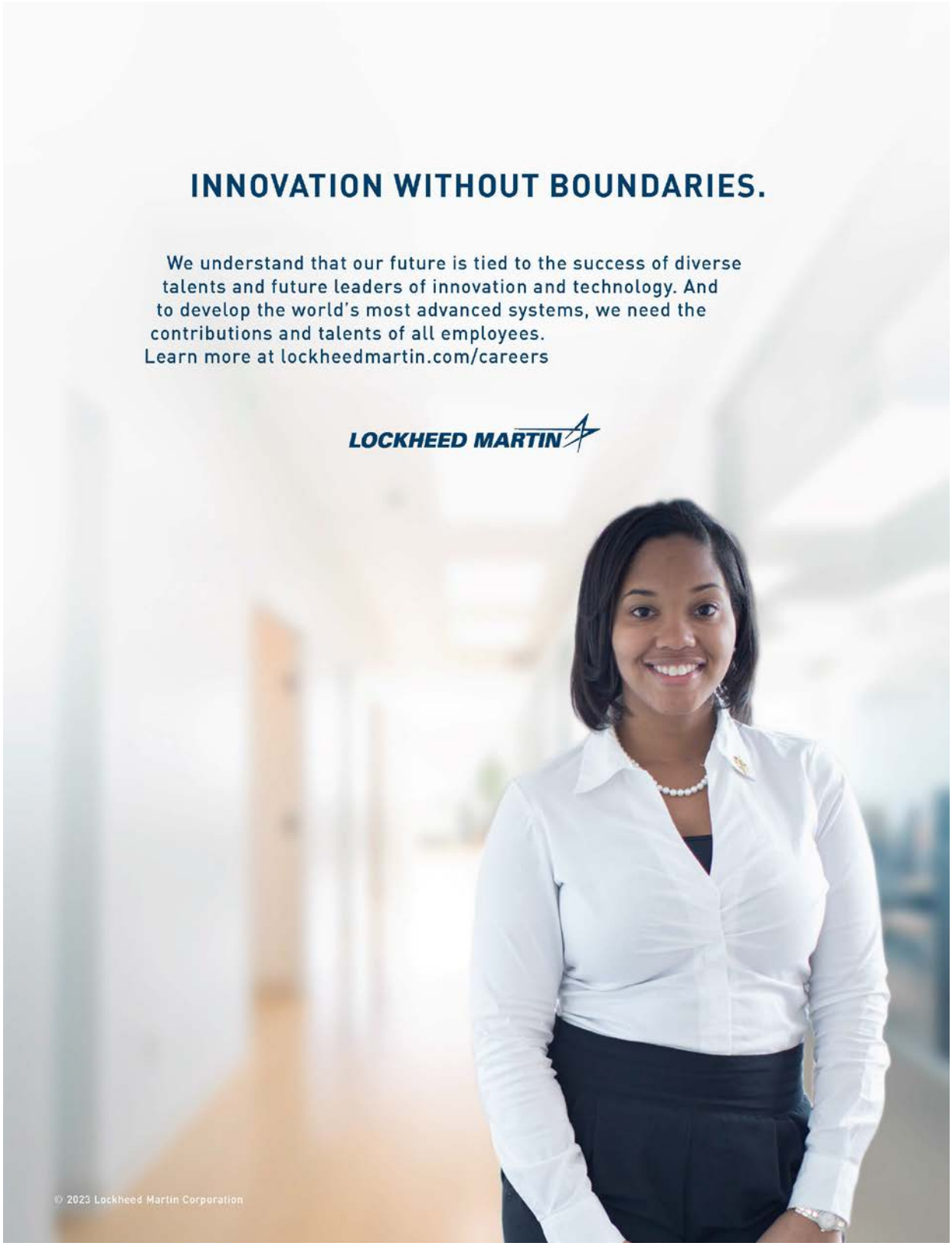
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