



PHYSICAL SCIENCES & ENGINEERING



ARTS & HUMANITIES



SOCIAL SCIENCES

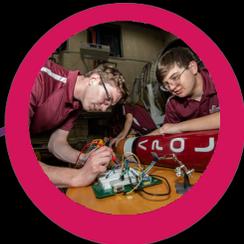


BIOLOGICAL SCIENCES & ENGINEERING



UNDERGRADUATE RESEARCH SYMPOSIUM SPRING 2020

APRIL 15
COLVARD STUDENT UNION



MISSISSIPPI STATE
UNIVERSITY™

JUDY AND BOBBY SHACKOULS
HONORS COLLEGE

Cancellation Notice

Given the unusual circumstances and recommended health precautions surrounding COVID-19, the Shackouls Honors College cancelled the Spring 2020 Undergraduate Research Symposium originally scheduled for April 15. This was done in accordance with Mississippi State University guidelines established during March 2020.

As a way to recognize the hard work of everyone involved, the booklet of submitted abstracts is available here. These abstracts represent research of over 230 undergraduate students who submitted on time and would have presented posters or papers if the event was held. This listing also indicates if students were accepted into specific competitions: Community Engaged Research; Public Health Research; or Thesis Research Competition (TRC). Much of the organization and planning of the event were months in the making so collected letters from sponsors are published as if the event was going to occur.

Kudos to our students and faculty mentors for their hard work and diligence in their research endeavors showcased here and wish them many happy discoveries and findings in their future! We also thank our sponsors for their promotion of this event and for their continued support for undergraduate research.

We hope you enjoy reviewing and reading about the exciting research MSU undergraduates have engaged in during this past 2019-2020 school year. We hope to see you next year in person for 2021 Spring Undergraduate Research Symposium.



**Anastasia D. Elder, Ph.D.
Interim Associate Dean for Undergraduate Research,
Shackouls Honors College**



MISSISSIPPI STATE UNIVERSITY™

JUDY AND BOBBY SHACKOULS HONORS COLLEGE

WELCOME

The Shackouls Honors College is pleased to sponsor the spring 2020 Mississippi State University Undergraduate Research Symposium. This event allows undergraduate students to showcase their hard work in research activities and for the MSU family to celebrate their engagement, dedication, and scholarship. Thank you for attending!

First, we would like to acknowledge that the posters and presentations would not be possible without the time, effort, and assistance of our dedicated faculty mentors. The student work presented here represents many hours of planning, analysis, discussion, and writing performed in conjunction with them.

Second, this event is an endeavor that relies on the support and sponsorship by many units. Prizes for academic areas are being partially supported by Phi Kappa Phi. The Shackouls Honors College has provided summer research support to some of the students presenting with additional funding from the Mississippi State University Office of Research and Economic Development and the National Strategic Planning & Analysis Research Center. In recognition of Mississippi State University's Carnegie Community Engagement Classification, the Undergraduate Research Symposium is pleased to be continuing to include a Community Engagement track in the spring symposium competition, sponsored by the Center for Community-Engaged Learning. There will also be separate competitions in Public Health Research, sponsored by the Department of Food Science, Nutrition, and Health Promotion, and a Thesis Research Competition, sponsored by the Graduate School. The Theta Tau Professional Engineering Fraternity will also recognize an undergraduate engineering student with the Tomorrow Builder Award.

Finally, we view the encouragement and support of undergraduate research and creative endeavors for all students to be part of our core mission as an institution of higher learning. These activities complement students' academic studies and preparation in a unique way by allowing them to dive deeply into important ideas and topics, paving the way for future intellectual work and exploration. Participating in undergraduate research is an exciting way for students to learn new skills, work closely with faculty mentors, meet others with similar interests, and engage in the intellectual culture of MSU in new ways.

We are delighted that you have joined us today to peruse the accomplishments of our young researchers and hope you learn much from the diversity of research activities underway at MSU. By the end of the event, we hope you have questioned old ideas, learned new things, were awed by innovative methods, or became inspired by discoveries. Enjoy!

Dr. Anastasia D. Elder

Associate Dean for Research, Shackouls Honors College
Professor of Counseling, Educational Psychology, and Foundations
Mississippi State University



MISSISSIPPI STATE
UNIVERSITY™

Mississippi State University: Our State's Land-Grant Research Flagship

We are honored to welcome you to Mississippi State University's Spring 2020 Undergraduate Research Symposium. Undergraduate students are an integral part of the multi-faceted research underway at Mississippi State.

Our faculty, staff, and students are conducting fundamental to applied research that provide innovative advancements, creative works, and new scholarship that address a range of pressing needs. As a result of this work, MSU is the leading institution in our state for research, which is a direct result of our embracing the land-grant mission. Strengths across all colleges and research centers have led to our institution being categorized by the Carnegie Foundation as a "very high research activity" institution. The Carnegie Foundation has also recognized Mississippi State with its Community Engagement Classification.

Pursuing research opportunities is a critical part of academic life on our campus, and our students are recognized for their commitment to discovery, creation, and exploration beyond the classroom. We are pleased that members of our faculty are dedicated to providing undergraduates with meaningful roles in the overall research enterprise, and promoting interdisciplinary research as an important component of scholarly activity.

Undergraduate research gives our students opportunities to apply classroom knowledge to new areas of interest and helps them develop skills, collaborate with faculty and peers, and gain confidence. It is exciting to see the results of their efforts on display at today's symposium.

Again, welcome to the symposium, and thank you for your contributions to and interest in research at Mississippi State University.

David R. Shaw, Ph.D.

Provost and Executive Vice President



MISSISSIPPI STATE UNIVERSITY™

OFFICE OF RESEARCH AND ECONOMIC DEVELOPMENT

Students Remain at the Core of MSU's Research Success and Impact

The Mississippi State Office of Research and Economic Development is proud to welcome you to the university's Spring 2020 Undergraduate Research Symposium. This event is a wonderful opportunity for students to showcase the exciting research they have been working on this year.

As a top-100 research university and a land-grant institution, MSU is committed to conducting groundbreaking research across many disciplines and using that knowledge to make an impact at the local, state, national, and global levels. Every day, students, faculty, and staff are making new discoveries in faculty labs, research fields, libraries, studios, and at MSU's more than 40 research centers and institutes.

One of the most exciting things about the university's diverse research portfolio is that boundless options exist for students in any major to get involved. Students can jump into ongoing projects that they find interesting and also use their creativity and passion to ask new questions and make their own world-changing discoveries.

Engaging with research is a tremendous way for students to apply what they have learned in the classroom and gain exposure to different academic and career paths. It also teaches critical skills like collaboration, drive and confidence.

All students presenting in this symposium have completed their work under the guidance of a faculty mentor. The university is proud of the way faculty connect with students to create meaningful, positive research experiences. These opportunities are important for students as they receive support from leaders in their fields, while these faculty gain fresh perspectives from the next generation of scholars.

Direct involvement of students in impactful, hands-on research, along with their preparation for exciting careers, ensures this university remains at the forefront of research and innovation in Mississippi and nationally. The tremendous impact Mississippi State has would not be possible without these dedicated students, many of whom are presenting here today.

Thankstoeveryoneofyouwhohassupportedthisterrificshowcase,andwehopeyouenjoythesymposium.

Julie Jordan, Ph.D.

Interim Vice President for Research and Economic Development



THE HONOR SOCIETY OF PHI KAPPA PHI

The Honor Society of Phi Kappa Phi (PKP) has a long and distinguished history. Currently, there are over 300 chapters of PKP scattered all across the world, from Maine to Hawaii and the Philippines, and from Alaska to Puerto Rico and beyond. During the 1996 – 97 academic year, PKP celebrated the 100th anniversary of the founding of The Honor Society of Phi Kappa Phi, and we are now in the second century of its recognition of- and service to - learning. The MSU chapter will celebrate its 70th year of membership next year. PKP invites only the highest achieving students from across all disciplines to join this prestigious society. Due to PKP's prestigious recognition and support of learning, the MSU Chapter is proud to also financially support the Spring 2020 Undergraduate Research Symposium in Griffis Hall at Mississippi State University. As President, I am honored that Phi Kappa Phi has been asked and is able to support this event as I have tremendous respect for undergraduate research at MSU. This symposium displays the importance of research for success as a student and beyond!

Thank you for all you do,

Dr. Scott Rush, MSU Chapter President



MISSISSIPPI STATE UNIVERSITY™

CENTER FOR COMMUNITY-ENGAGED LEARNING

In 2020, Mississippi State University was recognized by the Carnegie Foundation for its institutional commitment to community engagement through teaching, research, and public service with the Community Engagement Classification. Mississippi State University is one of 359 colleges and universities to achieve this elective classification. To support students, faculty, and staff involved in community engagement and engaged scholarship, Mississippi State University created the Center for Community-Engaged Learning (CCEL). One of CCEL's goals is to promote intentional opportunities for the advancement, production, and publication of research focused on the scholarship of engagement. The Community Engagement track of the Undergraduate Research Symposium is an avenue to highlight the work of students towards this goal.

Every day at Mississippi State University our students, staff, and faculty create partnerships with individuals and organizations beyond our campus to discover, develop, and disseminate knowledge that ultimately improves the learning, lives, and conditions of individuals and communities across Mississippi and around the globe. These mutually beneficial partnerships between external collaborators and Mississippi State University scholars are one of our university's greatest assets, and we applaud those involved in research that has the potential to change communities. If you are interested in learning more about community engagement, please reach out to Michelle Garraway at michelle.garraway@msstate.edu. She works each day toward helping Mississippi State University become a nationally recognized leader in community-engaged research, learning, and service.

Stephen Williams

Interim Director

Office of Student Leadership and Community Engagement



Dear Undergraduate Researcher,

Congratulations on your Undergraduate research and your participation in the Undergrad Thesis Research Competition! **We are proud of you!**

We commend you on your accomplishments. You have shown a commitment to research and creative discovery in your particular fields of study, an achievement worth recognition. As a researcher you are gaining valuable experience, whether it be theoretical or experimental, and you are helping to expand the body of knowledge in your field. You are exactly the sort of student we need in Graduate School at MSU! **We want you!**

These experiences can provide glimpses into the world of post-baccalaureate studies and can be beneficial when it comes time to apply for admission to graduate school. We strongly encourage you to continue your studies here at Mississippi State University. We assure you your work is being noticed. You should be very proud of what you have accomplished thus far in your academic careers.

If there is anything that we can do to provide information, contacts, or resources related to Graduate School, please visit the link below. **We are here to help you!**

<https://www.grad.msstate.edu/> (662)

325-7400

Best,

Brien Henry, Ph.D.

Associate Dean of the Graduate School
Mississippi State University



MISSISSIPPI STATE UNIVERSITY™
THE GRADUATE SCHOOL

Student Presenter

Student Presenter	Research Category	Project Number	Abstract Page #
Javad A'arabi	Biological Sciences and Engineering	022	17
Nada Abdel-Aziz	Arts and Humanities	008	17
William Acuff	Biological Sciences and Engineering	023	18
Peyton Anderson	Biological Sciences and Engineering	024	18
Daegan Appel	Physical Sciences and Engineering	122	19
Jessica Baldwin	Biological Sciences and Engineering	025	19
Spencer Barnes	Physical Sciences and Engineering	123	20
Benjamin Bartlett	Physical Sciences and Engineering	124	20
Mary Catherine Beard	Biological Sciences and Engineering	026	21
Charmaine Beluso	Physical Sciences and Engineering	125	21
Payton Billingsley	Biological Sciences and Engineering	027	22
Jourdan Blair	Biological Sciences and Engineering	028	22
James Blanche	Physical Sciences and Engineering	126	23
Ronni Brashear	Arts and Humanities	009	23
Frank Brinkley	Physical Sciences and Engineering	127	24
Jessica Browne	Social Sciences	181	24
J.C. Bryan	Social Sciences	182	25
Randa Byars	Arts and Humanities	001	25
Thomas Byrd	Physical Sciences and Engineering	128	26
Carter Cabe	Social Sciences	183	26
Stephon Calhoun	Physical Sciences and Engineering	129	27
Scott Camilleri	Social Sciences	184	27
Jamie Cantey	Biological Sciences and Engineering	029	28
Victor Carey	Biological Sciences and Engineering	030	28
Joy Cariño	Social Sciences	185	29
Giulia Carson	Social Sciences	186	29
Emily Chappell	Physical Sciences and Engineering	130	30
Kailey Clinton	Social Sciences	187	30
Ryan Cobb	Physical Sciences and Engineering	131	31
Cade Cockrell	Physical Sciences and Engineering	132	31
Tiffany Collins	Social Sciences	188	32
Darcey Collins	Social Sciences	189	32
Amber Cook	Biological Sciences and Engineering	031	33
Greg Cooper	Biological Sciences and Engineering	032	33
Mariah Corbell	Social Sciences	190	34
Sydney Cozart	Arts and Humanities	010	34
Desiree` Cunningham	Physical Sciences and Engineering	133	35
Samantha Curran	Biological Sciences and Engineering	033	35
Ajaya Dahal	Physical Sciences and Engineering	134	36
Chelsie Dahlgren	Biological Sciences and Engineering	034	36
Alex Davis	Arts and Humanities	011	37
William Davis	Physical Sciences and Engineering	135	37
Christopher Denney	Physical Sciences and Engineering	136	38
Amberly Dennis	Biological Sciences and Engineering	035	38
Krishna Desai	Arts and Humanities	002	38
Clayton Dickerson	Physical Sciences and Engineering	137	39

Student Presenter	Research Category	Project Number	Abstract Page #
Anna Dickie	Biological Sciences and Engineering	036	39
Alexis Dillender	Biological Sciences and Engineering	037	40
Olivia Dinep-Schneider	Biological Sciences and Engineering	038	40
Wellesley Dittmar	Biological Sciences and Engineering	039	41
Cameron Douglas	Social Sciences	191	41
Renordna Dukes	Social Sciences	192	42
Rachel Dykes	Biological Sciences and Engineering	040	42
Liam Elkington	Physical Sciences and Engineering	138	42
Hannah Ellis	Social Sciences	193	43
Madeline Enlow	Social Sciences	194	43
Madison Erwin	Social Sciences	195	44
Katie Evans	Biological Sciences and Engineering	041	44
Isidora Fereday	Biological Sciences and Engineering	042	45
Avery Ferguson	Arts and Humanities	003	45
Taylor Fikes	Arts and Humanities	012	46
Nicholas First	Biological Sciences and Engineering	043	46
Meredith Flamm	Biological Sciences and Engineering	044	47
Michael Folse	Biological Sciences and Engineering	045	47
Ashley Forwood	Social Sciences	196	48
Carly Foss	Physical Sciences and Engineering	139	48
Zoe Fowler	Physical Sciences and Engineering	140	49
Deonante Frazier	Biological Sciences and Engineering	046	49
Hannah Freeman	Biological Sciences and Engineering	047	50
Nathan Frey	Physical Sciences and Engineering	141	51
Sarah Frey	Biological Sciences and Engineering	048	51
Gabrielle Fuller	Physical Sciences and Engineering	142	52
Robert Fuller	Biological Sciences and Engineering	049	52
Anna Gamblin	Biological Sciences and Engineering	050	53
Daniel Garrity	Physical Sciences and Engineering	143	53
Deven Gill	Physical Sciences and Engineering	144	54
Lydia Glover	Biological Sciences and Engineering	051	54
Raven Gonsoulin	Biological Sciences and Engineering	052	55
Jessa Goodeaux	Biological Sciences and Engineering	053	55
Christine Grant	Biological Sciences and Engineering	054	56
Abigail Grantham	Physical Sciences and Engineering	145	57
Ashlyn Graves	Social Sciences	197	57
William Greer	Biological Sciences and Engineering	055	58
Brandon Grisham	Social Sciences	198	58
Utsaha Gurung	Biological Sciences and Engineering	056	59
Robyn Hadden	Biological Sciences and Engineering	057	59
Spencer Hagwood	Biological Sciences and Engineering	058	60
Ian Halbert	Social Sciences	199	60
Vaughn Hamill	Biological Sciences and Engineering	059	61
Taylor Hardy	Social Sciences	200	61
Turner Harrod	Physical Sciences and Engineering	146	62
Amanda Hayes	Social Sciences	201	62
Rhonda Hearn	Social Sciences	202	63
Alexis Hendrix	Social Sciences	203	63

Student Presenter	Research Category	Project Number	Abstract Page #
Benjamin Henkel	Physical Sciences and Engineering	147	63
Bailey Herring	Biological Sciences and Engineering	060	64
Bruce Hicks	Physical Sciences and Engineering	148	64
Caitlin Hidalgo	Biological Sciences and Engineering	061	65
Trace Hilbun	Biological Sciences and Engineering	062	65
Daniel Hill	Physical Sciences and Engineering	149	66
Rachel Hill	Biological Sciences and Engineering	063	66
Hailey Hodum	Social Sciences	204	67
Jessica Huffman	Social Sciences	205	67
Kierstynn Hunter	Social Sciences	206	68
Laura Ingouf	Social Sciences	207	68
Noel Irwin	Social Sciences	208	69
Ty Irwin	Physical Sciences and Engineering	150	69
Kaitlyn Jackson	Physical Sciences and Engineering	151	70
Abigail Jenkins	Biological Sciences and Engineering	064	70
Randi Jenkins	Biological Sciences and Engineering	065	71
Alexandria Johnson	Arts and Humanities	013	71
Jewel Johnson	Biological Sciences and Engineering	066	72
McKenzie Johnson	Arts and Humanities	014	72
Benjamin Jones	Physical Sciences and Engineering	152	73
Harrison Jones	Biological Sciences and Engineering	067	73
Marcus Jordan	Physical Sciences and Engineering	153	74
Allie Kerby	Biological Sciences and Engineering	068	74
Emily Knight	Biological Sciences and Engineering	069	75
Brady Kruse	Physical Sciences and Engineering	154	75
Alex Ladewig	Arts and Humanities	015	76
Taylor Ladner	Biological Sciences and Engineering	070	76
Spencer Lampkin	Physical Sciences and Engineering	155	77
Marisa Laudadio	Arts and Humanities	004	77
Heather Lee	Arts and Humanities	016	78
Mary Lee	Biological Sciences and Engineering	071	78
Samantha Lee	Social Sciences	209	79
Charles Lenoir	Social Sciences	210	79
Jacinda Leopard	Biological Sciences and Engineering	072	80
Margaret Loftin	Biological Sciences and Engineering	073	80
Marco Lopez	Physical Sciences and Engineering	156	81
Andrew Lowery	Biological Sciences and Engineering	074	81
H. Addison Lowery	Social Sciences	211	82
Elizabeth Lucas	Arts and Humanities	005	82
James Lucore	Physical Sciences and Engineering	157	83
BreAnna Lynch	Biological Sciences and Engineering	075	83
Elijah Magee	Biological Sciences and Engineering	076	84
Ali Marchant	Biological Sciences and Engineering	077	84
Randeep Reddy Marri	Social Sciences	212	85
Samantha Marshall	Arts and Humanities	017	85
Robert Matranga	Physical Sciences and Engineering	158	86
Conner McCartney	Physical Sciences and Engineering	159	86
Caleb McCreary	Biological Sciences and Engineering	147	86

Student Presenter	Research Category	Project Number	Abstract Page #
Byron McCullough	Physical Sciences and Engineering	160	87
Amye McDonald	Biological Sciences and Engineering	079	87
Meredith McLaurin	Social Sciences	213	88
Addison Meeks	Biological Sciences and Engineering	080	88
David Mees	Physical Sciences and Engineering	161	89
Kayla Mercer	Biological Sciences and Engineering	081	90
Abbie Metcalfe	Biological Sciences and Engineering	082	90
John Middleton	Biological Sciences and Engineering	083	91
Nathaniel Miller	Biological Sciences and Engineering	084	91
Julianna Mills	Physical Sciences and Engineering	162	92
Blaklie Mitchell	Biological Sciences and Engineering	085	92
Hannah Mizell	Social Sciences	214	93
Reagan Moak	Social Sciences	215	93
Cameron Moffat	Physical Sciences and Engineering	163	94
Zavion Moffett	Physical Sciences and Engineering	164	94
Drew Moran	Biological Sciences and Engineering	086	94
Nicole Moss	Social Sciences	216	95
Jacquelyn Mullins	Arts and Humanities	018	95
Rachel Nation	Biological Sciences and Engineering	087	96
Ashleigh Nicaise	Biological Sciences and Engineering	088	96
Luke Nichols	Biological Sciences and Engineering	089	97
Hailey Nickels	Arts and Humanities	019	97
Breana Norton	Social Sciences	217	98
Andrew Nuss	Biological Sciences and Engineering	090	98
Bohyun Park	Social Sciences	218	99
Allyson Parker	Arts and Humanities	020	99
Erin Parker	Biological Sciences and Engineering	091	100
Lauren Parker	Social Sciences	219	100
McKenna Patterson	Physical Sciences and Engineering	165	101
George Penniman	Social Sciences	220	101
Anna Persell	Social Sciences	221	102
Amy Pham	Biological Sciences and Engineering	092	103
Michael Pham	Physical Sciences and Engineering	166	103
Hannah Phillips	Arts and Humanities	006	104
Tyler Polderman	Physical Sciences and Engineering	167	104
Hannah Pray	Biological Sciences and Engineering	093	105
Katelyn Provine	Biological Sciences and Engineering	094	105
Delaney Reed	Social Sciences	222	106
Austin Reese	Biological Sciences and Engineering	095	106
Ramon Richardson	Physical Sciences and Engineering	168	107
Sarah Richardson	Physical Sciences and Engineering	169	107
Slater Richardson	Biological Sciences and Engineering	096	108
Mia Robertson	Social Sciences	223	108
Preston Robertson	Physical Sciences and Engineering	170	109
Ross Robertson	Physical Sciences and Engineering	171	109
Anastasia Rogers	Social Sciences	224	110
Thomas Rogers	Biological Sciences and Engineering	097	110
Britain Rohling	Physical Sciences and Engineering	172	111

Student Presenter	Research Category	Project Number	Abstract Page #
Anna Rourke	Biological Sciences and Engineering	098	111
Sommer Rush	Social Sciences	225	112
Erin Rushing	Biological Sciences and Engineering	099	112
Caroline Schaade	Biological Sciences and Engineering	100	113
Ella Schalski	Arts and Humanities	007	113
Hannah Scheaffer	Biological Sciences and Engineering	101	114
Samantha Seamon	Social Sciences	226	114
Chirantan Sen	Physical Sciences and Engineering	173	115
Katelyn Sette	Biological Sciences and Engineering	102	115
James Shaffer	Physical Sciences and Engineering	174	116
Katie Shearer	Biological Sciences and Engineering	103	116
Emily Sherman	Biological Sciences and Engineering	104	117
Matthew Shine	Physical Sciences and Engineering	175	117
Alex Shober	Physical Sciences and Engineering	176	117
W. Casey Siders	Biological Sciences and Engineering	105	118
Cheyenne Simmons	Biological Sciences and Engineering	106	118
Jacob Smith	Biological Sciences and Engineering	107	119
Eliza Strickland	Social Sciences	227	119
Jennifer Sublett	Biological Sciences and Engineering	108	120
Advaith Sunil	Biological Sciences and Engineering	109	120
Georgiana Swan	Social Sciences	228	121
Allyson Taylor	Social Sciences	229	121
Madison Taylor	Biological Sciences and Engineering	110	122
Landon Teer	Biological Sciences and Engineering	111	122
Mariat Thankachan	Physical Sciences and Engineering	177	123
Kimberly Thomas	Physical Sciences and Engineering	178	123
Brooklyn Thompson	Biological Sciences and Engineering	112	124
Emily Tingle	Social Sciences	230	124
Jessica Tomasi	Biological Sciences and Engineering	113	124
Luke Tucker	Biological Sciences and Engineering	114	125
Gracie Turbeville	Social Sciences	231	125
Alexis Turnipseed	Biological Sciences and Engineering	115	126
Natalene Vonkchalee	Biological Sciences and Engineering	116	126
Adam Wade	Biological Sciences and Engineering	117	127
Avery Walters	Social Sciences	232	127
James Warren	Biological Sciences and Engineering	118	128
Hayley West	Social Sciences	233	128
Sadie White	Biological Sciences and Engineering	119	129
Sydney Wicks	Social Sciences	234	129
Bayley Wilmoth	Biological Sciences and Engineering	120	130
Ethan Worch	Physical Sciences and Engineering	179	130
Ryan Yingling	Biological Sciences and Engineering	121	131
Amy Young	Social Sciences	235	131
Yongxin Yu	Arts and Humanities	021	132
Meilun Zhou	Physical Sciences and Engineering	180	132



MISSISSIPPI STATE UNIVERSITY™
DEPARTMENT OF FOOD SCIENCE,
NUTRITION AND HEALTH PROMOTION

MISSISSIPPI STATE UNIVERSITY™
DEPARTMENT OF COMMUNICATION



April 2020 marks the 25th annual celebration of National Public Health Week, a weeklong celebration designed to bring attention to the field of public health and the many ways that we can work to promote health and well-being within our communities and around the world. As part of MSU's National Public Health Week 2020 celebration, we are pleased to sponsor the Public Health Research Competition, which recognizes excellence in undergraduate research in public health-related fields.

Across the university, faculty, staff, and students are engaged in work with public health implications. Topics range from food security to mental health, environmental health, health communication, violence prevention, the built environment, and more. We are pleased to recognize the students at Mississippi State University who are conducting this important research. We would also like to thank the faculty mentors who support these students and the sponsors of this year's competition: the MSU Department of Food Science, Nutrition and Health Promotion; the MSU Department of Communication; and the Mississippi Public Health Association.

Congratulations, researchers!

Holli Seitz, MPH, PhD

Assistant Professor

Department of Communication and the Social Science Research Center



Theta Tau Professional Engineering Fraternity is a co-ed student organization that promotes service, professional development, and brotherhood. Our members are a diverse group from every major in the Bagley College of Engineering, and we strive to become the engineering leaders of the future. We are excited to support an individual in this year's research symposium to receive the Tomorrow Builder Award, which aims to recognize an engineering undergraduate student who uses their skills and research to help solve complex problems of critical importance to society.

Sponsored Symposium Competition Tracks

Community-Engagement Research Track Posters

Community engagement is defined as an activity that has an impact on the ability of individuals, groups, or organizations—either public or private—to achieve their intellectual, economic, and/or social goals. Community engagement projects also include activities that contribute to the development of a defined community, governmental initiative, and/or society-at-large within or outside of Mississippi.

The following undergraduate researchers were selected to participate in the Community-Engagement Research Track:

- Charmaine Beluso (125): D-SEA: The Underwater Depth Sensing Device for Standalone Time-Averaged Measurements
- Tiffany Collins (188): Inpatient Treatment Satisfaction
- Renordna Dukes (192): The Blind Side: Opioid Abuse at Home and Abroad
- Ashlyn Graves (197): The Impact of Dietary Quality on Academic Performance in College Students
- Utsaha Gurung (056): Effects of Banding and Camera Trapping on the Nest Success of Least Terns, Snowy Plovers, and Wilson's Plovers
- Jessica Huffman (205): Making a Mentor: A year two evaluation of professional development in engineering outreach
- Kierstynn Hunter (206): Bullying Behavior in Custodial Grandchildren vs Those Raised by Parents
- Laura Ingouf (207): Fish4Zambia: Exploring Household-Level Hunger Among Men and Women Engaged in Fishing Activities at Zambia's Lake Bangweulu
- Jewel Johnson (066): Biological Effects of Neonicotinoid Presence in Soil on the Small Hive Beetle
- Emily Knight (069): Comparison of Three Different Temperature Measurement Devices Among Difficult to Measure Foods in Child Nutrition Programs
- H. Addison Lowery (211): Risky Drinking in Children who Experienced Parental Physical Abuse: The Role of Coping Motives
- Addison Meeks (080): Advancing Canopy Reflectance-based Variable Rate Fertilizer N Application in Cotton with sUAS-RedEdge Camera Technology
- Reagan Moak (215): An Illness and Injury Simulation: Can Adolescent Health Promoters and Educators Learn Empathy?
- Anastasia Rogers (224): Teamwork and Team Building Strategies in Healthcare

Public Health Research Competition Posters

In celebration of National Public Health Week 2020, the Public Health Research Competition component of the Undergraduate Research Symposium is designed to highlight the important work that undergraduate students at MSU are doing in public health.

The following undergraduate researchers were selected to participate in the Public Health Research Competition:

- Nada Abdel-Aziz (008): Affordable Housing in the MS Delta
- William Acuff (023): Analysis of the Inhibitory Potency, Oxime-mediated Reactivation Profile, and Binding Characteristics of Metabolites of Phorate
- Peyton Anderson (024): Responses to Oxidative Stress in Beef Cattle
- Kailey Clinton (187): An Exploration of Perceived Opioid Misuse in Communities: Association with Demographic Characteristics
- Amber Cook (031): Accelerometer Cut Points for Adults with Down Syndrome
- Liam Elkington (138): Detection of Breast Cancer via Fractal Dimension of Tissue Microarray Samples
- Hannah Ellis (193): Differences in Illicit Prescription Stimulant Use Across ADHD Presentation Type
- Katie Evans (041): Efficacy of Carvacrol Against *Salmonella spp.* in Hummus at Refrigerated and Abusive Temperatures
- Nicholas First (043): Mosquito Surveillance using Salivary DNA
- Raven Gonsoulin (052): Transcriptomic and microscopy-based analyses of the effects of golgi alpha-mannosidase II inhibition on human hepatoma cell lines
- Christine Grant (054): Fabrication of Thermoresponsive Chitosan Gel as a Delivery Vehicle for Fosfomycin in the Treatment of Osteomyelitis
- Emily Knight (069): Comparison of Three Different Temperature Measurement Devices Among Difficult to Measure Foods in Child Nutrition Programs
- Taylor Ladner (070): Efficacy of Electrostatic Sprayed Chitosan Application to Reduce Spoilage and *Salmonella* on Catfish
- Caleb McCreary (078): Prediction of Oxygen Uptake from Accelerometer Output in Adults with Down Syndrome: Vector Magnitude vs. Vertical Axis
- Reagan Moak (215): An Illness and Injury Simulation: Can Adolescent Health Promoters and Educators Learn Empathy?

Public Health Research Competition Posters (cont.)

- Lauren Parker (219): Assessing the effects of universal school meals through the Community Eligibility Provision: A systematic review
- George Penniman (220): Partners in Crime: Comparing Dyadic vs. Individual Prosocial and Antisocial Responses to a Cyberball Paradigm
- Anna Persell (221): Prevalence and Consequences associated with Food Insecurity among Students at Mississippi State University
- Amy Pham (092): Development of Synthesis Strategies of Quinoline for Inhibition of HIV-Integrase
- Delaney Reed (222): Mindfulness tempers the relationship between conscientiousness and BPD symptoms
- Slater Richardson (096): Does Heart Rate Improve Prediction Of Oxygen Uptake From Hip Or Wrist Accelerometer Output In Adults With Down Syndrome?
- Samantha Seamon (226): Estimating the Economic Burden of Hypertension in Mississippi
- James Warren (118): Use of chondroinductive kartogenin to enhance microfracture-based repair of articular cartilage
- Hayley West (233): Hoarding and the Reasons for Clutter
- Sadie White (119): Comparison of four bacterial DNA extraction methods in poultry litter and fecal samples

Thesis Research Competition (TRC)

A competition that challenges undergraduate students to present a compelling verbal presentation of their research topic and its significance in just three minutes.

The following undergraduate researchers were selected to participate in the Thesis Research Competition (TRC):

- Javad A'arabi (022): A Novel Approach to Address Antibiotic Resistance in the Poultry Industry: Adopting Lactobacillus Species and Organic Acids as Alternative Treatments to Necrotic Enteritis
- William Acuff (023): Analysis of the Inhibitory Potency, Oxime-mediated Reactivation Profile, and Binding Characteristics of Metabolites of Phorate
- Payton Billingsley (027): To Wake or Not To Wake?
- Joy Cariño (185): Language Maintenance and Cultural Identity: Case Studies of Filipino Immigrant Families in Mississippi
- Kailey Clinton (187): An Exploration of Perceived Opioid Misuse in Communities: Association with Demographic Characteristics
- Liam Elkington (138): Detection of Breast Cancer via Fractal Dimension of Tissue Microarray Samples
- Avery Ferguson (003): "Conventional Romance and its Questioning of War in Graham Greene's *The End of the Affair* and Ian McEwan's *Atonement*"
- Hannah Freeman (047): Impact of Alternative Footwear on Lower Extremity Muscle Activation during Normal Gait, Unexpected, Alert and Expected Slips
- Raven Gonsoulin (052): Transcriptomic and microscopy-based analyses of the effects of golgi alpha-mannosidase II inhibition on human hepatoma cell lines
- Christine Grant (054): Fabrication of Thermoresponsive Chitosan Gel as a Delivery Vehicle for Fosfomycin in the Treatment of Osteomyelitis
- Brandon Grisham (198): Analyzing and Predicting Trends with Public Data from Online Communities
- Marcus Jordan (153): Design of a 6DOF Aerial Manipulator for Micro Aerial Vehicle Environmental Interactions
- Marisa Laudadio (004): Examining the intentional use of rhetoric in legal argumentation to advocate for system-wide foster care reform
- Rachel Nation (087): Impacts of Single and Mixed Tree Species Composition on Leaf Litter Decomposition Rates
- Amy Pham (092): Development of Synthesis Strategies of Quinoline for Inhibition of HIV-Integrase
- Delaney Reed (222): Mindfulness tempers the relationship between conscientiousness and BPD symptoms
- Ramon Richardson (168): Land Usage Correlation to Groundwater Quality
- Jennifer Sublett (108): A Changing World: Population Responses to False Environmental Signaling
- Emily Tingle (230): Grass Roots Organizing and Colorblind Ideology in Association with the Maintenance of White Womanhood
- Ryan Yingling (121): Mechanical Deformation Characteristics of Porcine Brain Tissue Enduring Cyclic Compressive Loading

Abstracts

022

Name: A'arabi, Javad

Major: Political Science

Faculty Advisor, Affiliation: Chinling Wang, Department of Basic Sciences

Project Category: Biological Sciences and Engineering

Other Competition(s): Thesis Research Competition (TRC)

A Novel Approach to Address Antibiotic Resistance in the Poultry Industry: Adopting Lactobacillus Species and Organic Acids as Alternative Treatments to Necrotic Enteritis

Necrotic enteritis (NE), caused by *Clostridium perfringens* (CP), is a re-emerging disease that costs a six-billion-dollar deficit to the global poultry industry. Low level usage of antibiotics added to animal feed (as a growth promoter) has been shown to be an effective measure to control disease. Due to the extensive belief of antibiotic-resistant bacteria transferring to humans, many poultry companies have removed growth promoters from poultry feed, resulting in an increased incidence of necrotic enteritis. Therefore, an alternative treatment without using antibiotics to treat this disease is critical for the survival/profitability of the poultry industry. *Lactobacillus* species have been shown to improve the gut integrity of humans and animals to compete against pathogens. The hypothesis was that the use of beneficial bacteria can inhibit the growth of harmful bacteria in the chicken gut. The objective of this study was to evaluate the effectiveness of probiotics bacteria, *Lactobacillus johnsonii* and *Lactobacillus salivarius*, to protect chickens against CP. In the experimental design, broiler chicks were divided into four groups: A) positive control, B) *L. Johnsonii* treatment, C) *L. salivarius* and D) negative control. Groups A to C were challenged with CP. The results showcased that the *L. johnsonii* or *L. salivarius* supplement did not protect birds against the CP challenge. Orally giving probiotics daily seems to introduce stress to the birds and increase the susceptibility of CP, resulting in higher mortality and intestinal lesions than the positive control group (challenged but no probiotics). The conclusion is that neither *L. johnsonii* nor *L. salivarius* protects chickens against the CP challenge. A different methodology of administering the probiotics to avoid stress to chickens, such as mixing in feed, water, or a mixture of beneficial bacteria and organic acids, should be considered for future studies.

008

Name: Abdel-Aziz, Nada

Major: Architecture

Faculty Advisor, Affiliation: Silvina Lopez Barrera, Architecture

Project Category: Arts and Humanities (Poster)

Other Competition(s): Public Health Research Competition

Affordable Housing in the MS Delta

The state of regional affordable housing reflects economic and social factors. Affordable housing in the Mississippi Delta is defined by population loss and lack of economic opportunity contributing to blight and an aging housing stock that is falling into disrepair and disfunction, with low rates of affordable new construction. This paper seeks to understand the local context and issues of affordable housing in the Mississippi Delta and to investigate global housing practices and strategies that could be applied in rural contexts. Publicly available data was investigated to understand the prevalent regional issues of poverty, economic stagnation and resulting effect on residents' wellbeing, health, as well as blight, aging and deterioration of the built environment. Existing literature was used to understand local issues affecting the availability and safety of housing stock, such as the lack of local code enforcement. To further understand the local context at a finer and historical scale, maps were created of a residential neighborhood to clarify the changing trends and history of housing and neighborhoods across multiple decades up to the present. After understanding local contexts, global practices and trends were examined, specifically the siting of affordable housing, citizen participation, and place-based design. Siting strategies specific to rural needs were contrasted with the current siting strategies of HUD and other government entities. Findings

suggests that some issues of affordable housing remain fundamental despite rural vs urban differences, with a large opportunity gap to be implemented in the Mississippi Delta such as place-based design and citizen participation. Recommendations center on strategies for enabling citizens to participate in the decision-making process and design of their built environments to remediate issues of current housing that is unresponsive to local culture and place.

023

Name: Acuff, William

Major: Biological Engineering

Faculty Advisor, Affiliation: Janice Chambers, Department of Basic Sciences, Center for Environmental Health Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Dr. Edward Meek, Dr. Steven Gwaltney

Other Competition(s): Public Health Research Competition, Thesis Research Competition (TRC)

Analysis of the Inhibitory Potency, Oxime-mediated Reactivation Profile, and Binding Characteristics of Metabolites of Phorate

Organophosphates (OPs), used as insecticides and nerve agents, pose a threat to humans because of their potency as inhibitors of acetylcholinesterase (AChE). The OP insecticide phorate is particularly toxic and could be used as a chemical weapon. Unlike similar OPs, phorate exhibits a delay in the appearance of toxic signs in laboratory rats. Phorate has a more complex metabolism than most OPs: activation to phorate-oxon (PHO), then PHO-sulfoxide (PHX), and then PHO-sulfone (PHS), which are increasingly more potent anticholinesterases. Additionally, PHO exhibits a different reactivation profile than the OP paraoxon (PXN) which is also a diethyl phosphate. Two hypotheses, that PHO is bioactivated to PHX and PHS in the brain, and that PHO utilizes an unorthodox ethoxy leaving group, could help explain these differences. Analysis of OP scavenger carboxylesterase inhibition in rat serum by phorate metabolites indicates poor inhibition efficacy by PHX as compared to PHO and PHS; this could support the hypothesis of an alternative leaving group. Computational modeling is used to further determine the plausibility of this hypothesis. Finally, oximes, like FDA-approved 2-PAM, can reactivate inhibited AChE, but 2-PAM is unable to penetrate the blood-brain barrier. MSU's novel substituted phenoxyalkyl pyridinium oximes (US patent 9,277,937) have been shown to reactivate inhibited AChE in the brain in animal tests. *In vitro* results showed levels of novel oxime AChE reactivation in rat brain preparations inhibited by PHO, PHX, or PHS that are comparable to those of 2-PAM. Initial *in vivo* results showed increased 24-hr survival compared to 2-PAM when novel oximes were administered following lethal doses of PHO in rats. MSU's novel oximes may lead to better protection from phorate poisoning. (Support: NIH R21 NS108954)

024

Name: Anderson, Peyton

Major: Animal and Dairy Sciences (Pre-Vet)

Faculty Advisor, Affiliation: Dr. Thu Dinh, Animal and Dairy Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Dishnu Sajeev, Chelsie Dahlgren, Paige Tipton, Daniel Rivera

REU/Research Program: Undergraduate Research Scholars Program

Other Competition(s): Public Health Research Competition

Responses to Oxidative Stress in Beef Cattle

Oxidative stress causes poor performance in animals and quality defects in meat. However, how animals respond to oxidative stress is not well understood. It was hypothesized that oxidative stress would decrease the antioxidant capacity and increase lipid oxidation in blood plasma. Therefore, the current study was aimed to monitor total antioxidant capacity (TAC), thiobarbituric acid reactive substances (TBARS), and glutathione peroxidase (GPX) activity in the blood plasma of beef cattle for 110 min after hydrogen peroxide injection. Five crossbred beef steers were injected with 20 mg of hydrogen peroxide per kg body weight intravenously through the jugular vein to induce oxidative stress. Blood was collected every 10 min from 0 to 110 min and processed to plasma. The plasma samples were analyzed for TAC (mM Trolox), TBARS (mM

malondialdehyde), and GPX ($\mu\text{M NADPH}/\text{min}$). Time-dependent patterns of biomarkers were observed, and the data collected was also analyzed by SAS 9.4 (SAS Institute Inc., Cary, NC), using a generalized linear mixed model with time as a repeated measurement factor. Animals produced clear biological responses post-injection. These responses had similar patterns, although the biomarker baselines varied. The TAC peaked every 10 to 20 min for each animal; however, averaging across five animals, no time difference was found ($P = 0.766$). The TBARS value peaked between 10 and 40 min or 60 and 100 min. Across five animals, the TBARS value was greatest at 90 min (21.93 mM; $P \leq 0.081$). Of the two animals analyzed for GPX, the enzymatic activity fluctuated every 10 min in the same pattern with peak activity of 178 to 184 $\mu\text{M NADPH}/\text{min}$ at either 40 or 60 min. Oxidative stress increased lipid oxidation. However, animals continued to remove oxidation products and synthesize antioxidants including enzymes as a response to oxidative stress.

122

Name: Appel, Daegan

Major: Computer Engineering

Faculty Advisor, Affiliation: Emily M. Willis, NASA, George C. Marshall Space Flight Center, EV44, Huntsville, AL

Project Category: Physical Sciences and Engineering

Co-Author(s): Joseph M. A. Feliciano

Utilizing ARTEMIS for Analysis of Lunar Plasma Environment to Compare with Existing DSNE Standard

The Design Specification for Natural Environments (DSNE) is a resource for crewed missions that documents essential parameters that define Earth's plasma environments. Dynamic plasma environments pose a significant threat towards the effectiveness of design and safety of a spacecraft. Electrostatic discharge resulting from the interaction of the spacecraft with the plasma environment can cause damage to surfaces and electrical components. The environment parameters defined in the DSNE are applied in spacecraft charging applications, such as Nascap-2k and SPIS. With the establishment of the new crewed missions and vehicles, such as the Orion capsule, SLS, and the Gateway, the focus is now on the Moon. To provide updated information about the Moon's plasma environment, the DSNE environment is being compared with data from the ARTEMIS pair of satellites. The essential pieces of data are the correlation between electron temperature, electron density, and altitude. By utilizing the SciPY scientific programming packages NumPY and Matplotlib, a graphical correlation of seven years of data (2012- 2018) is obtained to interpret the lunar plasma environment. Since there is great sensitivity of charging effects on any spacecraft, modular dockings, and EVA's, the DSNE standard must account for any significant discrepancy in the plasma environment. The analysis of ARTEMIS data will resolve whether an update of parameters in DSNE is required.

025

Name: Baldwin, Jessica

Major: Horticulture

Faculty Advisor, Affiliation: Lu Zhang, Department of Horticulture and Landscape Architecture, Oklahoma State University; Charles Fontanier, Department of Horticulture and Landscape Architecture, Oklahoma State University

Project Category: Biological Sciences and Engineering

Co-Author(s): Charles Rohla, Niels Maness

Comparison of Nut Growth with Heat Unit Accumulation for Pecans Planted in Different Geographical Locations in Oklahoma

While there are many native varieties of pecans in Oklahoma, many producers use Pawnee and Kanza due to their uniformity across trees and production yields. However, in the last three years the total yield across the state has dropped more than three million pounds. Scheduling irrigation, pesticide sprays, and preparing the orchard floor for harvest are all tied to how pecans develop into mature nuts and affect how they grow in any given year. The objective of this research was to find the correlation between heat units and pecan nut size to determine optimal spray application, fruit thinning, and harvest days for Pawnee across the state of Oklahoma to provide producers with accurate data. Nuts were collected at 6 locations across the state, placed into snack size Ziplock bags, then put into a cooler for optimum size preservation. Nuts were collected from 3 trees of each variety from the northern, eastern, western, and southern regions. A minimum of 10 nuts were collected

from each tree. 10 nuts were selected at random and measured in length, width1 and width2, weighed, and volumized. Each nut was measured with a digital caliper, then entered in an excel spreadsheet. Each nut was then cut down the middle to measure ovule expansion, then photographed. Heat units had a significant effect on pecan development. The more heat units accumulated, the more advanced the pecan nut. This correlation is important. However, with higher heat units in the south came higher humidity. This equates to more scab sprays. This project will continue to the next two growing seasons.

123

Name: Barnes, Spencer

Major: Computer Science

Faculty Advisor, Affiliation: Chaomin Luo, Electrical and Computer Engineering

Project Category: Physical Sciences and Engineering

A bacterial-foraging-based optimization algorithm for robot navigation

Bacterial foraging optimization algorithm (BFOA), inspired by the social foraging behavior of *Escherichia coli*, has been extensively utilized as a global optimization algorithm in many real-world applications. BFOA has significantly drawn the attention of researchers due to its efficiency in solving real-world optimization problems arising in several application domains such as control, robotics, and autonomous systems. The underlying biology behind the foraging strategy of *E. coli* is emulated in an extraordinary manner and used as a simple optimization algorithm. A bacterial-foraging-based optimization algorithm associated with developed vector-driven autonomous robot navigation is proposed in this project. The bacterial-foraging-based optimization algorithm is employed to guide an autonomous robot to reach goal with obstacle avoidance. As the robot plans its trajectory toward the goal, unreasonable path will be inevitably planned. A vector-based guidance paradigm is developed for guidance of the robot locally so as to plan more reasonable trajectories. In addition, square cell map representations are proposed for real-time autonomous robot navigation. In this project, both simulation and comparison studies of an autonomous robot navigation demonstrate that the proposed model is capable of planning more reasonable and shorter collision-free paths in non-stationary and unstructured environments compared with other approaches.

124

Name: Bartlett, Benjamin

Major: Electrical Engineering

Faculty Advisor, Affiliation: Ali Gurbuz, Signal Processing & Machine Learning

Project Category: Physical Sciences and Engineering

Gesture Recognition Using Spectrogram Analysis of Radar Data

Millimeter wave (mmWave) radar technology has become a staple in areas such as automotive autonomy due to its high frequency resolution in detecting objects and targets. Well known neural networks, such as ImageNet, You Only Look Once (YOLO) and the Region Convolutional Neural Network (R-CNN) use visual information for detection and classification. Unlike standard cameras, radars do not see objects in a visual format. A radar transmits a pulse of electromagnetic energy, and the reflections from the objects in front of the radar are received and processed to obtain range, angle and velocity information of targets. Due to the way a radar “sees” information in any given environment, there are no privacy issues like there are with visual information from a camera, and radar can work in dark and hostile weather environments. The lack of privacy invasion with a radar could help with the implementation of gesture recognition and body motion tracking in a more commercial or residential environment.

This project examines the analysis of time-frequency (spectrogram) data of simple hand gestures collected from a mmWave radar. Once the full dataset has been captured, signal processing is applied to extract the range and doppler frequency information over a preset amount of time from the data capture. Using the range and frequency information, time-frequency spectrograms can then be generated. The spectrograms are plotted using a color scale to show intensity changes in time, signifying specific signatures due to each gesture. Feature extraction can then be performed for an attempt on classification of the gestures. Frequency peaks as well as frequency values are the main features that can be extracted by hand, which can

greatly vary due to the gesture motion of a hand. Machine learning is used to perform classification of different hand gesture classes on the collected spectrogram images.

026

Name: Beard, Mary Catherine

Major: Biological Engineering

Faculty Advisor, Affiliation: Dr. Lauren Priddy, Department of Agricultural and Biological Engineering

Project Category: Biological Sciences and Engineering

Co-Author(s): Anna S. Rourke

Hydroxyapatite Coated Biodegradable Magnesium for Orthopedic Applications

Magnesium has recently been under investigation as an orthopedic implant material because of its biodegradability and similar mechanical properties to those of native bone. Pure magnesium degrades rapidly in an aqueous environment, such as body fluid, thereby eliminating the need for implant removal surgery in temporary implants (e.g. screws, pins). However, this degradation rate is faster than the rate of bone formation and can produce pockets of hydrogen gas that are difficult for the body to break down. Coating the surface of the implant may slow degradation and enable better osseointegration of new bone with the implant. Hydroxyapatite, the mineral component of bone, has been shown to improve osseointegration and biocompatibility of orthopedic materials. The goal of this study was to investigate the effects of hydroxyapatite coating on the degradation rate of pure magnesium. We hypothesized that hydroxyapatite coating would slow the degradation process of pure magnesium. Coated and uncoated magnesium disks (1" diameter) were immersed in cell culture medium at 37°C under gentle rocking, and surface characterization was performed at days 3, 10, 20, and 30 of degradation. Analyses included scanning electron microscopy to visualize the surfaces, and elemental mapping (calcium, phosphate, oxygen, and magnesium) and roughness scanning to quantify differences in surface chemistry and morphology, respectively, between the coated and uncoated groups. During the first three days of degradation, large increases in oxygen and decreases in magnesium were seen in the elemental composition of uncoated magnesium, while coated magnesium was relatively stable in elemental composition at all time points. At day 20, uncoated magnesium began to exhibit greater surface roughness than coated magnesium, suggesting that the coating reduced the pitting behavior commonly seen in the degradation of pure magnesium. This study demonstrates the potential for hydroxyapatite coating to modulate the degradation rate of magnesium and its alloys.

125

Name: Beluso, Charmaine

Major: Computer Science

Faculty Advisor, Affiliation: Curt Schurgers, UC San Diego Electrical and Computer Engineering Department

Project Category: Physical Sciences and Engineering

Co-Author(s): Alex Xu, Eamon Patamasing, Brian Sebastian, Eric Lo, Ryan Kastner, Liren Chen, Xuanyi Yu, Dan Sturm, and Robert Barlow

Other Competition(s): Community Engagement Research Track

D-SEA: The Underwater Depth Sensing Device for Standalone Time-Averaged Measurements

Access to accurate depth information is important for a wide variety of oceanographic science applications. For example, it is crucial in the creation of 3D models. Currently, divers are manually measuring the depth by using dive watches, but this method is inconsistent because of variable depth readings caused by changing wave heights and human errors. To combat these problems, we created the Depth-Sensor Enclosed Application (D-SEA) to automatically collect and average pressure data while displaying the calculated depth readings underwater. To use D-SEA, the user places it on top of the area of study to measure and gather the underwater depth readings over time. We are working on an affordable, waterproof prototype with a display that is readable underwater, an automatic transition between on and off states when submerged in seawater, and automatic data logging onto an SD card. From testing the recent prototype, results show that D-SEA lasted for weeks in the sleep state and days in the wake state while under depths of 4.40 meters.

027

Name: Billingsley, Payton

Major: Civil Engineering

Faculty Advisor, Affiliation: Eric Sparks, MSU Coastal Research and Extension Center

Project Category: Biological Sciences and Engineering

Co-Author(s): Matthew Virden, Nigel Temple

Other Competition(s): Thesis Research Competition (TRC)

To Wake or Not To Wake?

Wave energy is a major driver for coastal processes, such as erosion, sediment transport, and hydrodynamics. For this reason, it is important for wave energy to be considered in the process of site selection, design, and implementation of conservation and restoration projects. In areas influenced by boat wakes, “no-wake zones” have been established to protect sensitive shorelines, where vessels must pass at an idle speed. These zones are primarily marked with moored buoys, where approaching boaters will rapidly decelerate. It has been observed in the field that shorelines at the edges of these conservation zones will sometimes experience increased erosion after implementation of a no-wake zone. This research sought compare the wave heights caused by the abrupt stop of an approaching vessel to those caused by vessels cruising past at an uninterrupted speed. Waves were created by two vessels of different hull types, and wave heights were recorded at 10 hertz by pressure-sensor wave gauges arranged in 25-meter increments along a 75-meter length of shoreline. The results of this experiment showed that when a vessel rapidly decelerated, wave heights were consistently the same height, and occasionally higher, at the shoreline 75 meters away from the point of deceleration than heights measured when the same vessel cruised past at a consistent speed. These findings were unaffected by vessel hull type. The results suggest that no-wake zone buoys should be placed no closer than 75 meters to the protected shoreline, as waves caused by vessels decelerating to an idle speed will propagate at least that far. This test should be replicated with more wave gauges placed further down-shore from the point of deceleration, so that the results can better inform the positioning of no-wake buoys to effectively protect sensitive shorelines.

028

Name: Blair, Jourdan

Major: Biological Sciences

***Home Institution:** Louisiana State University

Faculty Advisor, Affiliation: Melissa Erickson, Pennington Biomedical Research Center

Project Category: Biological Sciences and Engineering

Co-Author(s): Christopher Axelrod, John Kirwan

Comparison of Recruitment Methods for the Lifestyle Intervention in Preparation for Pregnancy (LIPP) Clinical Trial

Clinical trials are used in biomedical research to determine the efficacy and tolerability of novel therapeutic strategies for disease treatment and management. The recruitment and retention of patients remains one of the most toilsome aspects of conducting a clinical trial. These difficulties are often underestimated, with 19% of clinical trials ended early due to a lack of recruitment [1], and 86% unable to reach recruitment targets within prespecified timelines [2]. Several factors contribute to trial recruitment success, including communication with the study staff, trial feasibility for the participant, and the trial protocol itself [3]. Here, we evaluated six recruitment methods used to enroll participants in a pregnancy and lifestyle intervention (LIPP) trial, including staff visits to potential participants’ medical appointments at Ochsner O’Neal, Ochsner High Grove, and Baton Rouge General Hospital, community outreach, the online recruitment service Trialfacts, and web screening through the Pennington website. Participant engagement rates for each recruitment method were obtained after arranging individuals into groups based on their stage of recruitment, and were as follows: Trialfacts 31.1%, Community Events: 18.7%, Ochsner O’Neal: 10.5%, Ochsner High Grove: 11.4%, Baton Rouge General: 0.9%, and Web Screening: 27.4%. Recruitment success was evaluated using enrollment percentages (Trialfacts: 41.7%, Community Events: 8.3%, Ochsner O’Neal: 8.3%, Ochsner High Grove: 8.3%, Baton Rouge General: 0%, Web Screening: 33.3%). The results of our analysis identified Trialfacts as the most effective recruitment method for this trial. This further emphasizes the growing importance of social media and technology in clinical trial recruitment success.

References:

- [1] Carlisle, B., Kimmelman, J., Ramsay, T., & MacKinnon, N. (2015). Unsuccessful trial accrual and human subjects protections: an empirical analysis of recently closed trials. *Clinical Trials*, 12(1), 77-83.
- [2] Kadam, R. A., Borde, S. U., Madas, S. A., Salvi, S. S., & Limaye, S. S. (2016). Challenges in recruitment and retention of clinical trial subjects. *Perspectives in clinical research*, 7(3), 137.
- [3] Huang, G. D., Bull, J., McKee, K. J., Mahon, E., Harper, B., & Roberts, J. N. (2018). Clinical trials recruitment planning: a proposed framework from the clinical trials transformation initiative. *Contemporary clinical trials*, 66, 74-79.

126

Name: Blanche, James

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Yu Lv, Aerospace Engineering; Davis S. Thompson, Aerospace Engineering

Project Category: Physical Sciences and Engineering

Hobby-King Pulse Jet Repair and Analysis

Pulse Jet engines have been around since World War II and have been a way to provide an engine with a large thrust to weight ratio while still having a relatively simple design. The current model of pulse jet that is available on campus for testing has fallen into disrepair. The purpose of this project is to repair the broken components on the pulse jet engine and then analyze certain parameters on the engine to evaluate the performance and compare against the design value. The repair for the engine resulted in extensive research on this model of pulse jet and the replacement of the reed valves located inside the engine periodically during testing. To begin the testing of the parameters for the engine a collection of sensors was placed around the combustion chamber and exhaust to collect data on pressure and temperature of the engine. A rolling platform device was then used for testing of the thrust of the engine. The testing potentially shows that the engine parameters match up to the ones given.

009

Name: Brashear, Ronni

Major: Art/Fine Arts

Faculty Advisor, Affiliation: Jenna Altomonte, Art

Project Category: Arts and Humanities (Poster)

Romanticization of Alcohol

My thesis uses the visual arts to critique the culture of alcohol consumption and abuse. Using affective painting methods, I permit the viewer to reach a point of mindfulness about the drinking community and how it affects our overall wellbeing. I engage my family's history of alcoholism and represent my physical and spiritual struggles against alcohol consumption. These experiences connect to culture of alcohol abuse affecting modern society and specifically critiques the social environments of college campuses.

Visually, I address the physical and psychological effects of alcohol abuse using the painting medium. Through my work, I will subvert and critique the romanticization of alcohol consumption affecting my collegiate peers. Physically and emotionally distressed figures will appear in my paintings, reflecting the consequences of over consumption. The paintings will confront the viewer with the truth behind the mirage of drinking. I challenge the audience to consider the question why we choose to continue consuming something that is obviously so harmful to us.

127

Name: Brinkley, Frank

Major: Mechanical Engineering

Faculty Advisor, Affiliation: Matthew Priddy, Mechanical Engineering

Project Category: Physical Sciences and Engineering

A Survey of Force Sensor Integration in Mechanical Engineering

With the demand for highly optimized systems, a clear understanding of loading characteristics on a design are necessary. The boundary conditions for complex surgical operations, such as minimally invasive spinal surgery, are not clearly understood and are difficult to simulate outside of the operating room. A better understanding of the load conditions experienced by surgical tools will help to create equipment tailored for their specific tasks. There are a variety of mechanical sensors used in industry to analyze loads applied to a system. From tractor-trailer weight stations to sensors measuring the loads on a human knee, mechanical sensors can be found in numerous applications across almost every industry. A literature review summarizing the types and uses of various mechanical sensors, such as strain gauges, linear variable differential transformers (LVDT), and load cells, in research as well as in industry practice has been performed. Since mechanical sensors such as strain gauges are designed to operate in specific environments, there are as many sensor options as there are possible applications. Because of this, selecting the proper sensor to accurately measure a desired load is critical. Using the information gathered in the literature review and standard industry practice, a decision tree based on typical boundary conditions and desired output has been developed to aid in the sensor selection process. The methods outlined in the decision tree are then implemented in a case study of integrating mechanical sensors into spinal cage implant instruments to better understand tool loads during a procedure.

181

Name: Browne, Jessica

Major: Agricultural Economics

Faculty Advisor, Affiliation: Seong Yun, Agricultural Economics; Matthew Interis, Agricultural Economics

Project Category: Social Sciences

Agricultural Land Use Changes and Terrestrial Ecosystem Services Valuation

The land in the Mississippi River Basin has a variety of land uses and land cover (urban, suburban, forests, agricultural land, etc.). Land use and land cover (LULC) change over time due to causes such as biofuel policies (Renewable Fuel Standard) and climate change. Land ecosystems provide services and disservices that benefit or harm people. These are referred to as ecosystem services. When land ecosystem services change, the benefit or harm to people can be measured in dollars. In this project, I conduct a comprehensive literature review to tabulate the estimated values of the ecosystem services bee pollination and bird watching from the literature. I seek to determine what dollar value estimates from the literature relating to organic land cover in the Mississippi River watershed region, how these values are measured, and how they could be categorized and combined to summarize the value of changing land cover. These estimates will be used in a meta-analysis to determine the value of ecosystem service changes resulting from biofuel policies and climate change. In this work, I summarize the types of ecosystem services and their estimated values currently existing in the literature and discuss challenges in maintaining pollinator and bird habitat facing land use and land cover changes.

182

Name: Bryan, J.C.

Major: Psychology

Faculty Advisor, Affiliation: Dr. Jarrod Moss, Psychology

Project Category: Social Sciences

Co-Author(s): Cati Poulos

Individual Differences in Cognitive Control and Base-Rate Sensitivity

The strategy that someone uses when attempting to solve a problem can have a tremendous impact on the time, required effort, and success at solving the problem. Prior studies suggest that strategies are altered due to the overall success rate of a given strategy (i.e., base-rate of success) as well as other cues that are predictive of problem-solving success (Lovett and Schunn, 1999). People that have higher base-rate sensitivity are better able to notice these underlying probabilities, leading to more effective strategy adaptation. Cognitive control, the ability to control one's attention, may affect base-rate sensitivity and therefore, how participants adapt their strategies. The current study examined if differences in base-rate sensitivity are related to differences in cognitive control. Participants completed the Building Sticks Task, in which base-rates of success and cue predictiveness were manipulated. Participants also completed two measures of cognitive control, the anti-saccade task and the AX Continuous Performance Task. Our findings suggest that people with higher cognitive control learn differently from their problem-solving experiences.

001

Name: Byars, Randa

Major: Communication/Communication Studies

Faculty Advisor, Affiliation: Melanie Loehwing, Communication; Brian Shoup, Political Science and Public Administration

Project Category: Arts and Humanities (Oral Presentation)

"I'm a Mac" "I'm a PC": The Narrative of Civic Involvement

Steve Jobs and Bill Gates have defined their careers using very different professional rhetorical styles, so we might expect that each would approach the task of delivering a university commencement address in a distinct way. Despite the diametrically opposed branding of their approaches to computing, their commencement speeches operate very similarly to fulfill both a commemorative and civic function. Jobs, at the Stanford University commencement address of 2005, focused on the importance of persistence and dedicating all effort to the cause that inspires an individual most. Gates, similarly, at Harvard commencement speech of 2007, focuses on using privilege for the solving of complex problems that affect those who do not have as much influence or capital and using all of the efforts an individual has to solve the most complex inequalities of the world. Walter Fisher's narrative paradigm offers a useful framework to assess and contrast the effectiveness of the narratives of these two commencement speeches and their successes and failures in involving the community around them and uniting, inspiring, and challenging the current communal atmosphere. This study engages research into narratives that inspire a community, including Beck (1994), Burns (2015), Gring-Pemble (2001), McClure (2009), Qvortrup and Nielsen (2019). The analysis of Jobs's and Gates's speeches show that while both use narrative probability—the facts and consistency of a story—they do not meet the standards of narrative fidelity—how the story “rings true” to the audience—which is a central concern of the commencement genre in particular (Agnew 2008; Bostdorff 2016). Ultimately, I argue that these speeches show how civic life goes far beyond voting in elections. It emerges and is confirmed, challenged, and engaged in communal settings. The commencement speech brings different political groups, religions, races, and socioeconomic classes together in one room to demonstrate true unity.

128

Name: Byrd, Thomas

Major: Computer Engineering

Faculty Advisor, Affiliation: Vuk Marojevic, Department of Electrical and Computer Engineering

Project Category: Physical Sciences and Engineering

Co-Author(s): Roger Piqueras Jover

CSAI: Open-Source Cellular Radio Access Network Security Analysis Instrument

This paper presents our methodology and toolbox that allows analyzing the radio access network security of laboratory and commercial 4G and future 5G cellular networks. We leverage a free open-source software suite that implements the LTE UE and eNB enabling real-time signaling using software radio peripherals. We modify the UE software processing stack to act as an LTE packet collection and examination tool. This is possible because of the openness of the 3GPP specifications. Hence, we are able to receive and decode LTE downlink messages for the purpose of analyzing potential security problems of the standard. This paper shows how to rapidly prototype LTE tools and build a software-defined radio access network (RAN) analysis instrument for research and education. Using CSAI, the Cellular RAN Security Analysis Instrument, a researcher can analyze broadcast and paging messages of cellular networks. CSAI is also able to test networks to aid in the identification of vulnerabilities and verify functionality post-remediation. Additionally, we found that it can crash an eNB which motivates equivalent analyses of commercial network equipment and its robustness against denial of service attacks.

183

Name: Cabe, Carter

Major: Biological Sciences

Faculty Advisor, Affiliation: Jarrod Moss, Psychology

Project Category: Social Sciences

Co-Author(s): Elijah Brown, Jaymes Durriseau

Understanding racial shooting bias using measures of attentional control

Prior research has shown that there is a reliable racial bias in shooting decisions, but it is unclear how the ability to control one's attention might allow people to mitigate this bias to make better decisions. Multiple measures of attentional control (Flanker task, Stroop task, and Antisaccade task) were used to examine the relationship between racial bias and attention. Using the First Person Shooter Task (FPST), Black and White targets were presented with and without guns in experimentally manipulated proportions (Correll, 2002). A Baseline FPST had Black and White targets be 50% armed. A High Control FPST presented White targets as 80% armed and Black targets 80% unarmed. It was expected that high attentional control would negatively relate to racial bias in the Baseline condition. In the High Control condition, high attentional control was expected to be associated with liberal shooting decisions against White targets and conservative shooting decisions against Black targets. Results showed no significant bias effect in the Baseline condition. However, racially biased shooting decisions in the High Control condition were significantly related to the Flanker and Antisaccade tasks. Unexpectedly, the Antisaccade and the Flanker tasks showed the opposite relationship to racial bias in shooting behavior. Additionally, the Stroop task did not show any relationship to bias. These findings suggest that these popular attentional control tasks have differential relationships to shooting bias.

129

Name: Calhoun, Stephon

Major: Building Construction Science

Faculty Advisor, Affiliation: Saeed Rokooei, Building Construction Science

Project Category: Physical Sciences and Engineering

Co-Author(s): Daniel Garrity

Improving Gender Disparity in Engineering and Construction (EC) through Exploring EC Female Students' Motivation

Inequality in gender for construction and engineering has been going on for decades. The number of women joining or in EC has shown an imbalance to the number of man counterparts. According to Isaacs, the lack of women in the construction industry are in common to the Engineering Profession. Also, it results in a lack of knowledge background and understanding of the profession. Isaac results in that women are enrolled in engineering to uphold approximately the same rate of skills as the men.

Within the last ten years, students have shown a growth in the ratio of women in the construction and engineering industries. Women Engineers were awarded 19.9 percent of all bachelor's degree award by engineering program 2015 and made up 21.4 percent of undergraduates enrolled in engineering. They received 25.2 percent of Masters' degrees and 23.1 percent of doctoral degrees (Yoder, 2015). There is still growing to do despite the rise in EC women if compared to other fields such as education and health service (74.t percent), financial actives (53 present), and information technology (39.2 percent).

The focus of women at Mississippi State University in the programs of construction and engineering impacted shown in the studies. The research aims to provide a better understanding of the factors that impact feme students when choosing majors in EC. Furthermore, the study intends to provide data to understand better influences, initiatives, and barriers for females in traditionally male-dominated professions. Women in the College of Engineering make up 19% of undergraduate students, and only 4% of graduate students and MSU's Building Construction Science Program have only 6%, female students.

184

Name: Camilleri, Scott

Major: Biological Sciences

Faculty Advisor, Affiliation: Dr. Mary E. Dozier, Psychology

Project Category: Social Sciences

Co-Author(s): Amy Young

The Association between Hoarding and Family Clutter in an Undergraduate Sample

Hoarding disorder is characterized by urges to save, difficulty discarding, and excessive clutter (American Psychiatric Association, 2013). Hoarding symptoms tend to start in adolescence and continue to worsen over the lifespan (Dozier, Porter, & Ayers, 2016). Older adults with hoarding disorder often report having had a family history of hoarding (Ayers & Dozier, 2015). Thus, the purpose of this study was to determine the rate of hoarding in an undergraduate sample and examine the association between hoarding severity and reported family clutter levels. Participants were recruited using the Psychology Research Pool at a large southern university ($N = 198$) and were administered an online survey. Participant age ranged from 18-48 ($\bar{x} = 20$) and was mostly female (70%). Participants reported a range of hoarding symptoms on the Saving Inventory-Revised (SI-R; Frost et al., 2004) ($\bar{x} = 33.5$, $SD = 10.6$, range 19-72) and 19% of participants reported clinically severe hoarding ($SI-R > 42$; Kellman-MacFarlane et al., 2019). Symptoms of anxiety and depression on the Patient-Reported Outcomes Measurement Information System (PROMIS; Cella et al., 2010) were significantly correlated with hoarding severity (both $ps < .05$), but when compared using a regression model, only anxiety symptoms predicted unique variance in the SI-R ($B = .30$, $SE = .10$, $p = .003$). Participants' ratings of their current hoarding severity was significantly correlated with their ratings of their primary caregivers' clutter levels on the Clutter Image Rating (CIR; Frost et al., 2008) ($r = .16$, $p = .03$), but not with grandparents' clutter (both $ps > .05$). Hoarding behaviors of a primary caregiver correlate with one's own clutter level. Future studies should involve social interaction, emotional relationships, and other factors from childhood that may influence hoarding behaviors.

029

Name: Cantey, Jamie

Major: Wildlife & Fisheries Science/Pre-Veterinary

Faculty Advisor, Affiliation: Peter Allen, Aquatic Sciences

Project Category: Biological Sciences and Engineering

Comparison of blood-oxygen binding affinity in channel and blue catfish

Fishes are closely adapted to environmental oxygen availability, which can change rapidly within aquatic environments due to changes in temperature, water-air mixing, and bioload or density of aquatic life. Catfish inhabit a wide range of habitats, with different species specialized to different habitat types. Channel *Ictalurus punctatus* and blue *I. furcatus* catfish offer an excellent example of interspecies differences in adaptation, living in overlapping ranges but specializing to different niches. Further, beyond ecological importance, both species are popular among recreational anglers and extremely important to the US aquaculture industry. Understanding the response of these species to environmental variability can aid in ecosystem and aquaculture management. Research shows channel catfish have greater hypoxia tolerance compared to blue catfish, although hybrids of both species have the greatest hypoxia tolerance. Hemoglobin, specifically its affinity for binding oxygen, is closely related to the environment a species is adapted to and an organism's capacity for environmental change. Therefore, we compared blood oxygen binding affinity in channel and blue catfish by developing blood oxygen-binding affinity curves. Both species were similar in age and size and were placed in a temperature-controlled recirculating aquaculture system. Using a sophisticated blood-oxygen binding system, blood collected from the caudal vein was used to measure the ability of both species to bind oxygen under a series of oxygen and nitrogen percentages, and with physiological relevant concentrations of carbon dioxide. Importantly, studying and evaluating blood-oxygen binding affinity can provide valuable insight into the environmental adaptability of both species, which has relevance for management of natural systems and aquaculture production

030

Name: Carey, Victor

Major: Agricultural Engineering Technology & Business

Faculty Advisor, Affiliation: Daniel Chesser, Department of Agricultural and Biological Engineering

Project Category: Biological Sciences and Engineering

Co-Author(s): Dr. Wes Lowe

Assessment of the Physical Properties and Flow Characteristics of Catfish Fingerling diets for use in the Oral ESV Vaccine Delivery System

The Oral ESC Vaccine Delivery System serves as the mechanism to administer a liquid *Edwardsiella ictaluri* vaccine to catfish fingerlings for the prevention of Enteric Septicemia in Catfish (ESC). The system coordinates and mixes the liquid vaccine suspension with a flowing stream of dry pelleted catfish fingerling diets at a targeted 100mL per pound of feed. Differences in system performance have been observed when utilizing various catfish fingerling diets, resulting in under or over application of the vaccine solution during vaccination operations. Since catfish fingerlings consume a relatively small amount of feed at each vaccination event, it is critical that vaccine uniformity and coverage be maintained to ensure effective vaccination.

The purpose of this study is to assess the physical properties and flowability of three commercially available feeds presently utilized for feeding catfish fingerlings: Delta Western Feeds shortcut pellet, Fish Belt Feeds mini-pellet, and Cargill micro-pellet catfish fingerling feed and to evaluate vaccine solution deposition at the pellet level for each of the three feed types. Characterized physical properties for each of the feeds utilized in this study were bulk density, particle size distribution, and moisture content. From largest to smallest, the average particle size distribution were as follows: Delta Western Feeds shortcut - 2.36 mm to 3.35 mm (98.02%); Fish Belt Feeds mini-pellet (2.00 mm to 2.36 mm) (93.30%); Cargill micro-pellet – 1.18 mm-1.40 mm (97.07%) and were determined to be significantly different for each of the three feeds ($P < 0.0001$). Observed mean average bulk densities were determined to be similar for Cargill Micro-pellet (0.5103 g/ml^3) and Fish Belt Feeds Mini-pellet (0.5135 g/ml^3); ($P > 0.7892$), and significantly different when comparing either feed type to Delta Western Feeds Shortcut (0.4377 g/ml^3); ($P < 0.0001$).

Moisture contents for each of the three feed types were determined to be significantly different and were observed to change by day, indicating moisture stratification in stored feed that could explain some of the observed variability in performance of the Oral ESC Vaccine Delivery System. Further performance evaluations to determine flow characteristics for each of the feed types and vaccine solution distribution at the pellet level are ongoing.

185

Name: Cariño, Joy

Major: English

Faculty Advisor, Affiliation: Dr. Ginger Pizer, English Department

Project Category: Social Sciences

Other Competition(s): Thesis Research Competition (TRC)

Language Maintenance and Cultural Identity: Case Studies of Filipino Immigrant Families in Mississippi

Around 3 out of 4 second-generation Filipino immigrants aged 6-15 in the U.S. spoke only English at home, according to a study based on the Integrated Public Use Microdata Samples (IPUMS) from the 2000 census (Alba et al. 2004). Second-generation Asian immigrant children overall had higher rates of only English speakers compared to Hispanics; among Asian immigrants, Filipinos had the highest percentage (76.3%). With the 2000 census statistics in mind, this project considers Filipino parents' and children's everyday language choices, languages attitudes, cultural identities, and how such factors relate to each family's language maintenance of heritage language, bilingualism, or shift towards only English.

This study consists of interviews and recorded family dinner conversations with five Filipino immigrant families who have children enrolled in a local public-school system in Mississippi. The children's ages ranged from 2-18, and the families' length of residence in the United States ranged from 2 to 28 years. Interviews, recordings, and the researcher's field notes were transcribed and analyzed to generate case studies on each family and to identify common themes relating to family language policy, language ideology, language attitudes, and cultural identity. These themes are discussed alongside implications for these families' language maintenance or cross-generational language shift.

186

Name: Carson, Giulia

Major: Psychology

Faculty Advisor, Affiliation: Gary L. Bradshaw, Psychology

Project Category: Social Sciences

Co-Author(s): Ashli Butler, Cheyenne Norman, Avery Douglass

Improving Undergraduate Participant's Motivation in Psychological Research

Undergraduate students participating in the Psychology Research Program often do so for extra course credit or as a requirement for their courses. This often times leads participants to complete research studies without accuracy. For example, undergraduates incorrectly answer the question "an inch is shorter than a yard." The current study examined different ways to motivate undergraduate participants to complete a task accurately. Participants were taken from Mississippi State University's Psychology Research Pool and were randomly assigned to each condition. The four conditions were control, social, feedback and delay. The control condition lacked any motivational factor. In the delay condition, participants were delayed a second each time they missed a question. In the feedback condition, participants were informed how well they were doing after each question and were given extra credit if they answered 90 percent of the questions correctly. In the social condition, participants would hear a beep for each incorrect answer.

Comparing the four conditions, as expected the control group had the lowest scores. The delay condition had the best performance with a 5% improvement over the control condition. The feedback and social condition groups fall between the scores of the control and delay conditions. The feedback condition improves beyond the control condition by 4% and the social condition by 2%. The lack of accuracy in the control condition reflects typical performance of poorly motivated undergraduates. In the social condition, individual differences and the number of participants present could be factors of how participants respond to the beep punishment. Participants may do better during the feedback condition because they

could be rewarded with extra credit. Finally, participants may be encouraged to perform best in the delay condition because of the delay experienced when a question is answered incorrectly.

130

Name: Chappell, Emily

Major: Chemistry

Faculty Advisor, Affiliation: Nicholas Fitzkee, Department of Chemistry

Project Category: Physical Sciences and Engineering

Co-Author(s): Kayla D. McConnell, Olivia C. Williams, Rebecca G. Manns

Understanding the Thermodynamics of Protein Binding to Gold Nanoparticles using Polarized Resonance Synchronous Fluorescence Spectroscopy and Dynamics Light Scattering

Gold nanoparticles (AuNPs) have unique properties that make them well suited to applications in drug delivery, biosensing, and catalysis. Such applications require exposure of AuNPs to biological fluids, where protein-nanoparticle interactions may adversely affect the intended AuNP function. Understanding the mechanism of protein-AuNP interactions is therefore important, and our goal in this work was to better understand how protein adsorption alters the behavior of the AuNP. We examined how citrate-capped 15 and 30 nm AuNPs behave when introduced to a dataset of six proteins. Using UV-Vis, fluorescence, and dynamic light scattering (DLS), we observe and measure the extent of protein binding to nanoparticle surfaces, as well as determine the binding affinity for each protein. In addition, we used polarized resonance synchronous spectroscopy (PRS2) in order to separate spectroscopic changes into contributions from absorbance and scattering. We find that nanoparticles scatter light in the 500-600 nm region, and the amount of scattering can be directly related to the size of the nanoparticle. As the concentration of protein introduced into the nanoparticle solution is increased, we find that the cross section also increases to a maximum that directly corresponds to the protein binding curves obtained from UV-Vis studies of binding. This increase also correlates with changes in the AuNPs hydrodynamic radius obtained through DLS measurements. Together, these data establish general protein-AuNP interaction parameters and highlight how proteins can influence AuNP behavior in biological fluids.

187

Name: Clinton, Kailey

Major: Biomedical Engineering

Faculty Advisor, Affiliation: Dr. David Buys Instructor, Department of Food Science, Nutrition, and Health Promotion; Dr. Mary Nelson Robertson, Department of Food Science, Nutrition, and Health Promotion

Project Category: Social Sciences

Co-Author(s): Mary Nelson Robertson, Laura H. Downey, Alisha M. Hardman, Holli H. Seitz, Je'Kylynn S. Steen, Amanda Stone, Daniel C. Williams

Other Competition(s): Public Health Research Competition, Thesis Research Competition (TRC)

An Exploration of Perceived Opioid Misuse in Communities: Association with Demographic Characteristics

Introduction: Prescription opioid misuse directly affects many Mississippians and the communities they live in. In 2017, an average of over 500,000 opioid dosage units were dispensed every day throughout the state of Mississippi. This research determined if there is an association between opioid misuse as a perceived community problem and demographic characteristics such as race, sex, employment status, and rurality.

Methods: 335 Mississippians, ages 30-59, participated in a 164 item online survey administered by Qualtrics that measured participants' perceptions of opioid misuse in their community and demographic characteristics.

Results: Survey findings indicate there is an association between rurality and opioid misuse perceived as a community problem (community problem) ($\chi^2(1)=5.82, p=0.02$), employment status and community problem ($\chi^2(1)=4.13, p=0.04$), and race and community problem ($\chi^2(2)=6.43, p=0.04$). Results demonstrate that a higher percentage of those who identified as rural, Black or African American, or unemployed view opioid misuse as not a problem in their community. No significant associations were found between other demographic characteristics and community problem.

Brief Discussion: The findings of this survey support previous literature findings which suggest there is an association between rurality, race, employment status, and opioid misuse perceived as a community problem. These findings are important for health care providers in Mississippi to know in order to provide adequate care to people who live in areas that are perceived to have a higher prevalence of opioid misuse. Health care providers can raise awareness through having discussions with their patients about opioids and alternative pain management methods to help prevent opioid misuse among Mississippians.

131

Name: Cobb, Ryan

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Dr. Yang Cheng, Department of Aerospace Engineering

Project Category: Physical Sciences and Engineering

Assessment of the Laguerre Method in Solving the Root Ambiguity of Angles-only Initial Orbit Determination

Initial orbit determination (IOD) is the process of defining the trajectory of an object in space using the minimally required number of observations of the object's position. A common form of this process is angles-only IOD, which uses three angular observations of two angles each (right ascension and declination) in order to completely define an object's orbit. Two famous mathematicians, Gauss and Laplace, independently developed formulations for angles-only IOD which both require solving an 8th order polynomial. This particular polynomial can have either three or one positive, real roots, all of which are valid solutions of the tracked object's state. It has been deemed impossible to determine which of the three roots corresponds to the actual satellite position without *a priori* information. This inherent ambiguity has remained a long-standing conundrum of astrodynamics since Gauss and Laplace first created their methods.

In a common astrodynamics text, the authors present a root-finding method created by Laguerre that is "assured" to converge to the correct root regardless of initial guess. This work attempts to assess the validity of that claim while also exploring other techniques for analyzing the angles-only IOD problem. A computer model was developed in order to simulate a statistically significant number of orbital cases over a wide range of altitudes, eccentricities, inclinations, and time between observations. This is in effect a Monte Carlo-type approach which helps determine under what orbital conditions the Laguerre method succeeds in finding the correct root. After numerous test runs, it is determined that the Laguerre method does not offer complete reliability in determining the correct root of the polynomial.

132

Name: Cockrell, Cade

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Jichul Kim, Department of Aerospace Engineering

Project Category: Physical Sciences and Engineering

Mobilization of CO₂ Sensor for Occupancy Detection

Energy efficiency has quickly become one of the world's largest concerns with worries of limited fossil fuel resources, pollution, and costly utility bills. With air conditioners being one of the largest energy consumption units installed in residential and commercial buildings, having control over them will significantly benefit businesses and potentially the average homeowner. Coupled with a CO₂ sensor, communication between an autonomous vehicle and the main air conditioner unit allows for smarter operation of air conditioning systems and will result in a more comfortable, energy efficient environment. Currently, to heat/cool a home or business large amounts of cool or hot air is dumped into rooms to achieve the desired temperature when there is a more precise way to allocate air being delivered from the unit. Attaching the CO₂ sensor to a vehicle can give a view of the CO₂ profile with spikes where humans are present. Mapping CO₂ values with the ground vehicle provides data that can be interpreted and used to control the A/C unit. Three dimensional maps are constructed to visualize the result of mobilizing the sensor as proof of identifying the presence of humans.

188

Name: Collins, Tiffany

Major: Social Work

Faculty Advisor, Affiliation: Dr. Angela Savage, Arts & Sciences - SW Meridian Campus

Project Category: Social Sciences

Co-Author(s): Samantha Beckham

Other Competition(s): Community Engagement Research Track

Inpatient Treatment Satisfaction

The purpose of this undergraduate project is to show the overall inpatient satisfaction of inpatient treatment in a facility in rural town in East Mississippi. The data collected was based on the Inpatient Consumer Survey and this facility is Joint Commission accredited. The data was collected based on these categories such as outcomes, dignity, rights, participation, environment, and empowerment. Clients are asked a few questions that relate to each of those categories to see how satisfied they were and what they were not satisfied with. The survey is used for quality improvement in patient care. The survey is given to the client to complete at the time of discharge.

The surveys are placed in the "patient advocate suggestion box" or sent directly to the patient advocate's office. Then the data is sent to the National Association of State Mental Health Program Directors Research Institute on a monthly basis. The inpatient treatment facility mission is to provide the highest level of healthcare services through integrated behavioral health programs. Their vision is to improve health, wellness, and quality of life for those with mental disorders. The inpatient treatment facility partners with a coordinated network of recovery-oriented community based services and is person-centered to build on strengths and resilience of consumers. This project was completed in collaboration with a community partner in South Mississippi.

189

Name: Collins, Darcey

Major: Forestry/Forest Management

Faculty Advisor, Affiliation: Joshua Granger, Forestry Department

Project Category: Social Sciences

Co-Author(s): Clayton Hale, Stephen Grado, Marc Measells, Thomas Matney

Hunting Activities of Forestry Undergraduates in Mississippi

The number of hunters and hunting activity days in the United States has continued to decline relative to population growth. In 1995, a survey was developed to collect annual hunting-related data every Fall semester from undergraduate students enrolled in the Forest Recreation Management course within the College of Forest Resources at Mississippi State University. Primary study objectives were to determine what portion of students participated in hunting, measure hunting activities, and compare this subset to national and state trends. Specific issues explored included number of hunting days, hunting locations, and species preference. From 1995 to 2019, 88% ($n = 1,099$) of the students enrolled in the course participated in the survey. Of those surveyed, 78% hunted ($n = 860$) and 22% did not hunt ($n = 239$). The mean number of hunting days ranged from 88.2 days in 2002 ($n = 31$) to 13.5 days in 2018 ($n = 58$), with an overall average of 38.1 activity days. There were roughly 2.8 activity days on private lands for every day on public lands. White-tailed deer (*Odocoileus virginianus*) was the species of preference, followed by eastern wild turkey (*Meleagris gallopavo*). On public lands, the highest number of activity days occurred on National Wildlife Refuges (7%). On private lands where fees were charged, the highest number of activity days occurred on leasing arrangements with private landowners (15%). On private lands where no fees were charged, the highest number of activity days was on nonindustrial private lands (50%). The results also indicated student hunting days have remained constant over the past 25 years, while the national average has continued to decline relative to population growth.

031

Name: Cook, Amber

Major: Biological Engineering

Faculty Advisor, Affiliation: Stamatis Agiovlasis, Kinesiology

Project Category: Biological Sciences and Engineering

Co-Author(s): Natalie L. King, Poram Choi, Supreete Ghosh, Fabio Bertapelli

Other Competition(s): Public Health Research Competition

Accelerometer Cut Points for Adults with Down Syndrome

Past research has indicated that the relationship between energy expenditure and accelerometer output is different between adults with and without Down syndrome (DS). This suggests a need for DS-specific cut-points for determining levels of sedentary behavior and physical activity (PA) from accelerometer output for adults with DS. The purpose of this study was to develop accelerometer output cut-points for sedentary behavior and moderate and vigorous intensity PA for adults with DS. Sixteen adults with DS (6 women; age 31 ± 15 years) performed 12 tasks: sitting; playing app on tablet; drawing; folding clothes; sweeping; fitness circuit; moving a box; basketball; standing; and walking at the preferred speed and at 0.8 and 1.4 $\text{m}\cdot\text{s}^{-1}$. We measured the rate of oxygen uptake with portable indirect calorimetry and expressed it in Metabolic Equivalents (METs). Output from a triaxial accelerometer (wGT3X-BT, Actigraph) worn on the non-dominant hip was determined as Vector Magnitude. Receiver Operating Characteristic (ROC) curves were used to identify Vector Magnitude cut-points for sedentary behavior and moderate (3.0 – 5.99 METs) and vigorous (≥ 6 METs) intensity PA. Overall performance of classification was assessed with the area under the ROC curve. Optimal cut-points maximizing sensitivity and specificity were selected based on Youden's index. Area under the ROC curve was high for all models: (a) sedentary behavior (0.96; 95% CI: 0.93 – 0.98); (b) moderate intensity PA (0.92; 95% CI: 0.88 – 0.96); and (c) vigorous intensity PA (0.92; 95% CI: 0.85 – 0.99). The optimal Vector Magnitude cut points were: (a) sedentary behavior ≤ 236 counts $\cdot\text{min}^{-1}$ (sensitivity 0.98; specificity 0.90; Youden's index 0.88); (b) moderate-intensity PA ≤ 2167 counts $\cdot\text{min}^{-1}$ (sensitivity 0.99; specificity 0.82; Youden's index 0.81); and (c) vigorous-intensity PA ≥ 4200 counts $\cdot\text{min}^{-1}$ (sensitivity 1.00; specificity 0.84; Youden's index 0.84). This study offers the first DS-specific accelerometer output cut-points for classifying sedentary behavior and PA intensity in adults with DS.

032

Name: Cooper, Greg

Major: Chemistry

Faculty Advisor, Affiliation: Colleen Scott, Chemistry

Project Category: Biological Sciences and Engineering

Synthesis of 3,6-Substituted Diketopyrrolopyrrole (DPP) for Optoelectronic Applications

N,N'-dialkyl diketopyrrolopyrrole (DPP) is one of the most commonly used moiety in organic electronic devices such as organic field effect transistors (OFETs) and organic photovoltaics (OPVs). Furthermore, DPP is utilized in organic light-emitting diodes (OLEDs) as well as fluorescent probes due to its distinguished fluorescent properties. The conventional synthesis of DPP can only give aromatic flanked DPP compounds; consequently, limiting molecular structure design in the real applications. Herein, a new and more efficient synthetic approach is presented, which uses readily available starting materials under mild reaction conditions. Moreover, this approach allows us to achieve a wide variety DPP compounds with varying substituents at 3 and 6-positions and those attached to the N atoms. Consequently, a molecular structure design by this approach extends beyond what can be obtained by the conventional synthesis leading to a broader applications for DPP materials. We will report our results from the synthesis and the developments toward new optoelectronic materials.

190

Name: Corbell, Mariah

Major: Psychology

Faculty Advisor, Affiliation: Dr. Arazais Oliveros, Psychology Department

Project Category: Social Sciences

Co-Author(s): Deepali M. Dhruve, B.S.

Intergenerational Transmission of Psychological Aggression Victimization in Same-Sex Parent-Child Dyads: Role of Parental Emotional Availability

Research supports a positive association between children's exposure to interparental violence and subsequent intimate partner violence (IPV) as adults (Oliveros & Coleman, 2019). Sometimes termed intergenerational transmission, this transfer has been attributed to role-modeling of aggression by same-sex parents (Wood & Sommers, 2011). Further, parents' emotional availability (PEA) tends to decline in IPV contexts, (Visser et al., 2016), and low PEA during childhood is associated with later difficulties in intimate relationships (Cascio et al., 2017; Paradis & Boucher, 2010). Victimization also often overlaps (i.e., bidirectional IPV; Bates, 2016), but it tends to receive less attention (Stith et al., 2000). Thus, the current study examined intergenerational transmission of psychological IPV victimization (PIPVV) between same-sex parent-child dyads and the role of PEA in amplifying (moderating) or explaining (mediating) transmission. Participants were 160 undergraduate students who completed the following measures online: Revised Conflict Tactics Scale (Straus et al., 1996), Lum Emotional Availability of Parenting Scale (Lum et al., 1996), and Abuse within Intimate Relationships Scale (Borjesson et al., 2003). We used the PROCESS macro (Hayes, 2013; models 1 and 4) to examine the role of PEA in the relation between witnessing parental PIPVV and later adult PIPVV. As hypothesized, PEA moderated the association between PIPVV exposure history and adult victimization, particularly at low levels of PEA, but only for mother-daughter dyads ($b = 0.01$, $SE = 0.01$, $p < .05$). Among father-son dyads, PEA predicted PIPVV, but moderation was not significant. Mediation models were not significant for either dyad. Simple effects show that at low PEA, as ratings of witnessing past parental PIPVV increase, ratings of current PIPVV decrease. Daughters who self-reported low PEA may not have felt as emotionally close to their parents, and in turn may have been less likely to identify with the victim. The findings suggest that daughters who have witnessed PIPVV against their mothers could benefit from social support external to the family nucleus.

010

Name: Cozart, Sydney

Major: Art/Fine Arts

Faculty Advisor, Affiliation: Dr. Jenna Altomonte, Art

Project Category: Arts and Humanities (Poster)

Exploring the Uses of Rotoscoping in 2D Animation

For my senior thesis project, I am developing a 2-minute traditionally-animated film inspired by the book series, *Throne of Glass*, by Sarah J. Maas. My poster will depict stills of my in-progress animation, as well as provide an overview plan of my thesis work.

I am proposing a research component with the film. I wanted to see if a specific process would help to keep my characters consistent from frame to frame, as well as to quickly establish an environment. This process, called *rotoscoping*, can be described as "tracing over" a frame of live action film or reference. This results in keeping the overall human proportions and pose of the figure/character true to real life - as well as keeping those volumes consistent with every consecutive frame. This process was used extensively by animation studios, like Disney, since the 1930s.

For my film, I drew each "important" pose of each figure's action - those poses that help get the point of the acting or the action across, the arcs, and the timing. Each pose was interpreted as a gesture drawing, NOT a tracing, to keep the movement and fluidity of the human figure. To conclude this process, I connected the main drawings to each other - using more drawings called *in-betweens* - from references and techniques learned from figure drawing practice.

To conclude my research - once I started actually animating the characters in the film - I realized something right away. I have discovered that rotoscoping is VERY limiting to the animator, even tracing just the important poses. It also takes the

fun out of animating - there's really no improvisation - the squash and stretch, the fluidity, is gone, and I want to show what I have learned in this endeavor.

133

Name: Cunningham, Desiree`

Major: Geosciences/Professional Geology

Faculty Advisor, Affiliation: Dr. Kelsey Crane, Geosciences

Project Category: Physical Sciences and Engineering

Structural analyses of fold-related thrust fault zones, Ocoee, TN

Faults are geologic structures typically represented in sketches and diagrams as tilted surfaces. Thrust faults are surfaces where rock blocks above the surface slide up relative to the rock below. This movement is caused by strong horizontal compressional stresses, and layers of rock near the fault may respond to these stresses by bending instead of alongside breaking. A fold is a set of bent beds. Although thrust fault surfaces are typically represented as simple planes, we observe the thrust faults in our field area to be intimately tied to folding, with rock deforming through folding within a zone of deformation called a fault zone. Conceptual models of fault zones are characterized by decreasing and uniform grain size and preferred grain orientation nearing the fault surface. However, we propose that faults in the presence of folds affect the surrounding lithology by altering the fault zone which can be seen on the outcrop scale and visualized through three-dimensional modeling. By bending, folds are able to accommodate stresses imposed on rock units, resulting in less movement along the fault surface and smaller fault zones. We study a fault zone characterized by folding through field analysis and modeling. In the field, we observed many thrust faults and their respective fault zones, described, sketched, and photographed these zones, measured orientation, and described the rock composition. Detailed pictures were imported into Agisoft modeling software and used to produce 3D outcrop models which were then transferred to Move, a structural geology modeling software. Move will be used to map the fractures, folds, and faults. Work presented here will describe the fault zone of fold-related faults using a fracture density map and produce a map of the fold fault zone. Results may have potential benefits in the petroleum industry because folds and faults act as natural oil and gas traps.

033

Name: Curran, Samantha

Major: Biochemistry

Faculty Advisor, Affiliation: Dr. Shien Lu, Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology

Project Category: Biological Sciences and Engineering

Characterization of antifungal activity of endophytic bacteria of soybean against the charcoal rot pathogen

Macrophomina phaseolina

Antimicrobial bacteria can protect plants from infection of pathogenic fungi such as *Macrophomina phaseolina*, a fungus that is known to cause charcoal rot disease in soybeans. Looking at Mississippi alone, this disease plays a large role in the recorded increased death toll among soybeans. Currently endophytic bacteria are being isolated from both soybean plants infected with charcoal rot disease as well as healthy plants to determine their antimicrobial activity against *Macrophomina phaseolina*. To achieve this, an initial bioassay screening was performed to demonstrate antifungal activity on both nutrient broth yeast extract agar (NBY) as well as potato dextrose agar (PDA). The isolates demonstrating the ability to inhibit the growth of *Macrophomina phaseolina*, testing positive for antifungal characteristics, further bioassays will be used to evaluate the antifungal spectra of the bacterial isolates. These bacterial isolates will then be cultured in NBY broth for DNA extraction which allows for further use in polymerase chain reaction (PCR) using 16s primers, 27F and 1492R. Subsequently, 16S rDNA sequence analysis will be performed on the bacterial isolates to ultimately determine the genus to which the isolates belong to. Further determination of taxonomic position can be conducted using specific PCR primers exclusive to the identified bacterial genera. Phylogenetic analyses can then be performed on the resulting sequences to determine the identities of the antifungal bacterial isolates. Overall, the data collected will provide insight towards the development of biologically-based management of plant diseases in hopes of reducing yield loss of crops.

134

Name: Dahal, Ajaya

Major: Computer Engineering

Faculty Advisor, Affiliation: Dr. John Ball, Electrical and Computer Engineering

Project Category: Physical Sciences and Engineering

Using Deep Learning to identify road lanes

The automotive market is moving toward higher levels of autonomous vehicles. Enabling technologies such as LiDARs, radars and low-cost cameras, as well as powerful graphical processing units (GPUs) and the explosion of deep neural networks ability to learn from data and provide results has propelled these efforts forward at a rapid pace. One item required for automotive autonomy is identifying road lanes, which is fairly easy for human drivers but very challenging for computers to do. The project's objectives are to (1) perform a scholarly literature review on road lane detection, (2) investigate deep learning architectures for performing lane detection, (3) implement a state-of-the-art method from the literature, (4) implement a custom method to try and outperform the state-of-the-art methods in literature. using existing datasets (Waymo, data collected at MSU), and (5) evaluate the performance and document the results in a final report and conference paper.

Data has collected using the PI's LiDAR, stereo cameras, global positioning system (GPS), and inertial measurement units (IMUs) in and around the Starkville area, in various times of day and weather conditions. This data, along with publicly available Waymo dataset, will be used to test and evaluate current algorithms and the proposed method. Another novel contribution will be an examination of rural test cases, e.g. test cases where the road markings are poor or even non-existent (e.g. gravel roads). Compared with the traditional models of shallow computational structures, one essential advantage of deep nets is that the data representations are constructed in the learning process automatically. Therefore, deep neural networks are often considered to be capable of end-to-end learning, emphasizing that manual feature construction is replaced by automatic representation learning. "However, automatic data representation deals with the input end of processing" (IEEE Deep Neural Network for Structural Prediction and Lane Detection in Traffic Scene).

034

Name: Dahlgren, Chelsie

Major: Animal and Dairy Sciences (Pre-Vet)

Faculty Advisor, Affiliation: Thu Dinh, Animal and Dairy Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Dishnu Sajeev, Peyton Anderson, Paige Tipton, Dr.Daniel Rivera

Impacts of Oxidative Stress on Major Fatty Acids in Blood Plasma of Beef Cattle

Oxidative stress causes quality defects in meat because of the generation of lipid radicals from unsaturated fatty acids. It was hypothesized that oxidative stress would decrease the concentrations of these fatty acids in blood plasma. Therefore, the current study was aimed to measure the concentrations of major fatty acids in the blood plasma of beef cattle after hydrogen peroxide injection. Five crossbred beef steers were injected with hydrogen peroxide intravenously through the jugular vein to induce oxidative stress. Blood was collected from each of the steers from 0 to 110 min with a 10-min interval after injection. The collected blood was further processed to extract the plasma. The plasma samples were analyzed for free fatty acids using gas chromatography-mass spectrometry after direct derivatization to fatty acid methyl esters. The concentrations of fatty acids were analyzed by SAS 9.4 (SAS Institute Inc., Cary, NC) using a generalized linear mixed model with time as a repeated measurement factor. Concentrations of major fatty acids fluctuated with a 20- to 30-min interval. Of six major fatty acids, stearic, linolenic, and arachidonic acids remained unchanged for 110 min ($P = 0.101$ to 0.902); whereas palmitic, oleic and linoleic acids decreased post-injection ($P = 0.005$ to 0.067), reaching the lowest concentration at 80 min. Palmitic acid decreased from 27.3 to 20.6 $\mu\text{g/mL}$ ($P = 0.028$). Oleic acid decreased from 14.8 to 9.0 $\mu\text{g/mL}$ ($P = 0.033$). Linoleic acid decreased from 32.6 to 20.4 $\mu\text{g/mL}$ ($P = 0.040$). Induced oxidative stress decreased the concentrations of unsaturated fatty acids. However, the animal had the ability to remove these products as a response to oxidation. The decrease in linoleic acid at 80 min

coincided with an increase in lipid oxidation at 90 min reported in another study of oxidative stress biomarkers of the same steers.

011

Name: Davis, Alex

Major: Music Education/Vocal Voice Emphasis

Faculty Advisor, Affiliation: Shrinidhi Ambinakudige, Geosciences

Project Category: Arts and Humanities (Poster)

Geography of Opera Music: Landscapes and soundscapes through the lenses of cultural geography and GIS

Geography of music came into the cultural geography realm in the late 1960s. Geographers have studied how economy, polity, society and culture are present in the production, performance, transmission and consumption of music (Carney 1990; Leyson et al, 1995). Music plays an important role in the construction of space and place.

Opera, which is often considered as the music of classical tradition has reached a global music status. Opera is a form of staged theatrical art that is presented with music and singing as the main medium to convey the content. It originated in Italy during the 17th century and is still thriving today. Opera Houses are often understood as cultural symbols and have produced unique cultural landscapes and soundscapes. The objective of this research is to track opera's footprints through not only time, but space, and show how economy, polity, society and culture influenced the geography of opera music production. The information in reference to location will be visualized using Geographic Information System (GIS). The findings will present how locations of opera venues show the diffusion of this artistry. The performers of both past and present along with the related historical significance will provide explanations to why and how opera spread to a worldwide status.

Opera's diffusion does not have a singular path. However, with deep research into the economy, polity, society and culture and they are linked to diffusion of opera and the people who have contributed, a general theoretical direction can be documented.

135

Name: Davis, William

Major: Chemistry

Faculty Advisor, Affiliation: Amanda Patrick, Department of Chemistry

Project Category: Physical Sciences and Engineering

Synthetic Monomer Characterization with High-Resolution Mass Spectrometry

The purpose of this work is to develop methods for characterizing novel synthetic perfluoro monomers and their precursor monomers by atmospheric pressure chemical ionization (APCI) and atmospheric pressure photo ionization (APPI). The exact mass measurements are needed to corroborate the identity of novel syntheses, alongside other characterization methods. While electrospray ionization (ESI) is a common ionization technique, it is inappropriate for the perfluoro monomers of interest here, given the fundamental mechanism of ESI and the analyte ion's structure. Thus, in this project, we evaluate and optimize alternative approaches to ionization. Here, a general APCI-mass spectrometry method was developed. Furthermore, the effects of various tunable parameters (flow rate, inlet temperature, etc.) were evaluated. In the analysis of perfluorinated monomers and their precursors, we obtained exact mass measurements for molecular ions (M^{*+}) and/or protonated pseudomolecular ions ($[M+H]^+$) for each monomer, with error below 5 ppm in most cases and less than 1 ppm in some cases. As expected, signal intensity for each ionization method was dependent upon analyte structure (e.g., phenolic OH facilitates negative-mode ionization, presence of a ketone facilitates minor positive-mode electrospray, etc.). In addition we evaluated the effect of vaporization temperature and the solution flow rate on the APCI-MS signal intensity. Good signal intensity with higher stability was obtained at higher vaporization temperatures and at higher solution flow rates. A discussion of the effects of tunable conditions and the structure/response relationship will be presented. Ongoing work aims to (1) investigate parameters controlling the relative intensity of the M^{*+} versus $[M + H]^+$ ions and (2) evaluate monomer series using APPI-MS.

136

Name: Denney, Christopher

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Dr. Yu Lv, Aerospace Engineering

Project Category: Physical Sciences and Engineering

Computational Fluid Dynamic Analysis of Liquid Fuel Dispersion in Various Flow Regimes

Computational fluid dynamics modeling is a practical method for observing the fluid flow and two-phase interaction phenomena which occur routinely during aerospace engine operations. Computer modeling is required due to the difficulty associated with physical measurement of flow within a combustion engine. The purpose of this study is to accurately simulate liquid fuel as it is sprayed into an airstream and model the liquid-air interactions to a reasonable degree of accuracy. Results of this study will be compared to other published research for verification. Phase one of the study will utilize the high-fidelity computational fluid dynamic modeling software OpenFOAM to analyze the fuel spray droplets as they are injected into ambient conditions. This phase provides a control for comparing the fuel-air mixture of other flow regimes. The second simulation will model the fuel as it is injected into a laminar flow environment, which will provide a fundamental understanding of the dual-state system interactions between fuel and air. A potential third phase of the study would simulate fuel injection into a turbulent flow. This third phase would give a more accurate representation of the flow dynamics within a jet engine. The results of this model can lead to a better understanding of fuel-air mixture dynamics for a variety of flow conditions.

035

Name: Dennis, Amberly

Major: Animal & Dairy Sciences

Faculty Advisor, Affiliation: Dr. Derris Devost-Burnett, Animal and Dairy Sciences

Project Category: Biological Sciences and Engineering

Determining the Temporal and Spatial Regulation of the Marbling Development in the Loin Muscle of Pigs

Intramuscular fat, also known as marbling, positively impacts the palatability and tenderness of meat, which contributes to eating quality. The goal for pork producers is to improve meat quality and production efficiency to satisfy consumers and increase carcass value. In pigs the loin muscle is the most economically important tissue given that the quality of the carcass including the total muscle and fat percentage are assigned based on LM measurements. Still, this anatomically protected muscle is not homogeneous in composition and these differences across the LM can impact predicted quality and quantity of lean pork produced. The objective of this study was to determine which adipogenic genes are responsible for the spatial and temporal development of marbling in response to different diets. A total of 80 pigs were randomly assigned to 1 of 4 diets: lysine deficient (LYS), vitamin A deficient (VIT-A), lysine and vitamin A deficient (LYS-A), and a control group who received the NRC recommended requirements (CON) from weaning through the finishing phase. At day 0, 84, and 160 of the trial, biopsies were taken from the proximal, medial, and distal locations of the LM. The biopsies were subjected to RNA isolation followed by quantitative PCR to determine location-specific adipogenic gene expression. At day 160 the animals were harvested to assess carcass characteristics.

002

Name: Desai, Krishna

Major: Political Science

Faculty Advisor, Affiliation: Dr. Melanie Loehwing, Communication

Project Category: Arts and Humanities (Oral Presentation)

“Art & Advocacy of Keith Haring”

The 1980's Pop Art scene in New York was marked not only by a spirit of liberation for the gay community, but also by the darker era of the AIDs epidemic. One figure who both shaped and was shaped by these movements was Keith Haring, a

young, openly-gay artist who became a leading activist in the movement to raise awareness about AIDs and safe sex. Using his distinct visual style and emphasizing accessibility of his art, Haring made an impact on the AIDs awareness movement during his life that has lasted to the present day. While his messages were unconventional, comical, and sometimes even explicit, his work provides a valuable model for exploring the role of visual rhetoric in democratic culture. The relationship between verbal advocacy and the public sphere is well established, but my project aims to advance the conversation by investigating the influence of visual advocacy. By examining seven artifacts from Haring's AIDs and safe sex campaign, this paper will identify the rhetorical strategies and visual elements that characterize his messages. This study has important implications for theories of rhetorical democracy and can illustrate to the potential for art activism to revive and expand the public sphere.

137

Name: Dickerson, Clayton

Major: Chemical Engineering

Faculty Advisor, Affiliation: Maryam Mirabolghasemi, Chemical Engineering

Project Category: Physical Sciences and Engineering

A Comparative Produced Water Management Decision-making Workflow: MSEEL Case Study

Using water production and well data from Marcellus Shale Energy and Environment Laboratory (MSEEL), this paper will present a decision-making workflow for produced water (PW) management by comparing options for treatment and disposal. This study evaluates three types of water treatment using published data, High Pressure Reverse Osmosis (HPRO), Direct Contact Membrane Distillation (DMCD), and Electrodialysis (ED). These three treatment methods are compared in terms of cost and environmental impact to a base case of disposal of all PW into a UIC Class IID injection well. This option is less than desirable for PW at the MSEEL site due to the large distance of the producing wells to the nearest commercial Class IID wells, which makes it risky and costly to transport the water for injection. The results of this study will provide a framework for operators to decide how to manage their PW at minimum cost and environmental impact. While other studies exist that offer optimum PW management strategies, they usually only focus on the technical aspects of treatment scenarios and do not demonstrate a detailed cost-benefit analysis through a case study. The presented procedure attempts to cover applicable PW management options for unconventional reservoirs and provide it as a guideline for operators' reference.

036

Name: Dickie, Anna

Major: Forestry/Wildlife Management

Faculty Advisor, Affiliation: Heather Alexander, Department of Forest Resources

Project Category: Biological Sciences and Engineering

Co-Author(s): Tracy Hawkins, Alison Paulson

Warming temperatures increase the rate of Cajander Larch (*Larix cajanderi*) seed germination

The climate is warming across the Arctic at twice the rate of the rest of the world. This rapid change in temperatures is causing shifts in species distributions and changes in disturbance regimes. Cajander larch (*Larix cajanderi*) is the dominant tree species in the Northeast Siberian Arctic. While this species is fire-dependent, it is unclear how warmer temperatures and/or more frequent fires in the region will affect future regeneration of the species. We sought to understand how warming temperatures affect seed physiology of larch. Our primary objectives were: 1) to determine the historical and future June temperatures in Northeast Siberia; and 2) to test how a range of temperatures affect larch seed germination. We first extracted future climate projections from the WorldClim climate database for the year 2070 and compared these to historical weather station data from Cherskiy, Russia. To test larch germination rates, we placed 16 replicates of 50 seeds into four incubators with diurnal temperature regimes of 15/6°, 20/10°, 25/15°, and 32/25 °C. Over the past fifty years, the mean maximum June temperature in Cherskiy, Russia was 15.7 °C. By the year 2070, mean maximum June temperatures are projected to increase between 0.4 and 1.5 °C for low to high emissions scenarios, respectively. After 31 days, we found the highest rates of larch seed germination in the 35/25 °C treatment (4.5 ± 1.0 %). Germination rates were lower in the cooler incubators. Seeds in the 25/15 °C treatment germinated to 3.0 ± 1.0 %, and seeds in 15/6 °C and 20/10°C treatments

germinated to 0.5 ± 0.5 %. Our findings indicate that warming temperatures could promote larch regeneration by increasing the rate of seed germination, as long as moisture availability remains consistent. Combined with other factors affecting larch regeneration, this could increase future post-fire larch regeneration in Siberia.

037
Name: Dillender, Alexis
Major: Animal & Dairy Sciences
Faculty Advisor, Affiliation: Anuraj Theradiyil Sukumaran, Poultry Science
Project Category: Biological Sciences and Engineering
Co-Author(s): Courtney Fancher, Hudson Thames, Tianmin Li, Mary Gates Colvin, Saijuan Chen Li Zhang

Antimicrobial efficacy of Luka 405 light bulbs in reducing the total bacterial load of broiler litter

Broiler litter harbors a wide variety of bacteria and the broiler industry is seeking ways to reduce the bacterial load in litter to mitigate poultry diseases and associated economic loss. The objective of this study was to evaluate the efficacy of LUKA 405nm light in reducing the total plate count (TPC) in broiler litter. A completely randomized design with a $2 \times 3 \times 4$ factorial arrangement of treatments including 2 light treatments (non-exposed and exposed), 3 litter depths (top, middle, and bottom 2 inches), and 4 exposure times (12, 24, 48, and 72 h) was used. Commercial broiler litter was aliquoted into 24 sterilized mason jars (420 g/jar). Three LUKA 405nm lights were hung at 8ft height and 8 jars were randomly put under each light with 4 jars covered with aluminum foil (non-exposed) and 4 jars not covered (exposed). One control and one treatment jars were removed at 12, 24, 48 and 72 hours under each light and litter samples were collected from top, middle, and bottom (140 g) of each jar to determine TPC, pH, and moisture. Samples were homogenized and serially diluted in sterile BPW, plated on tryptic soy agar, incubated at 37°C for 24 h, and the bacterial counts were determined (log CFU/g). Data were analyzed using Proc GLM procedure of SAS 9.4 at $P < 0.05$. There was no difference in TPC between control (7.93 log CFU/g) and light treated litter (7.91 log CFU/g; $P > 0.05$). The TPC of litter was also not affected by depth (7.99, 7.91, and 7.86 log CFU/g in top, middle, and bottom, respectively) and exposure time (7.83, 7.95, 7.98, and 7.92 log CFU/g at 12, 24, 48, and 72 h, respectively; $P > 0.05$). Further studies with shorter distances between the light bulb and litter are required.

038
Name: Dinep-Schneider, Olivia
Major: Animal & Dairy Sciences
Faculty Advisor, Affiliation: Caleb Lemley, Animal and Dairy Science
Project Category: Biological Sciences and Engineering
Co-Author(s): Zully E. Contreras-Correa, Darcie R. Sidelinger, E. Heath King, Derris D. Burnett

Examining melatonin-mediated changes in bovine fetal glomerular development during maternal nutrient restriction

Melatonin is a hormone which regulates the circadian rhythm in combination with external inputs such as photoperiod. Melatonin supplementation enhances uterine blood supply during pregnancy, thus having the potential to affect fetal development. The objective of this study was to investigate the effects of melatonin supplementation and maternal nutrient restriction on the development of fetal glomeruli in beef cattle. Twenty-nine Brangus heifers at 160 days of gestation were utilized in a 2×2 factorial design. Heifers were assigned to an adequate ($n=14$) or restricted (60% of adequate) nutritional plane ($n=15$). Half of each group were supplemented with dietary melatonin ($n=15$) the remainder with control ($n=14$). At 240 days of gestation, kidneys were collected from calves following C-section and weighed. One kidney lobe was dissected and embedded in OCT cryomolds. Samples were sliced into $7\mu\text{m}$ cryosections and stained with hematoxylin and eosin. Slides were imaged using an EVOS system and analyzed using ImageJ software. Data were analyzed with SAS software. Kidney weight was reduced in restricted calves when compared with adequate (101.6 vs. 116.0g; $P=0.0437$); while melatonin increased it compared with control (115.9 vs. 101.8g; $P=0.0513$). Statistics revealed no significant differences in glomeruli size or number between melatonin and control groups, but showed significant differences between nutritional groups. The restricted group had smaller (5623.07 vs. $6172.76\mu\text{m}$; $P=0.0226$) but more numerous glomeruli (17.76 vs. 15.37 glomeruli/ mm^2 ; $P=0.0068$) than the adequately fed group, respectively. Limited changes in glomeruli following

maternal melatonin supplementation were observed; however, other changes to the nephron may be caused by melatonin to influence kidney weights compared with the control. Larger kidneys and glomeruli have been associated with a lower risk of metabolic disorders such as hypertension, therefore an adequate plane of nutrition combined with melatonin during gestation may reduce the likelihood of kidney disease later in life.

039

Name: Dittmar, Wellesley

Major: Biological Engineering

Faculty Advisor, Affiliation: Filip To, Department of Agricultural and Biological Engineering

Project Category: Biological Sciences and Engineering

Novel Automated Drill Apparatus for Accessing Equine Hoof Wall

Equine laminitis affects thousands of horses a year and leads to euthanasia in most diagnosed cases. This disease is characterized by the failure of attachment cells connecting the hoof wall to the pedal bone within the foot capsule. Upon dissociation from the hoof wall, the pedal bone rotates downward, applying extreme pressure to the sole of the hoof and causing excruciating pain to the animal. Diagnosis of laminitis is complicated due to the thickness of the keratinized outer layer of the hoof wall preventing sensing of laminitic biomarkers within the hoof capsule. This paper presents the design and analysis of a novel automated apparatus that allows for the creation and accurate placement of access windows (ports) on the hoof wall. The apparatus consists of an articulating scaffold with two degrees of freedom (2DOF) on which a digitally controlled linear actuator (stage) is mounted as a carrier for a milling spindle (drill) to give the system a total of three degrees of freedom (3DOF) in its operation. The mill bit can be aimed perpendicular to the wall of the hoof and positioned at an initial starting point on the surface of the hoof using a graduated wheel. The spindle can then be activated and digitally controlled to create the access window of a precise depth (~50 mm precision). By simplifying and automating the placement and creation of access ports within the equine hoof capsule, observation, sensing of biomarkers characteristics of laminitis will be expedited, diagnosis can be done more quickly, and treatment can be administered efficiently, thus allowing for life-saving treatment of the disease before euthanasia becomes necessary.

191

Name: Douglas, Cameron

Major: Educational Psychology

Faculty Advisor, Affiliation: Dr. Katarzyna (Kasia) Gallo, Department of Counseling, Educational Psychology, and Foundation

Project Category: Social Sciences

Depression in African American Adolescents: Effectively Identifying and Treating It

Today, African American adolescents continue to remain underrepresented in the mental health care system. This is especially true when depression is the subject. Little to no research has been conducted on the effects and experience of depression in African American adolescents. The purpose of this literature review is to combine fifteen empirical studies in order to investigate this issue. The participants in these studies included African American adolescents aged anywhere from 12-18 and their primary caregivers. Various types of methodologies, such as survey questionnaires and interviews, were used to assess the severity of depression and suicidality in the participants. Different interventions, such as cultural-based stress reduction and behavioral activation, were used to treat depression and suicidality. Results suggest that depression manifests in African American adolescents due to multiple factors, and those factors also moderate the severity of the illness. Results also suggest that cultural-based stress reduction and behavioral activation have a positive impact on suicidality and depression, respectively. The findings from this literature review have implications for designing an intervention that combines elements together from cultural-based suicide prevention programs and behavioral activation as the best way to treat depression in African American adolescents.

192

Name: Dukes, Renordna

Major: Social Work

Faculty Advisor, Affiliation: Dr. Angela Savage, Arts & Sciences - SW Meridian Campus

Project Category: Social Sciences

Other Competition(s): Community Engagement Research Track

The Blind Side: Opioid Abuse at Home and Abroad

The opioid crisis is an epidemic that has touched millions around the globe. Overdose deaths, hospitalizations, and addictions are just a few elements that are synonymous with this catastrophic phenomenon. The purpose of this undergraduate project is to discover how this epidemic has affected our world, the United States, and rural Mississippi and what evidence-based measures are being taken to help combat this calamity. The project will focus on a rural town in South Mississippi.

Among the evidence-based treatments available for opioid addiction, medication-assisted treatment is considered to be highly effective in treating this chronic disease. This project is completed along with collaboration of a community partner in East Mississippi. The community partner facility specializes in opioid treatment and combines medication- assisted treatment with behavioral therapy for a holistic approach to opioid addiction. This project aims to educate the public about this evidence-based treatment and how it can aid in our fight against the opioid crisis.

040

Name: Dykes, Rachel

Major: Biochemistry

Faculty Advisor, Affiliation: Christopher Brooks, Department of Biological Sciences

Project Category: Biological Sciences and Engineering

The Microbiome of *Opuntia drummondii*

Plant-environment interactions are governed by many biotic and abiotic factors. Microbes influence the morphological and biological traits of a plant, influencing higher-order interactions with herbivores and other organisms within their environment. The expression of plants' different characteristics allows them to survive and reproduce throughout different seasons. *Opuntia drummondii* are endemic to northeastern Mississippi. During the winter season, *O. drummondii* pads lower towards the ground, as water is expelled from their tissues and into their root system. These plants also begin to express betalain pigments. Both of these actions function to prevent freezing of their water- containing tissues. I am characterizing the microbial communities living within *O. drummondii* plants during their winter physiological response. *O. drummondii* collected from West Point, Mississippi have been surface sterilized and their microbial communities cultured and isolated, using serial streak plating in the laboratory. The structure of the microbial community within *O. drummondii* tissues is discussed, including both species richness and overall species diversity.

138

Name: Elkington, Liam

Major: Physics

Faculty Advisor, Affiliation: Dr. Prabhakar Pradan, Physics and Astronomy

Project Category: Physical Sciences and Engineering

Co-Author(s): Prakash Adhikari

Other Competition(s): Public Health Research Competition, Thesis Research Competition (TRC)

Detection of Breast Cancer via Fractal Dimension of Tissue Microarray Samples

Breast Cancer, one of the most common and deadly varieties of cancer, is one of the most pressing medical issues today. One of the easiest ways to improve the survival rate of breast cancer is through its early detection. A novel method for this early detection involves analyzing a tissue sample by taking images using an upright microscope and quantifying the fractal dimension from the images through a box counting method. Fractals are structures that exhibit self-similarity in their mass

distribution. Tissues, along with many other naturally occurring structures, are fractal in nature. Biological tissues are also a spatially heterogeneous medium. The replication rate of cells is increased with the presence of cancer which results in the density of cells in a particular area of tissue to also increase. The tissue's fractal dimension increases in turn so as the stage of cancer increases the fractal dimension continually increases. The Breast cancer tissues studied in this experiment were imaged on a tissue microarray (TMA) slide that arranges several thin samples from different subjects with varying stages of cancer onto a single slide. Because it is proportional to the mass density pattern which affects the fractal dimension, the light transmission intensity pattern was used to find the fractal dimension of the tissue samples. The results showed a correlation between increasing stages of cancer and increasing fractal dimension.

193

Name: Ellis, Hannah

Major: Psychology

Faculty Advisor, Affiliation: Dr. Kevin Armstrong, Psychology Department

Project Category: Social Sciences

Co-Author(s): Justin Mendonca

Other Competition(s): Public Health Research Competition

Differences in Illicit Prescription Stimulant Use Across ADHD Presentation Type

Attention-Deficit/Hyperactivity Disorder (ADHD) is characterized by a pattern of inattentive and/or hyperactive-impulsive symptoms that interferes with the development and functioning of an individual (American Psychiatric Association, 2013). The Adult ADHD Self-Report Scale (ASRS) is a screener evaluating ADHD symptoms and consists of 18 items, nine of which assess inattention and nine that assess hyperactivity-impulsivity (Kessler et al., 2005). Different thresholds of these symptoms are associated with ADHD types of Predominately Inattentive, Predominately Hyperactive-Impulsive, or Combined. Illicit use of prescription stimulant medication (IUPS) is defined as the use of a prescription stimulant without a prescription, for nonmedical reasons, and/or overuse (Bavarian et al., 2015). Researchers have previously documented IUPS by individuals with ADHD (Wilens et al., 2008) but little research exists assessing whether type of ADHD symptoms predicts IUPS. This research investigated whether significant levels of "Hyperactive-Impulsive" symptoms were associated with a greater likelihood of IUPS. We examined a subsample ($n = 63$) of ADHD participants who had a current prescription for stimulant medication in order to determine whether ADHD individuals reporting significant Hyperactive-Impulsive symptoms on the ASRS more frequently reported IUPS than those reporting Inattention symptoms. A chi-square analysis came close to revealing differences between these two groups and approached statistical significance ($\chi^2 = 3.52$, $df = 1$, $p = .06$). The present study lacked statistical power due to the small size of our subsample, however, analyses with a larger number of current prescription holders may detect a significant relationship between ADHD type and lifetime IUPS. Further research is warranted to better examine this relationship.

194

Name: Enlow, Madeline

Major: Communication/Public Relations

Faculty Advisor, Affiliation: Holli Seitz, Communication

Project Category: Social Sciences

Examining language trends in tweets from President Trump and Obama over the first two years of presidency

This study examines trends in language used in Presidential tweets over time. Tweets from the first two years of presidency from the official twitter pages of both President Obama and President Trump were analyzed for positive and negative language using Linguistic Inquiry and Word Count (LIWC). Presidential milestones, such as the inauguration and State of the Union addresses, were noted when examining language trends. Word clouds were created to show the common words reflecting the positive or negative language most prevalent during these milestones. The poster will present trends over time in use of positive and negative language. Examining the trend in

language throughout multiple presidencies can present new information that is beneficial in testing hypotheses regarding presidential public perception and effects of language on readers.

195

Name: Erwin, Madison

Major: Criminology

Faculty Advisor, Affiliation: David May, Sociology

Project Category: Social Sciences

Co-Author(s): Dr. Brian Payne

REU/Research Program: REU for cybersecurity hosted in Norfolk, VA at Old Dominion

Cybersecurity and Cybercrime: A Multi-Level Analysis through Policy, Rhetoric, and Theory

Cyberspace is an ever-evolving world that both research and industry are constantly trying to manage. To manage deviance in cyberspace, a number of strategies are used. These strategies have become known as cybersecurity techniques. In this paper, I compare the number of complaints by state to the Federal Trade Commission for years 2015-2018 with the legislation those states enacted to improve cybersecurity. I also analyzed transcripts from President Trump's speech and compared themes to Hill and Marion (2018) and their review of Obama, Clinton, and G. W. Bush. The findings suggest that the less active states are in enacting legislation often correlates with a higher rate of complaints from the Federal Trade Commission. President Trump's speeches also follow a pattern similar to the last three presidents, being that his speeches are largely symbolic over tangible. Implications for research and policy are also discussed.

041

Name: Evans, Katie

Major: Microbiology

Faculty Advisor, Affiliation: Shecoya White, Department of Food Science, Nutrition, and Health Promotion

Project Category: Biological Sciences and Engineering

Co-Author(s): Taylor Ladner

Other Competition(s): Public Health Research Competition

Efficacy of Carvacrol Against *Salmonella* spp. in Hummus at Refrigerated and Abusive Temperatures

Hummus is a traditional Middle Eastern food typically made of mashed chickpeas, tahini, lemon juice and spices (Yamani & Mehyar, 2011). As a ready-to-eat food product, hummus is not further cooked after purchasing, which makes it particularly dangerous if contaminated during or after processing. Carvacrol, an active compound of thyme essential oil, is a proven natural antimicrobial and has been used to extend shelf life (Wang et. Al, 2018). In the present study, carvacrol was tested at either 0.5% (w/w) or 1.0% in store-bought hummus at both 4°C and 10°C. A four-strain *Salmonella* cocktail was used; triplicate cocktails were made using the same cocktail. Ten gram samples of Sabra® Classic style hummus were taken and stored in sterile bags. Samples were designated one of four groups: 1.0% carvacrol, 0.5% carvacrol, positive control, or negative control. Then 100µl of the *Salmonella* cocktail was added to each sample, except for negative controls. Samples were then stored at either 4°C or 10 °C for ten days. On days 0, 1, 4, 7, and 10, samples were plated onto Xylose Lysine Deoxycholate (XLD) selective media, to determine effectiveness of carvacrol. After incubating for 24 hours at 37°C, colonies were counted and CFUs (colony forming units) were determined. Results showed that 1.0% carvacrol treatment was the more effective of the two treatments, and had greatest effectiveness when hummus was stored at 4°C. Approximately a 2 log reduction of *Salmonella* was seen in 1.0% carvacrol treated hummus on day 10 when stored at 4°C, compared to an approximately 1.5 log reduction found in the 1.0% treated hummus stored at 10°C. Further studies will be needed to determine consumer perception of carvacrol treated hummus. This study shows that carvacrol can be used to reduce *Salmonella* load in hummus.

042

Name: Fereday, Isidora

Major: Biological Sciences/Microbiology

Faculty Advisor, Affiliation: Dr. Justin Thornton, Biological Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Keun Seok Seo, Joo Youn Park

Engineering Bacteriophage Delivery of an Antimicrobial CRISPR/Cas9 System to *Streptococcus pneumoniae*

Streptococcus pneumoniae is a gram-positive, facultative anaerobe and is a common cause of pneumonia, meningitis, and otitis media. As antibiotic resistance becomes an increasing concern, there is demand for novel treatments for bacterial infections. One such innovative solution is phage therapy, which uses bacteriophages to treat bacterial infections. The CRISPR (clustered regularly interspaced short palindromic repeats) and CRISPR-associated Cas9 genes are used as a genome editing system in bacteria. The CRISPR/Cas9 system can be targeted to a specific sequence of DNA and will cut the DNA at that location.

We hypothesize that by integrating a CRISPR/Cas9 system into the genome of a temperate pneumococcal phage, we will develop a system for specifically clearing *S. pneumoniae*. We have established a CRISPR/Cas9 system that is targeted to the pneumolysin (*ply*) gene, a key virulence factor of pneumococcus. Cleaving the chromosome at the *ply* gene will effectively neutralize the pathogen. To generate the CRISPR/Cas9 system, synthetic oligos specific to *ply* were cloned into the *BbsI* site of a pKS1 vector that contains a promoter, leader sequence, and direct repeats to create pKS2. To program the CRISPR/Cas9 system to the target gene, pre-crRNA was amplified from pKS2 and cloned downstream of the genes for the tracr-RNA and Cas9 to generate pKS4. Non-essential gene segments from *S. pneumoniae* temperate phage MM1 along with an erythromycin cassette for selection were cloned into pKS4 to flank the CRISPR/Cas9 system, thus resulting in creation of pKS5 and allowing for homologous recombination into the pneumococcal chromosome.

Successful integration into the genome should result in phage bearing CRISPR. Engineered phage will then be used for *in vitro* and *in vivo* assays for clearance of *S. pneumoniae*. This system has potential to act as a novel antimicrobial tool for reducing or eliminating *S. pneumoniae* without concerns of antibiotic resistance.

003

Name: Ferguson, Avery

Major: English

Faculty Advisor, Affiliation: Kelly Marsh, Department of English

Project Category: Arts and Humanities (Oral Presentation)

Other Competition(s): Thesis Research Competition (TRC)

“Conventional Romance and its Questioning of War in Graham Greene’s *The End of the Affair* and Ian McEwan’s *Atonement*”

Graham Greene’s *The End of the Affair* and Ian McEwan’s *Atonement* are both novels that take place in the midst of World War II but have minimal mention of the war itself. Both novels are dominated by character narrators that are writers, and it is their narrative choices that make war secondary in the novels’ plots. Surprisingly, none of the existing scholarship on either novel addresses this unexpected representation of the massive chaos World War II caused. The scholars do not engage with the ethics of representing war in fiction despite the fact that they primarily focus on other ethical issues in the novels.

Most would wonder why the writers emphasize the love affairs in both novels when war is raging in the background. Looking closely at these love affairs, I analyze the literary conventions of romance in both novels. My larger research project encompasses an analysis of the romantic hero, heroine, and conventional narrative endings, but for the sake of this presentation, I will just be focusing on the male hero. One must consider to what extent the protagonist of each novel fulfills the role of romantic hero. My research reveals that both novels refuse the conventions of romance with the inclusion of male heroes that do not comply with romantic ideals. The role of the romantic hero and its conventions are heightened within the system of war and the expectations for these heroes are much loftier and nearly impossible to fulfill. The central question in these narratives is who is doing the saving and who actually needs saving. These male heroes are unable to fulfill

the role of savior, which undercuts the entire concept of romance. Both authors redefine and question the conventions of romance to critique the representations of war in literature.

012

Name: Fikes, Taylor

Major: Art/Fine Arts

Faculty Advisor, Affiliation: Dominic Lippillo, Art

Project Category: Arts and Humanities (Poster)

Perceived Presence

The purpose of my photographic study of spaces is to draw attention to presence and our human desire to acknowledge others' presence. We are almost always feeling lonely, feeling crowded, or missing someone. The conversation my series of photographs intends to discuss is those feelings within the domestic space. Home becomes a very familiar space for most; it is the place that we become comfortable in and that we attach memories to. My research, primarily led by the book *Space and Place: The Perspective of Experience* by Yi-Fu Tuan, is to discover how our surroundings are impacted by who we are and the way we behave. Several of the chapters in his book address these feelings when it comes to domestic spaces. To achieve this, I will photograph spaces and personal belongings without including the individuals the spaces belong to. I will capture imagery of the home that highlights a context of presence and absence of presence. This may include imagery that portrays a father, a toddler, a grandparent, or even a lost loved one. The imagery will indicate varying personalities, ages, or stages of life all while addressing the main idea of domesticity.

043

Name: First, Nicholas

Major: Microbiology

Faculty Advisor, Affiliation: Jonas King, Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology

Project Category: Biological Sciences and Engineering

Co-Author(s): Aline Badial, Travis van Warmerdam, Hunter Walt

Other Competition(s): Public Health Research Competition

Mosquito Surveillance using Salivary DNA

Mosquito-borne diseases, such as Zika and West Nile Virus are significant threats to public health. Current mosquito surveillance techniques, such as morphological identification following capture in attractant-based traps are incredibly labor-intensive and require highly skilled personnel. Likewise, viral detection methods in this field require dissection of the mosquito's salivary glands. More recently, a technique using honey-baited FTA cards for the collection of mosquito saliva, coupled with qPCR analysis has been shown effective for viral surveillance. We propose that surveillance of mosquito species could potentially be coupled with this method if mosquito saliva contains ample DNA for species-level barcoding analysis. This method would require a gene that is highly conserved across the entire Culicidae family but with detectable differences among species. The mitochondrial cytochrome oxidase I (COI) gene fits these criteria, but it remains uncertain if it is ample and consistently present mitochondrial DNA in mosquito saliva. We hypothesize that if apocrine secretion occurs in the mosquito salivary glands at an adequate rate, as seen in studies with *Drosophila*, then detectable levels of mosquito mitochondrial DNA should also be found in the saliva. Primers for qPCR were designed based on the COI gene sequence of *Aedes aegypti* and *Culex quinquefasciatus* and validated following standard procedures. Artificial saliva collections were conducted using various concentrations of malathion ranging from 1% to 0.001% to assess the optimal concentration of the phagostimulant to induce mosquito salivation. Fragments of the *Aedes aegypti* and *Culex* COI gene were PCR amplified and cloned into a NEB pMiniT 2.0 *E. coli* plasmid. Levels of the mosquito salivary COI were quantified via serial dilutions of plasmid DNA and quantified via qPCR. Levels of DNA in *Aedes* saliva were variable, but often detectable, suggesting the existence of mitochondrial DNA in mosquito saliva.

044

Name: Flamm, Meredith

Major: Biological Sciences/Biological Sciences

Faculty Advisor, Affiliation: Andrew Lawton, Biological Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Alexandra Joyner, Memorial Sloan Kettering Cancer Center

Setting the Amount and Pattern of Cerebellar Folding

During human brain development the cerebellum and cerebral cortex fold into robust patterns that compartmentalize the neural circuits. We previously showed that at initiation of folding, the wild-type murine cerebellum undergoes a differential expansion where the outer layer of proliferating progenitors expands faster than the core. This behavior, along with radial and circumferential tension, and fluid-like behavior in the outer layer results in tissue folding. Here we analyze how the amount and pattern of brain folding is set by modulating these developmental and mechanical processes. The FVB/N mouse strain has a large cerebellum with 8-10 stereotypical folds while the C57/B6 strain has a small cerebellum with fewer folds. Additionally, the En2 mutant has a small cerebellum with a robust altered pattern of folding. In each case we found that folding initiates during periods of differential expansion between the outer layer and the core even when developmentally delayed. Preliminary evidence indicates that the FVB/N and C57/B6 have similar levels of differential expansion and folding at initiation. The reduction in final folding observed in the C57/B6 strain arises postnatally and may be due to regional differences in proliferation in the physically closed lobules. In contrast, the alteration in folding pattern in the En2^{-/-} arises at the initiation of folding and may be regulated by the shape of the unfolded anlagen.

045

Name: Folse, Michael

Major: Microbiology

Faculty Advisor, Affiliation: John Bickle, Ph.D., Department of Philosophy and Religion

Project Category: Biological Sciences and Engineering

The Lack of a “Gold Standard” in Chronically-Implanted Neural Electrodes Prevents Quality Comparison in Basic Science Research

Over the past thirty years, Deep Brain Stimulation (DBS) has proven to be a revolutionary and effective treatment for movement disorders such as Parkinson’s Disease and Essential Tremor (Miocinovic et al. 2013). The field of Functional Neurosurgery has rapidly evolved since Benabid et al. (1991) first used chronically implanted electrodes with continuous stimulation within the human brain for treatment of movement disorders. However, despite rapid developments over this period, difficulties remain in the ongoing search for superior electrode materials and design. Upon reviewing the published literature, my hypothesis is that these difficulties remain in part due to the lack of a “Gold Standard” for design and material, for a comparison in research trials. Although electrode designs in humans are highly regulated by organizations such as the FDA, design and materials of electrodes in basic science research vary widely. This is problematic because the published literature on murine (mouse) models suggests vast differences in safety and effectiveness with even relatively small changes to electrode morphology and material construction. Safety issues have not yet been observed in any large studies of humans treated with DBS electrodes; and future applications of implanted electrodes, such as brain-computer interfaces, will require even longer implantations of foreign electrode materials in cortical tissue. What constitutes a “gold standard” in DBS electrode materials and design is difficult to define, but some lessons for this project can be learned from research in other biomedical fields, such as orthopedics and cardiology.

196

Name: Forwood, Ashley

Major: Environmental Economics & Mgt

Faculty Advisor, Affiliation: Matthew G. Interis, Agricultural Economics

Project Category: Social Sciences

REU/Research Program: CALS/MAFES Undergraduate Research Program

Analyzing the Effects of Concession Price Changes on Average Total Revenue Per Fiscal Year for Mississippi State Football

In fiscal year 2019, Mississippi State University decreased the prices of most concessions items available during football games. The purpose of this research is to examine the effects of the price changes on concessions revenue. This is useful to examine because, for example, the Atlanta Falcons created a value menu of lower-priced items in 2018 and found that total money spent per person increased, suggesting that people are willing to consume more concessions at a lower price level (New York Times, 2018). Few researchers have focused solely on the relationship between concessions sold and total game revenue because reliable data on concessions revenue is not easily obtainable. Our data encompasses information collected from 27 different MSU home football games in the years 2015 to 2018. We estimated the change in concessions revenue resulting from the price change using three different approaches: comparing average concession revenue from FY19 to FY18, comparing FY19 to all years before that, and using an ordinary least squares regression in which total revenue was modeled as a function of explanatory variables including attendance and year fixed effects. We found that the percentage decrease in concessions revenue resulting from the price change was between 36-40%. Unlike with the Atlanta Falcons, our overall results suggest that the University is accruing less revenue than before the price change. A weakness of the data is that we have few observations and all prices move in the same fiscal year, making it difficult to isolate the effects of the price from other changes that occurred during that fiscal year. Our results are useful for Mississippi State Athletics or other institutions as they decide concessions pricing in conjunction with other revenue sources such as ticket sales, merchandise sales, revenue sharing, and television rights.

139

Name: Foss, Carly

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Rani Sullivan, Ph.D., Aerospace Engineering; Yeqing Wang, Ph.D., Aerospace Engineering

Project Category: Physical Sciences and Engineering

Experimental Validation of a Classical Laminate Theory Model

The use of composite materials within the aerospace industry has continuously increased in popularity due to its strength and lightweight properties. The objective of this project is to validate a Classical Laminate Theory (CLT) model by using experimental data to compare with the theoretical data of the model. The experimental data was gathered by fabricating and tensile testing carbon fiber composite plates. The baseline test articles were based on the layup pattern that the Mississippi State University Space Cowboys used for the composite fins on the 2019 competition rocket. Strain data was gathered during tensile testing using digital image correlation. Initial tensile testing of the baseline coupon set revealed that fiberglass tabs needed to be applied to each coupon to prevent slippage during testing. Tensile testing these coupons showed that the required loading for the carbon fiber to reach failure was too high for the fiberglass tabs, and these failed prior to the carbon fiber coupons themselves. Therefore, a quasi-isotropic plate layup was conducted in order to ensure that the failure load of the coupons would be low enough to be measured. Results from the quasi-isotropic experimental data were implemented into the CLT model, from which an optimized composite layup was yielded. The fabrication and testing of this optimized plate will reveal the validity of the CLT model and determine whether it could be useful for practical applications in the future.

140

Name: Fowler, Zoe

Major: Electrical Engineering

Faculty Advisor, Affiliation: Nicolas Younan, Electrical and Computer Engineering; James E. Fowler, Electrical and Computer Engineering

Project Category: Physical Sciences and Engineering

Providing a Robust Foreground Extraction Method

Background modeling for foreground detection is designed to model the background of a video and locate the moving foreground in the scene. Background modeling is done by separating the background from the foreground, a process known as background subtraction. Once a camera takes pictures of the scene in sets, the images in the photoset can be stacked so that a common background image can be computed. Many methods of background subtraction make the assumption that the moving foreground objects are sparse within a scene. In particular, the state-of-the-art DECOLOR¹ algorithm combines this sparsity assumption along with a requirement that the foreground be also spatially contiguous into a single process of optimization.

Background subtraction is useful for studying endangered species because it allows thousands of frames to be analyzed in order to determine whether an animal was present or not, as opposed to a researcher having to analyze frames by hand. However, camouflage has proved to be an issue when performing many foreground extraction methods. This is an issue when researchers are analyzing endangered species from video surveillance, as the animal, due to its camouflage, may get marked as background and go unnoticed. Therefore, we incorporated a redundant wavelet transform², which has shown potential in detecting camouflaged objects³, with DECOLOR, which enforced spatial coherence. Future steps will improve this method so that it outperforms all other foreground extraction methods in its robustness to camouflage, and it can then be used to identify endangered animals using camouflage to blend into the background. A submission is planned for one of the flagship signal-processing conferences to be held in 2021.

¹ X. Zhou, C. Yang, W. Yu. "Moving Object Detection by Detecting Contiguous Outliers in the Low-Rank Representation." IEEE Transactions on Pattern Analysis and Machine Intelligence. Vol 35, No. 3. March 2013.

² J. E. Fowler, "The Redundant Discrete Wavelet Transform and Additive Noise," IEEE Signal Processing Letters, vol. 12, pp. 629-632, Sep. 2005.

³ S. Li, D. Florencio, W. Li, Y. Zhao, and C. Cook, "A Fusion Framework for Camouflaged Moving Foreground Detection in the Wavelet Domain", IEEE Transactions on Image Processing, vol. 27, no. 8, pp.3918-3930, Aug. 2018.

046

Name: Frazier, Deonante

Major: Chemical Engineering

Faculty Advisor, Affiliation: Dr. Angela Verdell, Director of Diversity Programs & Student Development

Project Category: Biological Sciences and Engineering

Co-Author(s): Xavier Reed, Adam Swanier, Deanuta Collins

REU/Research Program: Louis Stokes Alliance for Minority Participation funded through NSF

Geographic Information System: A Study of Anthropogenic Activities and their Impact on the Mount Pleasant Creek

Watersheds are natural sources of water that are utilized by many inhabitants, and in many cases, watersheds are the primary source of water for many. These watersheds can vary in size and biodiversity, providing homes for many aquatic species. The Mount Pleasant Creek is one of the largest watersheds in Belize, and communities such as the Maya Mopan and the San Martin communities rely on this water for sustenance if potable water is not available. As populations increased in these areas, the residents imposed anthropogenic effects to the creek. Most notably, one of the effects is the destruction of the surrounding Riparian forests, which is dense vegetation that helps the creek to stay clean and vibrant. As a result, the water of the creek has dramatically decreased in hygiene, harboring bacteria that may be dangerous for human consumption.

The objective of this study is to create a map to show the sites of the creek that residents used for washing, recreational activities, etc. The creek was surveyed using GPS software and descriptions to determine the purposes of the many sites that had visible human impact. After the GPS data retrieval, ArcGIS was used to create a virtual story map as the creek progressed from the University of Belize to Maya Mopan.

In total, there were 41 sites. Most of these sites were used by residents to wash their clothes, with dump sites being close in number. In addition, surveys were conducted with the general populace to gauge the public perception and the frequency of usage of the Mount Pleasant Creek. The results of this study could help the Belizean government to know prime locations in which a “Clothes Wash Station” or a “Showering Station” may be needed for their citizens to alleviate the pressure imposed on the creek.

047

Name: Freeman, Hannah

Major: Physical Education/Kinesiology

Faculty Advisor, Affiliation: Harish Chander, Co-Director of Neuromechanics Laboratory

Project Category: Biological Sciences and Engineering

Co-Author(s): Sachini N.K. Kodithuwakku Arachchige, Alana J. Turner, Adam C. Knight, Chip Wade, John C. Garner

Other Competition(s): Thesis Research Competition (TRC)

Impact of Alternative Footwear on Lower Extremity Muscle Activation during Normal Gait, Unexpected, Alert and Expected Slips

Slip induced falls are a leading cause of both fatal and non-fatal injuries. The study intended to analyze the impact of alternative footwear [crocs (CC) and flip-flops (FF)] compared to slip-resistant low-top footwear (LT) on lower extremity muscle activity [vastus medialis (VM) & medial hamstrings (MH)], when exposed to dry normal gait, unexpected, alert and expected slips. Eighteen healthy males completed the study in a repeated measures design. Electromyography mean muscle activity (mV) from VM and MH of the lead/slipping leg was measured during the stance phase of the gait- slip trials and analyzed using a 3 (footwear) x 4 (gait-slip trials) repeated measures analysis of variance. Significantly greater lower extremity muscle activation for VM and MH during the stance phase was seen in US and AS conditions compared to NG and ES. In addition, significant footwear differences were seen for the alternative footwear during US and AS, while LT had no differences across all gait trials. The increased activity in knee extensors and flexors may be due to the slip recovery response, needed for lowering and moving the body’s center of mass over the base of support, while also suggesting co-contraction to recover from slips. The increased muscle activation in alternative footwear may be attributed to their design features such as sole tread pattern, material, geometrical design and non-secured heel. Findings also suggest, LT as the safest and efficient footwear especially when maneuvering slippery conditions.

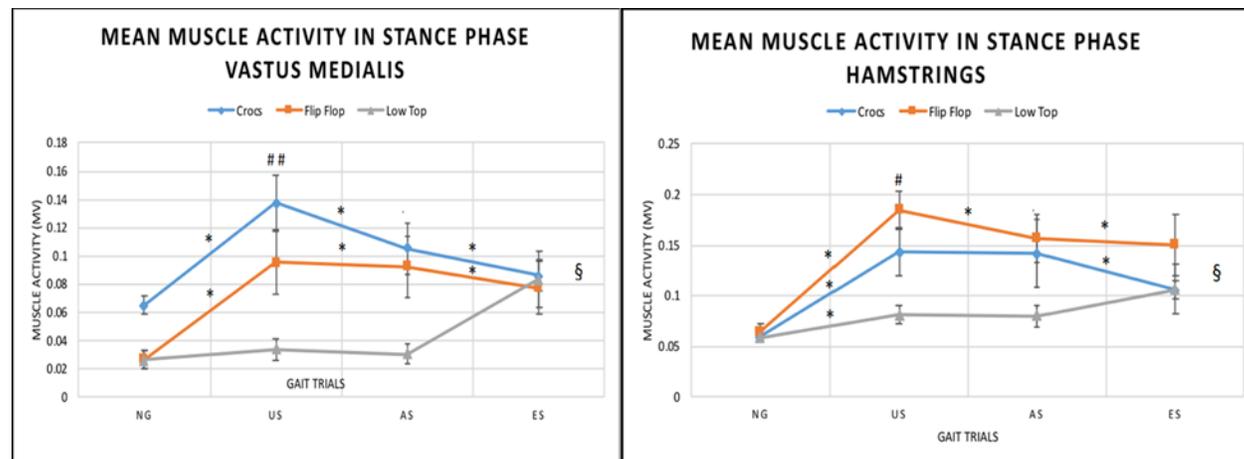


Figure 1 & 2. Mean Muscle activity (mV) for Vastus Medialis and Medial Hamstrings during stance phase for Crocs, Flip-Flops and Low Top Slip Resistant Shoe during normal gait, unexpected slip, alert slip and expected slip events. All differences were significant at $p < 0.05$.

141

Name: Frey, Nathan

Major: Chemistry

Faculty Advisor, Affiliation: Charles Edwin Webster, Chemistry

Project Category: Physical Sciences and Engineering

Co-Author(s): Robert W Lamb, Eric Dornshuld, Kelsie E. Krantz, Sarah L. Weisflog, Wenlong Yang, Paul Miller, Diane A. Dickie, Robert J. Gilliard

Computational studies of extremely twisted pyrene-fused N-heterocyclic germlyenes and diazaborolidines

Computational studies of extremely twisted pyrene-fused N-heterocyclic germlyenes and diazaborolidines Polycyclic aromatic hydrocarbons (PAHs) have applications in a wide variety of electronics, including organic light emitting diodes and field-effect transistors. These arenes tend to deviate from planarity, especially when sterically hindered, thereby forming twisted and/or bowl-shaped structures. In this computational study utilizing nucleus-independent chemical shift (NICS), DFT, and TDDFT, the structural, electronic, thermodynamic, and luminescent properties of various pyrene- and benzene-containing PAHs will be discussed.

048

Name: Frey, Sarah

Major: Agronomy

Faculty Advisor, Affiliation: K. Raja Reddy, Plant and Soil Sciences

Project Category: Biological Sciences and Engineering

Drought Tolerance Germination Study of *Brassica carinata*

Efforts to reduce greenhouse gas emissions from petroleum-based fuels has led to an increasing interest in the development and use of biofuels. The Departments of Defense, Energy, and Agriculture as well as commercial airlines are all in support of developing bio-jetfuels from non- food source oilseed crops. *Brassica carinata* is a non-edible oilseed species grown as a replacement fuel for airliners that has the potential to be a successful winter crop in the southeastern United States. Because *B. carinata* has not been widely commercially grown, suitable varieties must be identified for southeastern production as a winter crop. Drought tolerance is an important trait for suitable varieties to have, both because the crop would be planted at the driest time of the season and because the southeast has experienced increasingly unpredictable precipitation patterns that have contributed to increased drought. A series of germination tests were performed on twelve varieties of *B. carinata* in order to determine their drought tolerance. Polyethylene Glycol was used to decrease osmotic potential and simulate drought. There were five total tests: a control and four tests with osmotic potential decreasing by -0.1 each time. In each test, there were four replications of 100 seeds per variety that were incubated at 25 °C. After a 24-hour incubation period, seeds were monitored every two hours for 48 hours to track germination. Analysis of the results showed variance in the drought tolerance of the twelve tested varieties that allowed them to be sorted into groups based on their performance.

142

Name: Fuller, Gabrielle

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Rob Wolz, Department of Aerospace Engineering; Calvin Walker, Department of Aerospace Engineering

Project Category: Physical Sciences and Engineering

Experimentation and Analysis of Radomes

For over a hundred years, airplanes have been designed to provide humans with a means of travel and communication. One of the ways to communicate to people on the ground or in another plane is through the use of radios. Radars are also used to provide important data to flight crews. Both radios and radar systems mounted within the airframe must be able to operate with minimal interference. Antennas for radars are typically mounted under protective fairings called radomes. Effective radomes must protect radar systems from exposure airloads and possible foreign object damage. They must do this while without disrupting the radar's performance. Radome material must therefore have excellent radio wave transmissivity, while being flexible, strong, and affordable. A few popular materials that are used for radomes on airplanes include fiberglass and ceramic. Fiberglass is usually used on low Mach aircraft whereas ceramic is used on high Mach aircraft. Testing experimental determines transmissivity characteristics of fiberglass, ceramic and porcelain. Transmissivity along with strength, flexibility, and affordability properties are investigated and presented. This project includes an experiment that tests the transmissivity of radome materials and an analysis that discusses the strength, flexibility, and affordability of radomes.

049

Name: Fuller, Robert

Major: Biochemistry

Faculty Advisor, Affiliation: Dr. Ling Li, Biological Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Seth O'Connor

QQS expression is dependent on methylation context

Cytosine DNA methylation is an important form of epigenetic regulation in eukaryotes. While cytosine methylation in animals is mostly restricted to symmetrical methylation in the CG context, plants have unique methylation pathways capable of managing cytosine methylation in all three methylation contexts (CG, CHG, and CHH: where H is anything other than G). To better understand how different states of methylation affect gene expression, we studied *QQS* (*Qua Quine Starch*), a species-specific orphan gene in *Arabidopsis thaliana*, involved in regulation of starch and protein accumulation. Expression level of *QQS* was known to increase with complete loss of methylation in its promoter (all three contexts). We used the *jumonji 14* (*jmj14*) mutant, a mutant with inhibited CHG and CHH methylation, to determine how *QQS* is affected when CG methylation is unaltered. Starch staining revealed an increase in leaf starch in *jmj14* plants, a phenotype similar to *QQS-OE* plants, suggesting a lower expression of the *QQS* gene. In addition, qPCR revealed a decreased expression level of *QQS* in *jmj14* mutant. Our results indicate that different methylation contexts may confer different biological effects and multiple epigenetic pathways can control the activity of the orphan gene *QQS*.

050

Name: Gamblin, Anna

Major: Wildlife & Fisheries Science/Wildlife Science

Faculty Advisor, Affiliation: Dr. Raymond Igaly, Wildlife, Fisheries, and Aquaculture

Project Category: Biological Sciences and Engineering

Co-Author(s): Dr. Abby Darrah

REU/Research Program: Undergraduate Research Scholars Program

Restoration and Succession Concerning Changing Shorebird Communities on Dredge-Spoil New Round Island

Urbanization along the Mississippi coast in recent decades has resulted in a decline in native shorebird habitat and populations. After the 2010 Deepwater Horizon Oil Spill, New Round Island, a near shore dredge-spoil island, was created as a marsh bird restoration site. From 2017 to 2019, shorebird communities were observed in relation to vegetation succession to evaluate restoration success regarding the provision of alternative habitat for threatened shorebird communities. New Round Island was a 66 ha near shore island on the Mississippi Coast containing open sand, a medial lagoon, mudflats, and various seral stages of vegetation. Following the Audubon Coastal Bird Survey protocol, we surveyed numerous bird species from those of low conservation concern (e.g. Royal Tern, Sandwich Tern, Gull-billed Tern) to concerned (e.g. Least Tern, Black Skimmer, Snowy, Wilson's, and Piping Plovers) during the non-breeding season. Numerous characteristics of the island were also measured, such as the progression of the wrack, garbage, and mudflats. Surveys during the breeding season showed that while colonial nesters declined, solitary nesters increased. By 2019, Sandwich, Caspian, and Royal Terns in addition to Laughing Gulls were reported to have no nests during the breeding season. Apart from the breeding season, island use among the three species of Plovers and Black Skimmers has shown an increase from 2017 to 2019, and all Tern species have decreased their use of New Round Island. Changes in shorebird communities on New Round Island during breeding and non-breeding seasons are likely due to vegetation succession but continued observations will help confirm this conclusion.

143

Name: Garrity, Daniel

Major: Building Construction Science

Faculty Advisor, Affiliation: Saeed Rokooei, Building Construction Science

Project Category: Physical Sciences and Engineering

Co-Author(s): Stephon Calhoun

Investigating Engineering and Construction Students' Perceptions toward Their Professional Careers

Gender differences in Engineering and Construction (EC) is not a 21st Century problem. For decades, the number of women in EC has shown great imbalance to their male counterparts. In 2014, the National Center for Education Statistics (NCES) concluded that the main reason for the reluctance of women in EC is the lack of role models (Blore, 2016). The number of women in CE are low but showing signs of hope.

In the past ten years, however, studies have shown women in the engineering and construction industries at a steady increase. In 2018, 21.9 percent of engineering bachelor's degrees, 26.7 percent of master's programs and 23.6 percent of doctorates were to women, according to American Society for Engineering Education (Roy, 2018), which is a notable, steady rise throughout the years of 19.1 percent since 2007. Despite the rise in EC women, in comparison to other fields such as education and health services (74.6 percent), financial activities (53 percent), or information technology (39.1 percent) (Roy, 2018).

This study's purpose is to look at several components as to why there is such a disparity of females in engineering and construction programs at Mississippi State University. This research seeks to examine and discover the reasons that impact female students when choosing majors in EC. Moreover, the study intends to provide data to better understand inspirations, ideas, and impediments for females in the conventionally male-filled professions. Women in the College of Engineering make up 19% of undergraduate students and only 4% of graduate students. In MSU's Building Construction Science Program has only 6% female students.

144

Name: Gill, Deven

Major: Mathematics

Faculty Advisor, Affiliation: Vaidyanathan Sivaraman, Mathematics and Statistics

Project Category: Physical Sciences and Engineering

REU/Research Program: ORED Undergraduate Research Program

Double-threshold graphs

Double-threshold graphs are graphs with special structure motivated from uniform sampling in phylogenetic trees in bioinformatics. These graphs are defined by the property that two vertices in the graph are adjacent if and only if the sum of the weights assigned to these vertices is no less than a fixed lower bound and no greater than a fixed upper bound: all graphs within this class are those for which there exists some distribution of weights satisfying this property. Recently Kobayashi, Okamoto, Otachi, and Uno posed the problem of structural characterization of graphs in this class. We have made major progress in presenting such a characterization. In particular we have found an infinite family of graphs and sixteen other graphs which are obstructions to being double-threshold: obstructions are defined as graphs which are minimally outside of a specific class meaning that if any single vertex is deleted from the graph the graph immediately falls into the class. We have designed new rules about the distribution of weights which dictate how these graphs are constructed; these rules are also used to facilitate the identification of specific graphs as obstructions and the construction of graphs that are candidates for obstructions. In addition, we have found specific conditions for which we know that the number of obstructions is finite. The proof under these conditions serves to give a means to construct such graphs which are not obstructions. Our conjecture is that we now have the complete list of all obstructions. Proving such a conjecture would completely settle the problem posed by the aforementioned researchers. Our current research focuses on proving this conjecture.

051

Name: Glover, Lydia

Major: Industrial Engineering

Faculty Advisor, Affiliation: Wenmeng Tian, Industrial and Systems Engineering

Project Category: Biological Sciences and Engineering

Co-Author(s): Weitong Chen, Lauren Priddy

REU/Research Program: ORED Undergraduate Research Program

In-situ layer-wise quality characterization of 3D printing based bone tissue engineering

3D printed polymer-based scaffolds can potentially be a good alternative for bone grafting due to its high geometric flexibility, biocompatibility, and mechanical properties. However, the process-structure-property relationship in a bioprinting process is still not fully understood. Currently, the geometric quality of 3D printed scaffold is usually evaluated by SEM images or X-ray CT scanning, which are both destructive tests. There is no research on in-situ quality characterization and monitoring for bioprinting processes. High-resolution digital cameras can be used to capture images once one layer of fabrication is completed. This research project aims to quantify the porosity of the 3D printed scaffolds based on in-situ layerwise images. Image segmentation methods are used to identify the porosity regions in the images, and multiple shape descriptors of each porosity can be characterized. In addition, the effects of different process parameters on the dimensional accuracy are also investigated. The results of this study can serve as a significant step for design and optimization for 3D printed scaffold geometric accuracy control.

052

Name: Gonsoulin, Raven

Major: Biochemistry

Faculty Advisor, Affiliation: Jonas King, Biochemistry

Project Category: Biological Sciences and Engineering

Co-Author(s): Hunter Walt

Other Competition(s): Public Health Research Competition, Thesis Research Competition (TRC)

Transcriptomic and microscopy-based analyses of the effects of golgi alpha-mannosidase II inhibition on human hepatoma cell lines

Hepatoma tissue culture (HTC) cells are an essential in vitro alternative to studying effects on primary human hepatocytes. More specifically, they can aid in the study of disease (i.e. malaria, hepatitis C, and Hepatocellular carcinoma) interactions and invasions of liver cells by infectious agents. In previous literature, swainsonine has been proven to disrupt Golgi alpha-mannosidase II and claimed as an inhibitor of viability of human hepatoma cells. The objective of this study was to elaborate the effect of swainsonine on core intracellular structures and the glycocalyx of the commonly used hepatocellular line, HepG2. The working hypothesis was that single enzyme inhibition would lead to a more global effect. Cells were grown under standard environmental conditions on poly-D-lysine or rat tail collagen-coated plates with cover slips. Cells in the experimental group were then treated with 1 μ g/mL swainsonine (a high concentration based on previous studies) in each well for 72 hours. Cells then went through RNA-seq analysis of the total transcriptome and correlative microscopy analysis. For RNA-seq analyses, RNA was purified using RNAzol and sent to Novogene for further QC and sequencing. Differential expression analyses were then conducted using a Tuxedo suite-based pipeline. For microscopy analyses, cells on coverslips were fixed and then incubated in 1% BSA and primary antibodies AMF-17b (VIM), TROMA-I (KRT2), MNCD2 (CAM), and PCRP-DAXX-5G11 (DAXX). RNA-seq and microscopy analysis show significant changes in a broad range of pathways related to extracellular matrix formation and some core cellular processes. Results using live/dead cell staining show that swainsonine treatment does not greatly impact HepG2 viability at the concentration used, in contrast to one highly cited report. This data on the global effects of inhibition of a specific N-linked glycosylation pathway establishes a baseline for ongoing research in our lab as we investigate the effects of these changes on the biology of *Plasmodium*-hepatocyte interactions.

053

Name: Goodeaux, Jessa

Major: Food Science & Technology

Faculty Advisor, Affiliation: Derris Burnett, Department of Animal and Dairy Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Dr. Shecoya White, Emily Sherman, Dianna Wilson

A Comparative Evaluation of the Chemical Composition of Various Red Meats

Due to the increased demand for healthy red meat alternatives, products that increase satisfaction and appeal while improving health implications have been sought by the red meat industry. In the present study, the composition of various ground elk, bison, and venison were evaluated in order to analyze the possibility of these products being consumer demanded alternatives for ground beef. The first part of this study examined the chemical composition of a variety of non-traditional red meat products using an InfraLab e-Series Meat Analyzer to determine the content of fat, moisture, protein, and collagen. Results showed that the ground beef advertised to contain 20% fat (Sam's Club 80/20) contained an average fat content of 21.68% fat. This sample also contained 16.86% protein. The ground beef advertised to contain 7% fat (All Natural Beef 93/7) contained an average fat content of 7.93% and an average protein content of 20.46%. The fat content analyzed in both of these ground beef samples were consistent with the advertised value. Results from the analysis of ground venison showed that the average percentage of fat is 8.76% and the average percentage of protein is 20.26%. The fat and protein content of the ground venison was most aligned with the All Natural Beef 93/7 values, therefore, for a consumer seeking low fat and high protein, venison is potentially a suitable alternative to ground beef. Consumers seeking ground red meat that is more similar to Sam's Club 80/20 could consider ground bison. The averages of all bison samples presented a

fat content of 13.1% and a protein content of 19.22%. Further evaluations will be conducted in order to determine consumer approval of these ground red meats as an alternative to ground beef.

054

Name: Grant, Christine

Major: Biological Engineering

Faculty Advisor, Affiliation: Dr. Lauren Priddy, Agricultural and Biological Engineering

Project Category: Biological Sciences and Engineering

Co-Author(s): Malley Gautreaux

Other Competition(s): Public Health Research Competition, Thesis Research Competition (TRC)

Fabrication of Thermo-responsive Chitosan Gel as a Delivery Vehicle for Fosfomycin in the Treatment of Osteomyelitis

Osteomyelitis is a bone infection that can occur due to *Staphylococcus aureus* (*S. aureus*). Current treatments for infection are debriding the area and long-term antibiotics. However the debridement is invasive and a rise in resistant bacteria limits antibiotic use^{1,2}. To improve the treatment of osteomyelitis, direct delivery to the infected area via a chitosan hydrogel is being investigated.

Chitosan is a naturally occurring polysaccharide that is biodegradable and biocompatible³. Combined with its intrinsic antimicrobial properties, chitosan in the form of a hydrogel is a potential sustained- released treatment for osteomyelitis when loaded with an antibiotic.

In the present study, we are developing the protocol for fabricating chitosan gels from water-soluble chitosan and quantifying the ability of the hydrogels, when loaded with fosfomycin, to kill planktonic and biofilm *S. aureus* populations. Fosfomycin was chosen due to its greater efficacy (at one-tenth the dose compared to vancomycin²) in treating biofilms.

The chitosan hydrogel was fabricated by altering a protocol for acid-soluble chitosan to work with water-soluble chitosan, which was chosen for its resultant neutral pH gels. Chitosan was slowly added to distilled water while on ice with stirring. Once most of chitosan was dissolved, a β -glycerophosphate disodium salt solution was added³. The resulting solution is temperature dependent: liquid at cold temperatures and gel overnight at 37°C.

Preliminary Kirby-Bauer work demonstrates that chitosan alone has some antimicrobial activity. In addition, when loaded with vancomycin, the chitosan-vancomycin gel showed similar efficacy in killing the bacteria as a PBS solution with the same dose of vancomycin. Future work will include the efficacy of fosfomycin loaded gels in killing of planktonic and biofilm *S. aureus* populations over 24-hours. The results of the planktonic assay will be quantified via dead cell staining and flow cytometry, and results of the biofilm study measured via fluorescent imaging. This *in vitro* work will help lay the foundation for evaluation of the antimicrobial effects of chitosan-fosfomycin *in vivo*².

References

1. Urish, K. L. & Cassat, J. E. *Staphylococcus aureus* Osteomyelitis: Bone, Bugs, and Surgery. *Infect. Immun.* (2020) doi:10.1128/IAI.00932-19.
2. Cobb, L. H. *et al.* CRISPR-Cas9 modified bacteriophage for treatment of *Staphylococcus aureus* induced osteomyelitis and soft tissue infection. *PLoS One* **14**, 1–17 (2019).
3. Chenite, A. *et al.* Novel injectable neutral solutions of chitosan form biodegradable gels in situ. *Biomaterials* **21**, 2155–2161 (2000).

145

Name: Grantham, Abigail

Major: Chemical Engineering

Faculty Advisor, Affiliation: Dr. Santanu Kundu, Chemical Engineering; Dr. Bill Elmore, Chemical Engineering

Project Category: Physical Sciences and Engineering

Co-Author(s): Katie Elmore

Enzymatic Polymerization of Epoxidized Oleic Acid

Cottonseed oil is a prime candidate for polymerization due to its wide availability and limited uses. Here, an attempt has been made to synthesize non-crosslinked polymers starting with cottonseed oil using enzymatic polymerization process. The resultant polymer will have applications in many areas and will also be attractive because of the renewable starting material and the possible biodegradability of the polymer. Cottonseed oil has single carbon-carbon double bonds present that can be converted into oxiranes using an epoxidizing reaction. The epoxidized cottonseed oil (ECSO) can then be used in the polymerization reactions. After drying the ECSO (using molecular sieves and anhydrous calcium hydride), dried toluene and the enzyme catalyst (Novozym N435) are added. The resultant mixture is then heated under Argon atmosphere. The resulting polymer is then characterized using differential scanning calorimetry, thermogravimetric analysis, and gel permeation chromatography. Oleic acid is one of two distinct fatty acids found in cottonseed oil. It was found that oleic acid is a preferable candidate for polymerization, because cottonseed oil appears to yield crosslinked polymers when analyzed. The same epoxidation and polymerization techniques are used on oleic acid and the resultant polymers are found to not be crosslinked upon analysis. This is key to making a polymer with thermoplastic properties, which is both recyclable and processable in industrial settings. The polymerized oleic acid could potentially be used in an electrospinning to produce fibers, which could be used in many applications.

197

Name: Graves, Ashlyn

Major: Human Sciences/Apparel Textiles & Merchandising

Faculty Advisor, Affiliation: JuYoung Lee, School of Human Sciences

Project Category: Social Sciences

Co-Author(s): Stone Vincent, Sarah Suddoth, Kristina Dunham, Austin Waddy

Other Competition(s): Community Engagement Research Track

The Impact of Dietary Quality on Academic Performance in College Students

Several studies have examined the impacts that diet can have on cognitive performance, particularly that of elderly patients or those suffering from mental decline. Less often discussed is the possible relationship between diet quality and academic performance in college students, particularly in regard to grade point average. Here we examine that relationship through a survey of college students aged 18 to 25, from universities across the United States. The nutritional quality of individual diets [1] is measured using the Multifactor screener scale by NHIS (2000) alongside GPA. We will then use a Pearson product-moment correlation to determine the relationship between the two variables. Surveys are distributed digitally, and answers received anonymously to ensure confidentiality. Through the data collected, we can observe the tendencies of college students in regard to their dietary habits. The research will allow us to find the significance level between diet and both GPA and letter grades.

055

Name: Greer, William

Major: Animal and Dairy Sciences (Pre-Vet)

Faculty Advisor, Affiliation: Henry Paz, Animal and Dairy Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): W. M. Greer, V. M. De La Guardia, C. Becker, A. Stone, H. A. Paz

REU/Research Program: URSP

Rumen and hindgut bacterial community responses to heat abatement strategies in grazing dairy cattle

The gastrointestinal microbiome is central to productive performance in ruminants. Heat stress jeopardizes the intestinal milieu of the grazing cow, but the effect on the resident bacterial community has remained largely unexplored. The objective of this study was to evaluate the effect of heat abatement strategies on the rumen and hindgut bacterial community structures in grazing dairy cattle. Twenty-seven lactating cows (18 Holstein and 9 Jersey cows) were randomly assigned to one of the following treatments: (1) control (no heat abatement), (2) shade (portable shade structure 80% protective shade cloth), or (3) misters (PVC misters at 3 m tall). Each treatment was replicated 3 times ($n = 9$). Cows were acclimated to graze Hybrid Pearl Millet for 16 d before the start of the study and then assigned to paddocks according to treatment for 39 days. Cows had access to water and were offered supplemental concentrate at 15.11 kg/head/day. On day 39, a rumen sample was collected via esophageal tubing and a fecal sample was collected via fecal grab from each cow. The rumen and fecal bacteriomes were characterized by sequencing the V4 region of the 16S rRNA gene using the Illumina MiSeq platform. Raw sequences were processed using the QIIME2 pipeline and statistics were performed using the R software (v3.4.3). Significance was considered at $P \leq 0.05$. Alpha diversity was evaluated using the Shannon-Wiener index and did not differ by sample type (rumen vs fecal; $P = 0.55$, averaged 6.17 ± 0.50) or across treatments ($P = 0.57$, averaged 7.60 ± 0.50). Beta diversity was evaluated using the weighted UniFrac distance metric and differed by sample type ($P = 0.001$), but did not differ across treatments ($P = 0.80$). Overall, the bacterial community composition in the dairy cows differed across gastrointestinal segments, but was not influenced by heat abatement strategies.

198

Name: Grisham, Brandon

Major: Business Information Systems

Faculty Advisor, Affiliation: Merrill Warkentin, Department of Management and Information Systems; Zhenya 'Robin' Tang

Project Category: Social Sciences

Other Competition(s): Thesis Research Competition (TRC)

Analyzing and Predicting Trends with Public Data from Online Communities

Reddit has become one of the largest social news forums in the world, featuring an average of 430 million active users and 21 billion views per month (RedditInc Press, 2019). A key question is how businesses and academia can effectively use the public information provided by Reddit's organized communities to explore salient interesting research questions. Given the scope of Reddit's 130 thousand 'subreddits', difficulties arise from the lack of collection tools that can analyze user opinions, posted questions, or shared perspectives. This research utilizes a personally-created program that collects daily traffic data from the entire website, scraping various parameters like subscriber growth and post frequency into a keyword-driven database. The API-programmed script also populates our database with details regarding specific communities, highlighting areas of interest for businesses and academia alike. By utilizing this database system, one can locate and chart growing or diminishing trends among Internet users. An example of one of these trends include correlating data resulting from the Coronavirus Disease (COVID-19). Clear patterns emerge between the subscriber growth of the Coronavirus subreddit, a rise in the posts regarding the Coronavirus on numerous investment subreddits, and the impact the virus has made on the U.S. stock market. The ultimate goal of this research is to leverage statistical data analysis and machine-learning techniques to capitalize on this dataset. This research will help illuminate Internet user interests, predict rising and falling trends, and chart the current popularity of cultural phenomena.

056

Name: Gurung, Utsaha

Major: Wildlife & Fisheries Science/Wildlife Science

Faculty Advisor, Affiliation: Mark Woodrey, Coastal Research and Extension Center

Project Category: Biological Sciences and Engineering

Co-Author(s): Abby Darrah, Raymond Iglay

Other Competition(s): Community Engagement Research Track

Effects of Banding and Camera Trapping on the Nest Success of Least Terns, Snowy Plovers, and Wilson's Plovers

Bird banding and camera trapping are usually considered safe for research purposes with minimal impacts on bird nesting success. However, a few studies suggest potential negative effects. Therefore, we investigated the effects of bird banding and camera traps on the nest success of Least Terns (*Sternula antillarum*), Snowy Plovers (*Charadrius nivosus*), and Wilson's Plovers (*Charadrius wilsonia*) in coastal Mississippi. We compared banded 29 Least Terns, 8 Snowy Plovers, and 22 Wilson's Plovers to unbanded 117 Least Terns, 11 Snowy Plovers, and 9 Wilson's Plovers. We also deployed camera traps on 12 Snowy Plover and 16 Wilson's Plover nests and compared to 5 Snowy Plover nests and 12 Wilson's Plover nests that were never subjected to camera traps. We used logistic-exposure survival analysis to estimate daily nest survival probability, compare nest fates of banded and unbanded individuals of each three species, and compare nest fates of plover nests with and without camera traps. The daily nest survival probability did not significantly differ when birds were banded ($\bar{x} = 0.986$, SE < 0.001) or not ($\bar{x} = 0.988$, SE < 0.001) or when camera traps were deployed ($\bar{x} = 0.987$, SE < 0.001) or not deployed ($\bar{x} = 0.985$, SE < 0.001). We conclude that bands and camera traps can be used on these species without significantly affecting their nest success along coastal Mississippi.

057

Name: Hadden, Robyn

Major: Biochemistry

Faculty Advisor, Affiliation: Jean M.N. Feugang, Department of Animal and Dairy Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): BreAnna N. Lynch, Orion S. Rivers, Allison R. Julien, Carrie K. Vance

REU/Research Program: URSP

Quantum dot conjugates for high sensitivity fluorescence detection of sperm proteins

Quantum dots (QD) are semiconductors of a nanometer scale that can be used for efficient bioimaging due to their high brightness, photostability and wide spectrum fluorescence. These properties are suitable for very sensitive detection of low abundance biomolecules such as arginine vasotocin (AVT) and gonadotropin-releasing hormone (GnRH). Here we used QD conjugated with AVT or GnRH to examine the likely presence of corresponding receptors on mammalian spermatozoa. Freshly harvested and extended boar semen was obtained from a commercial boar stud (Prestage Farms; West Point, MS) and centrifuged. Sperm pellets were resuspended in a pre-warmed Phosphate-Buffered Saline solution (PBS), and spermatozoa were adjusted to 200×10^6 /mL. Approximately 1 nM of QD alone (negative control), QD-AVT, QD-GnRH, and QD-PLG (plasminogen, used as positive control) were added to 100×10^6 sperm suspension (0.5 mL). Sperm mixtures were incubated at 30-35°C for 60 minutes, followed by sperm (total and progressive) motility and morphology analyses (Computer-Assisted Sperm Analyzer). Excess QDs were washed out from mixtures (3X) through centrifugation. Sperm pellets and corresponding supernatants were imaged for fluorescence emission using IVIS and confocal microscopy. Data of six replicates were statistically analyzed (ANOVA-1). $P < 0.05$ indicates significant difference. Sperm motility parameters were significantly increased in all groups ($P < 0.04$) except QD-GnRH (60% and 11%), when compared to the control (no QD; 64% and 9%). The QD-GnRH negatively affected sperm morphology ($P < 0.05$). Fluorescence signals (IVIS) and QD-point attachments on spermatozoa (Confocal) were detected in all QD samples. QD alone had low dispersed presence on spermatozoa. This preliminary study indicates the likely presence of AVT and GnRH receptors on boar spermatozoa, the activation of which may influence sperm motility parameters. The QD-AVT binding contributes to the conflicting data

surrounding the presence of AVT in mammals. The proposed QD detection system holds great promise for spotting low abundance proteins.

058

Name: Hagwood, Spencer

Major: Microbiology

Faculty Advisor, Affiliation: Christopher Brooks, Department of Biological Sciences

Project Category: Biological Sciences and Engineering

Studying the Effects of Spines on Heat Dissipation in *Opuntia engelmannii* var. *lindheimeri*

Most species of cactus throughout the world have spines, which are a modified form of leaves and are commonly associated with protection from herbivores. While defense against herbivory is thought of to be the most common purpose for spines, there have been previous studies performed that suggest a second purpose: temperature regulation. The purpose of this study was to determine the role that the presence of spines play in thermal regulation of *Opuntia engelmannii* var. *lindheimeri*. Seven pairs of stem segments were collected from *Opuntia engelmannii* var. *lindheimeri* growing in Galveston Island State Park, TX and potted in 8-inch pots using a common pool of well-drained soil. Within each pair, one of the sample's spines were removed, while the other's spines were left unaltered. The samples will be placed in the light of a heat lamp in increments of four hours at a time. During these trials, the samples' IR temperatures will be measured to determine the temperature difference between the stem segments with and without spines. The differences in the rate of cooling over time between the samples with and without spines are discussed. The effect of the size of stem segments on the rate of cooling is also discussed. Plant size, spine number, spine length, and the direction that flattened stem segments face in natural populations all have an important effect on the heat balance of these desert plants.

199

Name: Halbert, Ian

Major: Psychology

Faculty Advisor, Affiliation: Coleen Sinclair, Psychology

Project Category: Social Sciences

Co-Author(s): Jessica Utley

Social identity and aggression

According to surveys conducted by the National Center for Education Statistics and Bureau of Justice, about 20% of students ages 12-18 experienced bullying. Research indicates that bullying contributes to a variety of adverse effects such as increased risk for experiencing depressive symptoms and suicidal ideation (Hespacioglu, 2018). Social identity, the extent to which one identifies with a social group and engages in expected behaviors as a result of group membership, plays a significant role in how bullying is perceived among adolescents (Ojala & Nesdale, 2004). Social identity plays a significant role in adolescent identification with group membership as well as how they respond to actions of members of perceived outgroups (Smeekes & Verkuyten, 2015). This study examined the extent to which responses to bullying differed depending on whether youth were targeted according to their social identity or whether they were targeted by members of an outgroup or ingroup. A nationally-representative sample of students took part in an online survey (N= 600) that assessed their experiences of peer victimization, their group affiliation, the perceived group affiliation of those that participated in victimization, and the behavioral responses to victimization. Results indicate that when victimized by a member of a perceived outgroup, students were more likely to respond antisocially. When victimized by a member of the ingroup, students were more likely to engage in prosocial behavior.

059

Name: Hamill, Vaughn

Major: Biochemistry

Faculty Advisor, Affiliation: John J. Riggins, Biochemistry - Entomology

Project Category: Biological Sciences and Engineering

Co-Author(s): Kristy McAndrew

Comparison of ecoacoustic methods and traditional biodiversity estimates as predictors of wood decomposer arthropod diversity

The objective of this study was to determine if ecoacoustics was a time efficient and accurate method for determining arthropod biodiversity in decomposing wood. Ecoacoustics is a specific type of bioacoustics that focuses on community-level acoustic information to determine biodiversity.

Traditional sampling of decomposer invertebrates is typically expensive, time consuming, and destroys the samples during the process. This makes widespread experimentation wood decomposition studies challenging and limits our ability to understand the role of biological communities in the terrestrial carbon cycle. To determine the accuracy of ecoacoustics, four indices were analyzed and compared to biodiversity estimates calculated from physically sorted and identified invertebrate samples collected from decomposing wood. The ecoacoustic indices included acoustic complexity index, spectral entropy, roughness, and spectral peak count. The typical extraction method included extracting invertebrates from decomposing wood with Berlese funnels and physically sorting and identifying the arthropods to the Order level. The information from the critter sorting was used to calculate Shannon's and Simpson's biodiversity indices and Order richness. 1-minute and 2-minute ecoacoustic readings were analyzed to their respective sorted samples with Pearson's correlation test at $\alpha = 0.05$, where all p-values ≥ 0.08 .

Preliminary results indicate that there is no significant linear correlation between the sorted samples and the ecoacoustic measurements, but future work will include full sample sets, an increase in sample size from $n=16$ to $n=90$, and machine learning techniques if the indices are not able to provide statistical predictions.

200

Name: Hardy, Taylor

Major: Educational Psychology

Faculty Advisor, Affiliation: Dr. Kasia Gallo, Educational Psychology

Project Category: Social Sciences

REU/Research Program: Social Sciences

The Effects of Music on Memory in Elderly with Types of Dementia

This literature review summarizes the findings of 15 empirical studies exploring how different types of music therapy and interventions affect memory in elderly with various types of dementia. Generally, each one of these studies focused on how music enhances cognitive processes and memory, and improved overall mood and quality of life. In most studies, participants were the elderly with dementia, specifically with Alzheimer's Disease. These participants were around the same age, averaging 74 years old. Some studies, on the other hand, varied in participant age; some researchers compared the effects of music-based interventions on young healthy people with the effects on elderly people with dementia. The results were similar in all 15 articles; researchers found that music-based interventions do in fact appear to improve memory and prevent atrophy (shrinking) of the human brain.

Keywords: Dementia, music intervention, music therapy, Elderly, Alzheimer's Disease

146

Name: Harrod, Turner

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Adrian Sescu, Aerospace Department

Project Category: Physical Sciences and Engineering

Co-Author(s): Yeqing Wang

Testing the Feasibility of Acoustic Liners on Quadcopter Drones

Quadcopter drones are often accompanied by loud, undesirable noises that can be irritating to the operator and nearby individuals. The successful reduction in noise output in drones has serious applications in aerospace, primarily in the noise reduction of helicopters. This research tested the energy absorption and deflection of acoustic liners around the blades of a quadcopter drone. The purpose is to determine if there is a significant reduction in noise output from the drone. Testing was conducted indoors to reduce ambient noise. The design of the acoustic liners was done using a 3-D printer.

201

Name: Hayes, Amanda

Major: Human Sciences/Human Dev & Family Studies

Faculty Advisor, Affiliation: Joe Wilmoth, School of Human Sciences

Project Category: Social Sciences

Co-Author(s): Anna-Riley Yoviene, Madison Smith, Emily Michael, Hannah Moak

How the combination of parenting style and sex education affects adolescent risky sexual behavior and later adult sexual behavior

The purpose of this study is to determine whether parenting style and level of sexual education can predict the probability of adolescents' engaging in risky sexual behavior, as well as the impacts on adult sexual practices. Prior research indicates that comprehensive sex education is more effective than abstinence-only sex education; likewise, much research has found that authoritative parenting style is most effective. Our study combines the two aspects to determine the most effective method in guiding adolescents from risky sexual behaviors; as previously determined by research, risky sexual behaviors are risk factors that could lead to further adversity. Our research will be conducted via survey distributed by email and social media to college-age (18-26 years of age) men and women in the south eastern region of the United States. We will utilize the Authoritative Parenting Index (Jackson, Henriksen, Foshee) to determine parenting style as defined by the child; four questions developed by Landor, Simons, Simons, Brody, and Gibbons to measure adolescent risky sexual behavior; questions focused on Knowledge and Life Skills in the Sexuality Education Review and Assessment Tool (UNESCO) to determine the quality of sex education; and the Safe Sex Behaviors Questionnaire (DiLorio) to determine adult sexual behavior. We will conduct a linear multiple regression test to determine if level of sex education and parenting style predicts adolescent risky sexual behavior, as well as adult sexual behavior. We will also conduct a Pearson product-moment correlation to determine if there is a statistically significant relationship between adolescent risky sexual behavior and adult sexual behavior. We expect authoritative parenting style and comprehensive sex education will predict adolescent risky sexual behavior. We also predict that authoritative parenting and comprehensive sex education will predict adult sexual behavior. Furthermore, we expect a positive correlation between adolescent risky sexual behavior and adult sexual behavior.

202

Name: Hearn, Rhonda

Major: Social Work

Faculty Advisor, Affiliation: Dr. Angela Savage, School of Social Work

Project Category: Social Sciences

The Impact on Childhood Obesity in Ages 0-5

Childhood obesity is a chief public health concern in the United States putting children and adolescents at risk for poor health conditions. We now have the highest percentage of overweight youth in our nation's history. Over the last three decades, the prevalence of childhood obesity has nearly tripled. Today, approximately 15% of American children are considered overweight and an additional 16% are considered obese. This amounts to approximately 24 million children who are struggling with unhealthy amounts of excess weight. Among overweight and obese children 3 to 5 years old, there is a 40% chance of becoming an overweight and obese adolescents. It is on the rise and the rate is higher among those at a worse socioeconomic position and racial/ethnic minority individuals. For this undergraduate project information presented will show the impact poverty has in the Black Belt area in Alabama. This project was completed in collaboration with a community partner who provide educational services for the Black Belt community in Alabama.

203

Name: Hendrix, Alexis

Major: Social Work

***Home Institution:** Mississippi State University - Meridian

Faculty Advisor, Affiliation: Dr. Angela Savage, Arts & Sciences - SW Meridian Campus

Project Category: Social Sciences

REU/Research Program: Social Work

Intimate Partner Violence

Intimate Partner Violence (IPV), also known as domestic violence, has been a national issue that has affected a variety of individuals regardless of socioeconomic status. It has been analogized that IPV is not only a problem worldwide, but also in the rural area of Mississippi. Due to this problem, there have been many state and federal laws that have been put in place to combat IPV. The central focus of this project idea is to show that IPV is an issue. This project will discuss specific evidence-based interventions that have been favorable to show a decrease in this problem.

A domestic violence shelter in East Mississippi has been working aimlessly to protect and provide basic needs for victims. The intervention that has been successful for the facility is the Batterer Intervention Program which originated from the Duluth Model that is used worldwide to help with victims of circumstances. The 24 week program helps victims to become independent and conquerors of their current situation. The main goal is to make sure the victims are protected wholeheartedly from their abuser and not have to remain a victim but will eventually be a survivor to live and tell his/her story. The story of those victims can impact the lives of other victims and hopefully save many lives than those who were lost. It is time to take the next step.

147

Name: Henkel, Benjamin

Major: Physics

Faculty Advisor, Affiliation: Benjamin Crider, Physics

Project Category: Physical Sciences and Engineering

Automated gantry system for use with germanium gamma-ray imaging (GeGI) detector

Depleted uranium (DU) that is used in military munitions and left over from other processes pollutes the soils and environments of many different locations. Due to the fact that the most common isotopes of uranium, uranium-235 and uranium-238, can undergo radioactive decay to produce a chain of emitted radiation such as alpha particles and gamma

rays, these leftover chunks of dangerous material can be detected using gamma-ray detectors and then removed using appropriate extraction tools. If these leftovers are not removed, they can pollute soils and water supplies, contaminating thousands of square miles of land, prohibiting further use of these locations. Thus, finding and removing these contaminants before they cause a larger array of issues is a high priority. To aid in the retrieval of DU, scintillator detectors mounted on robots are currently used to survey these locations to gather data about possible contaminants. As an extension to the capabilities of existing robot systems, efforts to integrate a novel Germanium Gamma-ray Imager (GeGI) detector with the robots are underway. The GeGI detector allows visualization of the nature of the source of gamma radiation through a variety of imaging modes, but a full characterization of the detector capabilities/limitations must be performed before it can be utilized in the field. To characterize this detector, an automated gantry system on top of a sandbox is being developed to simulate these robotic devices moving over these contaminated environments and allow researchers to conduct experiments that will greatly improve the accuracy and reliability of detection. The development of this gantry system is done in part by combining the abilities of several electric motors and motor drivers with the graphical programming language of LabView. Progress on the gantry system, its applications toward characterizing the GeGI detector, and features of the GeGI detector itself will be presented.

060

Name: Herring, Bailey

Major: Biochemistry

Faculty Advisor, Affiliation: Dr. Darrell Sparks, Biochemistry, Molecular Biology, Entomology and Plant Pathology

Project Category: Biological Sciences and Engineering

Co-Author(s): Dr. Ashli Brown Johnson, Darren Nakamura

Detection of Heavy Metals in Nutraceutical Products

Nutraceuticals are nutrients that are consumed for a health benefit similar to vitamins, minerals, herbs, and extracts. Many nutraceuticals have made claims of curing illnesses and helping reduce symptoms associated with ailments. According to FDA regulations, most nutraceuticals would be classified as a dietary supplement and not a drug. Under this definition, a dietary supplement is meant to provide nutrients, whereas a drug is designed to treat illness or disease. Because supplements aren't considered drugs, they aren't put through the same strict safety and effectiveness requirements that drugs are. Recent concerns with these products have included the presence of heavy metals such as mercury, arsenic, and lead, as well as pesticides. Due to the rise in popularity and increase in availability and usage, hemp oil products and other essential oil blends were chosen for this project. The objective of this study was to measure levels of inorganic contaminants in these products. The hemp and essential oils were purchased from various sources including vitamin distribution companies and CBD suppliers. Each sample was acid-digested using a CEM Mars6 Microwave Digester in order to free the metals from organic substrates. Samples were analyzed on an Agilent Technologies 7900 Inductively Coupled Plasma Mass Spectrometer (ICP-MS) and Milestone DMA-80 Direct Mercury Analyzer to determine the presence of selected inorganic contaminants. Preliminary results showed up to 10 ppb of mercury in these products. No detectable lead, arsenic, selenium, or thallium were found in the tested samples. Given that plants are potential bio-accumulators of heavy metals, and since a large amount of plant material is processed to extract the nutraceutical concentrates and essential oils, there exists a risk of heavy metal contamination.

148

Name: Hicks, Bruce

Major: Electrical Engineering

Faculty Advisor, Affiliation: Ali C. Gurubuz, Electrical and Computer Engineering

Project Category: Physical Sciences and Engineering

A Decentralized EV Power Controller Facilitated by Reinforcement Learning

As the presence of electric vehicles (EVs) becomes more prominent, their potential effects on the power grid, as both a mobile power storage and a mobile power draw, become increasingly important. This study focuses on the mitigation of

these effects through the application of a decentralized, edge-based controller with limited dependence on any form of centralized communication system, inspired by the end-to-end control methods utilized in Internet operation. Therefore, the ultimate goal of the study is to develop and optimize a working control mechanism to assist in maintaining the safety and utility of the power grid during the inclusion of increasingly high levels of EV penetration. The study begins with the implementation and evaluation of several power system simulations. These simulations, allowing for the collection of theoretical data about the responses of the grid to varying levels of EV participation, are used to create sets of testing data. System-level analysis, with a focus on the application of reinforcement learning techniques, will be applied to these pools of data to facilitate the creation and optimization of a valid edge-based controller. Here, we evaluate the merits, requirements, and limitations of this approach.

061

Name: Hidalgo, Caitlin

Major: Animal and Dairy Sciences (Pre-Vet)

Faculty Advisor, Affiliation: Dr. Erdogan Memili, Animal and Dairy Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Muhammet Rasit Ugur

REU/Research Program: Undergraduate Research Scholars Program

Improving Bull Fertility Using Molecular and Cellular Markers of Sperm

Efficient and sustainable production of cattle is vital for global food security. Bull fertility is critical for efficient reproduction of cattle. Cryopreservation of sperm from elite bulls is important for insemination of large numbers of cows. However, molecular and cellular markers and mechanisms regulating sperm cryopreservation and bull fertility are unclear. These gaps in the knowledgebase are important because they are preventing advances in fundamental animal science and technology. The objectives of this research were to determine dynamics of the PAWP protein expression and ascertain nuclear dynamics in sperm from 16 Holstein bulls with different sperm freezability phenotypes using immunocytochemistry, flow cytometry and nuclear decondensation assay. The results of flow cytometry experiments showed that average numbers of cells with detectable PAWP were 1604.4 ± 1766.4 and 3555.2 ± 1488.1 between the high vs. low freezability group, respectively ($P=0.029$). In addition, there was a linear relationship between post-thaw sperm viability and PAWP expression in cryopreserved bull sperm ($P=0.014$). The immunocytochemistry experiments revealed that PAWP was localized in the post-acrosomal sheath of the bull sperm. Moreover, PAWP is moderately conservative among mammals, and it interacts with WWP1, YAP1, ACTR5, INO80C, MGA, PCGF6, PLCZ1, BAG3, and DOC2 proteins. Biological network analyses revealed that PAWP has a significant gene ontology terms in cellular and biological processes including nucleus organization, organelle organization, male and female pronucleus assembly, egg activation, and fertilization ($P < 0.05$). The results are significant in advancing gamete biology and cryoscience and assisted reproductive technologies.

062

Name: Hilbun, Trace

Major: Geosciences/Professional Geology

Faculty Advisor, Affiliation: Dr. Brenda L. Kirkland, Geosciences/Professional Geology

Project Category: Biological Sciences and Engineering

Comparing Growth Rates of Cyanobacteria in Varying Water Chemistries for Maximizing CO₂ Absorption

Climate change from rising concentrations of greenhouse gases has been an increasing global concern over the past few decades. Growing algae is a simple solution in helping to absorb CO₂ out of the atmosphere through photosynthesis. It also shows promise as a sustainable structural material as it calcifies into CaCO₃, absorbing more CO₂ gas. In order to properly grow and care for the algae at a large scale it's optimal growing and calcifying conditions must be understood and manipulated. Five algal mat samples were grown by putting layers of sand, desiccated material from a prior mat, distilled water, and active cultures of cyanobacteria/cyanophytes alongside each other in varying water chemistries including sea water, uric acid, CaSO₄, CO₂, and regular spring water for control. These mats were evaluated and compared over the course

of a couple months as the algae grew. Uric acid and CaSO₄ samples showed to be promising factors in maximizing algal growth and showed evidence of carbonate precipitation within two days. The sea water sample eventually showed some calcium carbonate as well as NaCl crystals. These results show that by adjusting and monitoring parameters algal mats can grow and capture CO₂ out of the atmosphere more rapidly than they do in nature.

149

Name: Hill, Daniel

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Adrian Sescu, Xipiter UAV design team; Calvin Walker, Xipiter UAV design team

Project Category: Physical Sciences and Engineering

Analysis of the Aerodynamic and Stability Characteristics of Flying Wings

One of the goals in the aviation industry is to make aircraft as efficient as possible. There have been several ideas that aircraft designers have undertaken over the years in address this issue. One such idea is the flying wing, which was observed to improve the aerodynamic performance by eliminating the vertical stabilizer. While this new configuration reduces the drag, several additional problems present themselves, including lateral and directional stability problems. The goal of this project is to analyze the aerodynamic and stability characteristics of flying wing aircraft, and to introduce a new conceptual flying wing design for general aviation. Initial analysis and research provided extensive unknown issues and aspects of flying wings which include bell-shaped lift distributions and geometric wing twist. The YB-49 aircraft served as the base flying wing aircraft for this study, which included CFD simulations to analyze the flow velocity in the y-direction, as well as the pressure distributions across the upper and lower sections of the aircraft. An aerodynamic model of the YB- 49 was created in 3DFOIL containing the same parameters as the real aircraft. 3DFOIL was used to produce spanwise loading graphs, also known as lift distribution curves, as well as to provide the total drag force for the YB-49 aerodynamic model. In addition to the aerodynamic and stability analysis of the YB-49, the conceptual design and analysis of a general aviation flying wing was undertaken using the same process of the aforementioned YB-49.

063

Name: Hill, Rachel

Major: Agronomy

Faculty Advisor, Affiliation: William Kingery, Plant and Soil Sciences; Shankar Ganapathi Shanmugam, Institute for Genomics, Biocomputing & Biotechnology

Project Category: Biological Sciences and Engineering

Soil Microbial Ecology: Effect of Tillage Practices on Microbial Diversity

As the world's population climbs, increasing agricultural production sustainably in order to meet requirements for food, feed, fiber, fuel and medicines is at the forefront of agricultural research. One developing area of interest is in the relation of soil microbial ecology to crop yield. The first phase is determination of the abundance and distribution, or diversity of prokaryotic species that are present in the soil in close proximity to crop roots. The completion of this phase leads to determining the effects from microbes on plant growth and development, which will allow for the final phase: determining which species are responsible for specific functions. It is predicted that certain farming practices and soil management techniques can be implemented to increase the size and functional diversity of microbial communities. To quantify soil microbial diversity, the conserved 16S rRNA genes from microbial populations in a soil sample are targeted and sequenced on a Illumina Mi-Seq platform. After sequencing, the fragments of DNA are placed together in an assembly process utilizing bioinformatics pipelines, which are performed at the MSU High Performance Computing Collaboratory. From this, the DNA is grouped into taxonomic units, which are then used to estimate diversity utilizing diversity index calculations. The general experiment that was conducted included a soybean-corn- soybean rotation for three years at two locations namely, the Southeastern Coastal Plain and the Lower Mississippi River Valley Alluvium land resource regions. Four different tillage treatments were: high intensity, medium-high intensity, medium-low intensity, and low intensity. Analysis of variance

statistical methods were used to compare tillage treatment effects on diversity. The general findings concluded that lower tillage intensity resulted in greater microbial diversity, and that diversity increased with time for the lower intensity treatments.

204

Name: Hodum, Hailey

Major: Psychology

Faculty Advisor, Affiliation: Dr. Cliff McKinney, Psychology

Project Category: Social Sciences

Co-Author(s): Erica Szkody

Who to Trust: Impact of Parenting Styles on Trust

Gender differences in parent-child relationships can vary with the amount trust between each pair. Research shows that mother-daughter pairs base their trust on advice and emotional support, whereas father-son relationships base their trust on protection and security. When fostering trust, parenting style should be considered; the warmer and more involved the parenting style is, the child may be more willing to be trusting of that parent. The current study examined the association between parenting style and trust in parent-child gender dyads among emerging adults (N = 528; 45.8% male). We hypothesized that parenting styles high in warmth (e.g. authoritative and permissive) would be associated in higher levels of trust in same sex parent-child dyads. Emerging adults at a large Southern university completed survey measures on the variables of interest. Regression analyses were performed to examine both mother and father parenting styles (as measured by the Parenting Authority Questionnaire) on parent-child trust (as measured by the Inventory of Parent and Peer Attachment). We found that for males, authoritative maternal parenting style and authoritative paternal parenting style were positively associated with maternal trust. Additionally, for men, authoritarian paternal parenting style, authoritative maternal parenting style, and authoritative paternal parenting style were positively associated with paternal trust. For women, authoritarian maternal parenting style, authoritative maternal parenting style, and authoritative paternal parenting style were positively associated with maternal trust. Lastly, for women, authoritative paternal parenting style was associated with more paternal trust. Overall, findings are consistent with the literature on parents of emerging adults in the Southern United States. Specifically, parenting styles associated with control were associated with higher levels of reported trust, whereas parenting styles often associated primarily with warmth had a lower effect. Further implications of these findings will be discussed.

205

Name: Huffman, Jessica

Major: Industrial Engineering

Faculty Advisor, Affiliation: Morgan Green, Mechanical Engineering

Project Category: Social Sciences

Co-Author(s): Emily McCabe

Other Competition(s): Community Engagement Research Track

Making a Mentor: A year two evaluation of professional development in engineering outreach

Mentorship in K-12 programs for engineering provides the opportunity for college students to gain a unique experience developing their professional skills while students in K-12 programs get the opportunity to learn about engineering concepts while witnessing collaboration and support at the mentor level. Developing strong mentors breeds successful outreach programs, which raises attendance and creates the need for more programs and mentors. This study will evaluate the growth of mentors over the course of training for and working at an outreach event. Additionally, the implementation of a volunteer hierarchal system will be evaluated, in which teams of experienced volunteers serve specific roles in the process of planning and organizing the events, including the volunteer training events and the outreach event sessions. Surveys will be completed before and after the volunteer training process and after the outreach event to evaluate mentor growth in professional skills, such as communication, teaching, and teamwork, and evaluate increased confidence to enter a job market. Current data will

be compared to existing data from the previous year to evaluate continuing program success. There will be additional surveys to assess whether or not volunteers who return year after year cause a larger impact on the mentor program and have continuous professional skill growth. With the implementation of a hierarchy, observations will be noted during training and outreach events to evaluate the success of the hierarchy in coordinating the outreach sessions. Initial data responses indicate there is room for growth in professional skills as well as confidence to enter the workforce.

206

Name: Hunter, Kierstynn

Major: Psychology

Faculty Advisor, Affiliation: Danielle K. Nadorff, Ph.D., Psychology

Project Category: Social Sciences

Co-Author(s): Madison McElroy, Rhodes Lipsey

Other Competition(s): Community Engagement Research Track

Bullying Behavior in Custodial Grandchildren vs Those Raised by Parents

Previous research demonstrates that bullying behaviors in children can have implications throughout the lifespan for all parties involved. Children can exhibit bullying behaviors for several different reasons, but a specific group of children that are at risk of being involved in bullying behaviors are custodial grandchildren, (i.e., children being raised by their grandparents). Custodial grandchildren typically receive care from grandparents because of problems with the parental generation, such as substance abuse, poverty, and neglect. Linked to these early traumatic experiences, grandchildren raised by grandparents tend to manifest behavioral, emotional, and academic problems. The mental health and life satisfaction levels of these children may also be affected by both their family structure and these children's experiences with bullying. The current study examined the effects of bullying behavior in children on life satisfaction and mental health, and the moderating effects of caregiver type (custodial grandparents vs. parents) on these relations. Data was taken from the Health Behavior in School-Aged Children (HBSC) dataset, where 12642 students were surveyed. Caregiver type predicted significant differences in mental health, life satisfaction, and bullying behavior. Additionally, caregiver type was found to significantly moderate the relation between being the perpetrator of bullying acts and life satisfaction. Interpretations, limitations, and implications are discussed.

207

Name: Ingouf, Laura

Major: Anthropology

Faculty Advisor, Affiliation: Dr. Kathleen Ragsdale, Social Science Research Center; Dr. Mary Read-Wahidi, Science Research Center

Project Category: Social Sciences

Co-Author(s): M.R., Kolbila, R., Marinda, P., Pincus, L., Torell, E.

Other Competition(s): Community Engagement Research Track

Fish4Zambia: Exploring Household-Level Hunger Among Men and Women Engaged in Fishing Activities at Zambia's Lake Bangweulu

Objective: Funded by USAID and Feed the Future Fish Innovation Lab, the multi-methods Fish4Zambia study was conducted in July 2019 among men and women engaged in fishing activities (i.e., fish value chain (FVC) actors) at Zambia's Lake Bangweulu. Fish4Zambia's goal is to better understand how gender and related disparities within the FVC impacts men and women differently in order to help transition rural households towards better food security, nutrition, and economic development through sustainable fisheries productivity.

Methods: To help achieve Fish4Zambia's goal, we administered the Women's Empowerment in Fisheries Index (WEFI) – which included the 6-item Household Hunger Scale (Ballard et al., 2011) – to a random sample of FVC actors at Zambia's Lake Bangweulu ($N=397$, 51% female). The Household Hunger Scale categorizes household-level hunger (HLH) in the past four weeks as occasional, moderate, or severe for three distinct Hunger Events (HE):

HE1) no food to eat in household due to lack of resources, HE2) household member(s) went to sleep hungry, HE3) household member(s) went all day and night without food. We disaggregated the data by gender and conducted chi square analyses to examine the three HE.

Results: Women (67.1%) were more likely than men (54.5%) to report HE1 ($p=.00$). Women (64.7%) were more likely than men (46.1%) to report HE2 ($p=.00$). Women (49.1%) were more likely than men (31.1%) to report HE3 ($p=.00$). Although men and women were equally likely to report their household experienced occasional hunger for HE1-HE3, women were significantly more likely to report their household experienced moderate and severe hunger for HE1 and HE2.

Summary: Disaggregating this data by gender highlighted the fact that women more often reported HLH as compared to men in this sample. Taking gender into account can provide a more complete picture of how food insecurity impacts different household members across the FVC.

208

Name: Irwin, Noel

Major: Agricultural Economics

Faculty Advisor, Affiliation: Seong Yun, Agricultural Economics

Project Category: Social Sciences

Valuing Water Quantity and Quality in Agricultural Land Use and Land Cover

The Mississippi River Basin, a mixture of urban areas, grassy plains, forests, and agricultural land, has certain land use and land cover values. Our study primarily focused on the changes in agricultural land use and land cover (AGLULC) driven by biofuels policies and climate change. As changes in AGLULC occur, the ecosystem services value (which is the value of ecosystem services that produces services that benefit people or disservices which harm them) changes as well. Ecosystem services are valued monetarily although they are not traded in the market. Our study provides a reasonable set of AGLULCs under various biofuels policy and climate change scenarios. The estimate of the value of the changes is provided by benefit transfer and meta-analysis techniques, which rely on using value estimates from existing studies and adjusting them using statistical techniques so that they are accurate for the study area and population. In particular, existing studies concerning changes in water quantity and quality were examined. The existing studies employed several techniques to estimate values, such as the hedonic pricing method, the travel cost method, and the defense method, as well as stated and non-stated preference surveys. I documented the values from the surveys via data-entry into an Excel spreadsheet, as well as other variables estimated in the surveys, such as gender, income, location, and age. I present an overview of the types of the ecosystem services valued in the literature and their estimated values.

150

Name: Irwin, Ty

Major: Mechanical Engineering

Faculty Advisor, Affiliation: Omid Askari, Mechanical Engineering

Project Category: Physical Sciences and Engineering

Co-Author(s): Saeid Zare

Influence of Plasma Discharge on Flame Stability

Advancement in methane propulsion system technology has quickly ascended into NASA's main focus, particularly due to methane's availability for reusable rocket engines allowing preservation for both resources and money. Despite the improvement in this field, the issue of flame stability and engine reliability still persist. Studies show that implementing plasma into these combustion systems serves as a path to enhance the flame stability. To study these obstacles hindering optimal performance, a Planar Laser Induced Fluorescence (PLIF) system is used alongside O₂ and CH₄ flames in a single-element coaxial injector. The PLIF system produces Nanosecond Repetitive Pulsed (NRP) plasma which discharges into flames originating from a flat flame burner. Advanced cameras and complimentary software are utilized to perform laser diagnostics to study the flame stabilization mechanisms. Before any research on the flame stability is to be taken, the PLIF system itself

must be studied to ensure optimal conditions when performing the analysis. The members of the Plasma and Combustion Research Laboratory (PCRL) have dedicated the past academic year to accumulating a manual to provide detailed instruction on how to keep the system at peak performance. This manual will aid any new member added to the PCRL team with the required daily, monthly, and yearly upkeep and maintenance required to sustain the system, troubleshooting options reparations in the case of failure, and step-by-step procedures on collecting and analyzing the software data for a wide range of operating conditions. After the PLIF system is fully studied and understood, the PCRL team will begin its analytics on the plasma's influence in flame stability improvement.

151

Name: Jackson, Kaitlyn

Major: Electrical Engineering

Faculty Advisor, Affiliation: Angela C. Verdell, Ph.D., Office of Diversity Programs and Student Development

Project Category: Physical Sciences and Engineering

Low Load Bearing Backpack "LLB"

Back strain can be caused by one of many different reasons. Twisting or lifting heavy objects can cause a fiber in the lower back to overstretch or tear. Nearly 80% of the U.S. population will experience some form of lower back pain in their lifetime. Although there are bookbags currently in the market designed to alleviate back strain, there remains a gap in performance. Presently, there are very few case studies and data validation efforts being done on lower back problems resulting from backpack usage. The purpose of this research is to design a backpack that reduces the overall force on the wearers' back, thereby reducing back stress and strain.

To gather preliminary data, this study will use a pressure pain threshold device to determine the force and pressure negatively impacting the lower back. A sample of students were evaluated to determine students' preferences for bookbags regarding comfortability, functionality, low load bearing capability, among other factors. In addition, students were asked how many textbooks were carried daily and for the duration of usage throughout a typical school day. From this evaluation an average load was calculated for each student. Based on the data obtained, a comfortable backpack load was derived by averaging student responses. After determining the comfortability threshold, this will provide a standard for developing a backpack that will minimize discomfort and result in optimal load distribution for the user.

064

Name: Jenkins, Abigail

Major: Animal & Dairy Sciences

Faculty Advisor, Affiliation: Dr. Shengfa Liao, Animal and Dairy Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): R. M. Humphrey M. S. Hasan

Evaluation of the effects of dietary methionine level on carcass characteristics of finishing gilts

Amino acid methionine (Met), as a nutrient, plays multiple important roles in various biochemical and physiological processes in pigs. For example, Met functions as the universal codon for the initiation of protein biosynthesis, which can regulate the growth and development of pigs, especially the muscle growth. In practice, however, Met is the second or third limiting amino acid (i.e., the level is low) in typical grain-based swine diets. This study was conducted to evaluate the effects of dietary Met level on carcass characteristics of finishing gilts. Twelve individually penned gilts (Large White x Landrace; initial body weight 75.4 ± 6.5 kg) were randomly assigned to three dietary treatments ($n = 4$). Three corn and soybean meal-based diets were formulated to meet the NRC (2012) recommended requirements for various nutrients except for Met, whose concentrations were 0.14, 0.19, and 0.24% (as-fed basis; in the standard ileal digestible basis) for Diet 1 (Met-deficient), Diet 2 (Met-adequate), and Diet 3 (Met-excess), respectively. The gilts were fed the diets in an *ad libitum* manner for 5 weeks. At the end of the feeding trial, pigs were harvested in a meat laboratory, and the carcass characteristics were subsequently measured according to the standard procedures adopted by the National Pork Producers Council. Data were statistically analyzed using the ANOVA Procedure of SAS (v. 9.4), and $P \leq 0.05$ was declared as significant difference. Results showed that

there were no differences among the three dietary treatments in all the 24 carcass characteristics parameters measured ($0.06 < P < 0.94$). In conclusion, the results of this study indicated that the dietary Met level (at least, at the range tested in this study) have basically no effect on the carcass characteristics of finishing gilts.

065

Name: Jenkins, Randi

Major: Biological Sciences/Biological Sciences

Faculty Advisor, Affiliation: Barbara Kaplan, Basic Sciences

Project Category: Biological Sciences and Engineering

Identification of the Cell Types That Produce Interferon-gamma in Response to Cannabidiol

Cannabinoid compounds (i.e., those from marijuana) are well known to be anti-inflammatory and immunosuppressive. However under certain conditions they have been reported to enhance or suppress immune function. For instance, immune cells can be activated to different degrees with different stimulants or amounts of those stimulants. This could mimic individual responses to infectious agents. Previously we showed that one cannabinoid, cannabidiol (CBD), enhanced IL-2 and IFN-gamma cytokine production in response to low level cellular activation. The overall goal of this work is to understand the consequences of CBD increasing cytokine production. We hypothesize that the CBD-mediated increase in IFN-gamma production will lead to both immune enhancing and immune suppressing functions. As an initial step we investigated the immune cell types that produce IFN-gamma in response to CBD plus low level stimulation. We treated primary mouse splenocytes with 10 μ M CBD and activated with 4 nM phorbol ester plus 0.05 μ M ionomycin overnight. This level of stimulation was previously used to show the enhanced cytokine production with CBD. Using flow cytometry we found that CBD induced IFN-gamma production from CD8 T cells, B cells, and macrophages. CD4 T cells also contributed a small amount. Future studies will investigate the consequences of increased IFN-gamma production in the various cell types. These data are significant because they will help us understand the immune effects from CBD use.

013

Name: Johnson, Alexandria

Major: Art/Fine Arts

Faculty Advisor, Affiliation: Dominic Lippillo, Art

Project Category: Arts and Humanities (Poster)

Broken Now Everlasting

For my thesis, titled Broken Now Everlasting, I am capturing photographic images of a loved one, my sister. Within those images I am telling the emotional story of our relationship. According to Reader's Digest, "Birth order can play a huge part in shaping your personality, life, and relationships." Birth order is only one of many reasons a sibling's relationship can be affected. My sister and I are five years apart, and we did not have a close relationship. Part of the distance between us is my fault because I rejected her; I did not always want her company because I felt that we did not have anything in common because of our age difference. Because of this, it caused a lot of emotional chaos within her.

Now that we are older and closer, we have a strong sisterly bond. My thesis project will allow me to take black and white photographs addressing how the relationship was and is now. This project is personal because it is my way of apologizing to her for the damage I caused. I have studied many articles relating to the sisterly bond and according to an article written by Anna Goldfarb, in the New York Times "The first step to establishing a healthy adult sibling relationship is to release baggage you're carrying from childhood." I want to let go of the baggage and pain I caused and become a loving big sister. It is my desire to expose and address the emotional truth of our sibling bond by making photographic images that speak of our emotional truth. I tell the emotional truth of our sibling bond by making photographic images that speak of our emotional truth. I hope this work will allow the viewers to honestly reflect on their relationships with their siblings.

066

Name: Johnson, Jewel

Major: Biochemistry

Faculty Advisor, Affiliation: Audrey Sheridan, Entomology

Project Category: Biological Sciences and Engineering

Co-Author(s): Lars Straub, Jeff Harris, Peter Neumann

Other Competition(s): Community Engagement Research Track

Biological Effects of Neonicotinoid Presence in Soil on the Small Hive Beetle

Insecticide presence in agricultural soil is a significant concern due to the adverse effects posed to insects that are considered beneficial to the environment, such as pollinators. In order to observe the direct results of neonicotinoid accumulation in agricultural soil, specifically its effects regarding pupation and reproduction success, we used the Small Hive Beetle, *Aethina tumida* Murray, as our model organism. Small Hive Beetles work as an adequate model as they are easily reared in large quantities in a short amount of time and pupation occurs in the upper layers of the soil where exposure to insecticides is most likely to occur. The specific neonicotinoid used was Thiamethoxam. We hypothesize that pupation of the Small Hive Beetle with the use of soil contaminated with realistic amounts of Thiamethoxam (25 ng/g, 100 ng/g, and 400 ng/g) will negatively affect the success of pupation and reproduction of the emerging organisms. Laboratory-reared larvae (N=1200) were separated into four treatment groups: Control, TMX-25, TMX-100 or TMX-400. Each group consisted of 3 individual pupation cages, each containing 100 larvae and the soil compound. The containers were then incubated at standard conditions (30 °C, 60% RH) until emergence. From the emerged beetles, 50 males and females were paired and mated over a period of 15 days to observe oviposition rate. The containers with Thiamethoxam contaminated soil revealed lower reproduction, emergence, and oviposition success compared to the control group. These results are potentially due to the neonicotinoid negatively affecting metabolism and detoxification during metamorphosis, as well as sperm quality and quantity in Small Hive Beetle males that have been exposed to the insecticide.

014

Name: Johnson, McKenzie

Major: Architecture

Faculty Advisor, Affiliation: Alexis Gregory, College of Architecture

Project Category: Arts and Humanities (Poster)

Ethical and Empathetic Research in Architectural Education

The challenges for architects include designing for various clients while also creating places that impact communities and those who experience them. These challenges are overcome with time, design experience, as well as identifying the obligations architects have to design spaces with the ability to evoke emotional and physical connections to the space. The profession of architecture is a service that uses ethical and empathetic ideas to understand and shape society. The basis of this research is to bring attention to the topics of empathy and ethics within architecture schools in the United States and whether there is a need to address the topics to prepare students for the obligations and responsibilities within the architecture profession.

Student leaders from twenty architecture schools around the United States were selected through their connection with The American Institute of Architecture Students (AIAS) which is an organization dedicated to advancing leadership, design, and service among students. An interview was presented to students to gather data in order to better understand the teachings of ethics and empathy in architectural education. Questions regarding the schools' course layout and the relevance of the topics within design studies were asked to create a comparison between the schools' architectural education. The responses of the students were compared by geographical locations, demographics of the students, and the area of the schools. The data will be analyzed by identifying similarities in responses, in addition to what the correlating courses teach in schools with the effort to understand and apply these practices in the profession.

This research aims to expose what is assumed to be the current lack of empathetic and ethical teachings in architecture schools. The results can then be used to see the possible implementations in schools, and the need for ethics and empathy in education as well as the profession.

152

Name: Jones, Benjamin

Major: Mechanical Engineering

Faculty Advisor, Affiliation: Omid Askari, Mechanical Engineering

Project Category: Physical Sciences and Engineering

Co-Author(s): Saeid Zare

Designing a Novel Chemical Kinetic Mechanism using Rapid Compression Expansion Machine

One of the main goals set by the Department of Energy (DOE) is to reduce petroleum consumption by 30% and GHG emissions by 14% by the year 2030. For this goal to be reached, there must be widespread and substantial utilization of improved fuels. In order to utilize promising oxygenated biofuels, such as anisole, a complete knowledge of the fundamentals of the spray and combustion parameters in addition to the chemical kinetic pathways is essential in the replacing the conventional petroleum fuels. This research focuses on using a Rapid Compression Expansion (RCEM) machine to simulate engine-like conditions to measure the spray and combustion fundamental characteristics. The RCEM is capable of performing a single stroke with pre-determined conditions where data can be gathered and interpreted for both compression and expansion processes. Members of the Plasma and Combustion Research Laboratory (PCRL) at Mississippi State University have spent the past year refining the RCEM and related systems (fuel supply, CAMAS software, etc.), upgrading and troubleshooting of the total system, and building a previously-made manual for the system's operation. Additionally, the PCRL lab relocated, and a visit from the TESTEM company was utilized to update the system and define the experimental methods for future testing: the use of the pressure rise rate to determine the ignition delay time of fuels. This accrued knowledge and updating of the system is a step toward developing a novel chemical kinetic mechanism for oxygenated biofuels and will be necessary for the machine to be utilized by future faculty and students involved with the PCRL at Mississippi State University.

067

Name: Jones, Harrison

Major: Biochemistry

Faculty Advisor, Affiliation: Dr. JoVonn Hill, Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology

Project Category: Biological Sciences and Engineering

REU/Research Program: Undergraduate Research Scholars Program

Digitization of Pollinator Specimens into Online Databases

Online databases bring together specified information as a public or academic resource. The Symbiota Collections of Arthropods Network is a prime example, bringing together insect and arthropod specimen information from around the world. Details like location, coordinates, and date of occurrence are added specific to each specimen. Museum and collection specimens add to publicly recorded information and make up a larger system of data that can be referenced to understand and show relationships, such as species distribution over time.

Given the recent concerns about pollinator conservation, we digitized label data from pollinator specimens in the Mississippi Entomological Museum. Primarily, this focused on bumblebees; pollinators important in outreach, agriculture, and environmental research. These specimens come from various entomologists over decades of collection, and in doing so present a problem. Collection information, which would add to large sets of data for reference, is not consistent. Over decades and countries, specimen information is recorded differently, or not recorded at all. Without well recorded details, finding specimen information is another roadblock to research. As the specimens reflect individual projects and private collections, they cannot wholly represent trends over large areas or time periods unless they were originally collected to do so. As part of this, museum specimen records show bees in only one physiographic region of Mississippi. In this case, and on a greater scale, digitizing pollinator specimens shows a need for greater and more comprehensive collection and research.

153

Name: Jordan, Marcus

Major: Mechanical Engineering

Faculty Advisor, Affiliation: Avraham Cohen, Penn Engineering

Project Category: Physical Sciences and Engineering

Other Competition(s): Thesis Research Competition (TRC)

Design of a 6DOF Aerial Manipulator for Micro Aerial Vehicle Environmental Interactions

Micro aerial vehicles (MAVs) are proving their utility in places where manned operations or grounded robots are not feasible. However, MAVs continue to prove vulnerable to unexpected environmental stimuli, reducing their effectiveness in dynamic situations. Thus, this project studied how aerial manipulators could be designed focusing on modularity so that the parts and end effector of a quadrotor's manipulator could be easily exchanged for different applications and to quicken required field maintenance and repairs. This project had a three pronged approach: design and build a computer assisted design (CAD) model for an aerial manipulator, implement the electronic systems and their controls for the chosen quadrotor, and develop the Robotic Operating System (ROS) code for the aerial manipulator and electronic control system. During the duration of the SUNFEST program, the CAD model for the aerial manipulator was designed and 3D-printed; electronic components were made functional for the quadrotor; and progress was made on the ROS coding. With these results, we developed further insight into the design and determined that improvements in modularity could be made to help increase overall efficiency and decrease the quadrotor's weight. An interesting follow up project would be to design further iterations of the aerial manipulator to further increase its modularity, focusing on the quadrotor's weight and the interchangeability of the end effector. It would be interesting to extend this study to a quadrotor based on a fully coupled dual quaternion representation.

068

Name: Kerby, Allie

Major: Biochemistry

Faculty Advisor, Affiliation: Dr. Steven Elder, Agricultural and Biological Engineering

Project Category: Biological Sciences and Engineering

Co-Author(s): Jay Warren

REU/Research Program: CALS Undergraduate Research Scholars Program

Kartogenin Immobilization onto Collagenous Scaffold

Scaffold-based approaches to cartilage tissue engineering strategies can be enhanced through sustained delivery of chondrogenic factors. Kartogenin, KGN, is a small molecule that promotes differentiation of human bone marrow mesenchymal stem cells into chondrocytes. The purpose of this project is to explore the use of EDC/NHS chemistry for binding KGN to a collagen-rich, natural scaffold such that KGN is gradually released over a period of 2-4 weeks. Preliminary experiments were conducted to determine solubility of KGN, EDC, and NHS in PBS, ethanol and DMSO; to test whether these interfere with assaying KGN by measurement of absorbance at 284 nm wavelength; and to investigate how rapidly KGN is released after simple adsorption onto a collagenous scaffold. DMSO was found to be the ideal solvent, and none of the substances significantly interferes with the A₂₈₄ of KGN. A₂₈₄ increases linearly with KGN concentration up to at least 1 mg ml⁻¹. Adsorbed KGN was rapidly released from decellularized, freeze-dried porcine meniscus scaffolds within 48 hours. An experiment is underway to measure the rate of KGN release after crosslinking with EDC/NHS. EDC was reacted with KGN in DMSO, followed by reaction with NHS, at weight ratio of 4:1:1 (EDC/KGN/NHS). Pieces of decellularized porcine patellar tendon were then crosslinked in this solution overnight. KGN adsorption without EDC/NHS crosslinking, EDC/NHS crosslinking without KGN, and DMSO alone were also tested as controls. Measurement of the KGN release profile is in progress. Future experiments will test the chondrogenic activity of released KGN.

069

Name: Knight, Emily

Major: Food Science Nutrition Health Promotion

Faculty Advisor, Affiliation: Brent J. Fountain, Food Science, Nutrition and Health Promotion

Project Category: Biological Sciences and Engineering

REU/Research Program: Undergraduate Research Scholars Program

Other Competition(s): Community Engagement Research Track, Public Health Research Competition

Comparison of Three Different Temperature Measurement Devices Among Difficult to Measure Foods in Child Nutrition Programs

In 2019, 52.1 million children were enrolled in the National School Lunch Program and 49.6 million were enrolled in the School Breakfast Program (U.S Department of Agriculture [USDA], 2019). According to the USDA (2015), the only reliable method for ensuring the food safety of TCS (time-temperature control for safety) foods is to measure the internal endpoint temperature. Feng and Bruhn (2019) found that foodservice workers lacked knowledge related to selecting, sanitizing, calibrating, and utilizing a food thermometer. As a result, temperature control and risk of foodborne illness remain a concern for child nutrition programs. The purpose of this study was to compare the accuracy of the bimetallic-stemmed and infrared thermometers to the more accurate thermocouple thermometer. A second purpose was to identify best practices for measuring the internal temperature of select menu items from the Mississippi Recipes for Success 2019. Recipes were selected based on the risk of foodborne illness and the difficulty of obtaining accurate internal temperature due to shape and thickness. Data were collected on eight different recipes at five schools in a Mississippi public school district. While both the infrared and bimetallic thermometers yielded average temperatures below that of the thermocouple thermometer, observed temperatures were commonly above the recommended endpoint temperature for safe service. Since infrared thermometers measure the surface temperature, they may not be a reliable indicator of internal temperature. Bimetallic thermometers remain most common in foodservice due to low cost and ability to measure internal temperature. Techniques such as stacking, selecting the centermost product in the oven, and the method of inserting the probe can improve the accuracy of a bimetallic thermometer and the appearance of food at service. In conclusion, child nutrition operations can benefit from standardizing measurement techniques and staff training.

154

Name: Kruse, Brady

Major: Computer Science

Faculty Advisor, Affiliation: Prasad Calyam, Electrical Engineering & Computer Science

Project Category: Physical Sciences and Engineering

Co-Author(s): Samaikya Valluripally, Benjamin Frailey, Boonakij Palipatana, Roland Oruche, Aniket Gulhane, Khaza Anuarul Hoque

REU/Research Program: REU in Consumer Networking Technologies @ the University of Missouri-Columbia

Detection of Security and Privacy Attacks Disrupting User Immersive Experience in Virtual Reality Learning Environments

Virtual Reality Learning Environments (VRLE) are new form of immersive environments which are integrated with IoT devices for delivering learning content in a collaborative manner to users who are spatially distributed. To streamline data delivery, provide immersive user experience and allow the users to interact in such a distributed environment, these VR applications (*special education, surgical training, etc.*) rely on network connected devices and components. Gaining unauthorized access to these connected devices causes security, privacy attacks (SP) that can adversely impact the educational user experience and disrupt the data delivery. Due to this, it is necessary to investigate the SP issues that can potentially impact users' immersive experience (UIX). In this paper, to analyze attack surfaces in VRLE, we identify the SP issues that impact the application usability and presence of immersion factors using our preliminary survey. Existing VRLE systems do not employ any such monitoring systems to detect SP issues that can hinder VRLE experience. Based on our preliminary analysis, we propose a novel anomaly detection system to detect attacks before the UIX can be disrupted. We apply i) machine learning techniques such as *KNN classifier* to detect anomaly events of network based attacks that includes potential threat scenarios of *Denial of Service (packet tampering, packet drop, packet duplication)* and ii) statistical Z-score analysis to detect an

anomaly related to the VRLE integrity (*Non-network attack: Unauthorized access (Password attacks)*). We demonstrate the effectiveness of our proposed anomaly detection approach using a VRLE application case study viz., vSocial, specifically designed for teaching youth with learning impediments about social cues and interactions. Based on our experimentation results, we show the adaptive characteristics to consider diverse SP issues with varying impact on UX score. Using a risk evaluation approach, we enlist the best practices to incorporate effective anomaly detection in realistic VRLE applications that need to be more secure and safer in operational nature.

015

Name: Ladewig, Alex

Major: Art/Fine Arts

Faculty Advisor, Affiliation: Jenna Altomonte, Art Department

Project Category: Arts and Humanities (Poster)

Abuse: How Common it is and How Normal It Looks

This poster proposal centers on my thesis for my BFA in sculpture. I am requesting critical feedback regarding conceptual ideas and practical design. Titled, *Two-Faced*, my thesis focuses on the commonality of abuse and the after-effects of abusive relationships on the survivor. My personal experience with abuse, being a survivor myself, serves as the motivating factor for the show. The works will show the two sides to abusers: one from the perspective of the survivor and the other from the outsiders. Essentially showing how abusers showcase themselves as perfectly normal to the world versus how they really are. Merging sculpture and text, I have written poems based on stories that peer survivors have shared in interviews I have conducted with them, giving each piece more context to why it was chosen. Making each furniture piece based on the stories of the survivors.

I am using furniture design in my show to bring attention to how and where abuse occurs and how normal an abusive home can look from an outsider's perspective. The furniture pieces will be fully functional and made from a diverse array of materials such as: ceramics, soft materials (leather and felt), metal, and wood. When the viewer goes into the room it will look like a normal home, but as the viewers read the poems, they will realize what is going on behind closed doors within the show. This tension between the pristine furniture and the content of the poems reflect how survivors feel towards their abusers and how the abusers are perceived. I intend for viewers to interact with the furniture and poems, adding personal narratives to the object concerning indirect and direct experiences with abuse by sharing their experience in a journal so I can further my research to how common abuse is.

070

Name: Ladner, Taylor

Major: Biochemistry

Faculty Advisor, Affiliation: Dr. Shecoya White, Food Science, Nutrition, and Health Promotion

Project Category: Biological Sciences and Engineering

Co-Author(s): Dr. Derris Burnett, Katie Evans

REU/Research Program: CALS/MAFES Undergraduate Research Scholars Program

Other Competition(s): Public Health Research Competition

Efficacy of Electrostatic Sprayed Chitosan Application to Reduce Spoilage and *Salmonella* on Catfish

Seafood popularity has increased over the years, and one of the more popular meats is catfish. Catfish meat is highly perishable leading to rapid spoilage. Eating raw/undercooked fish can lead to foodborne illness due to *Salmonella*. Chitosan, a complex polysaccharide found in shellfish exoskeletons, has been shown to have antimicrobial and antioxidant properties. Catfish fillets were cubed into 1x1x0.5-inch cubes and inoculated with 6 log CFU/g of a four-strain cocktail of *Salmonella* then left to sit for 30 minutes at room temperature for adherence. The meat was then sprayed with an electrostatic spray gun filled with a patent pending chitosan solution for either 5, 15, or 25 seconds. In addition to the treated samples, there was an untreated negative control (uninoculated) and an untreated positive control (inoculated). All samples were then individually stored in sterile bags at 4°C. The samples were tested in triplicate on days 0, 1, 3, 5, and 7 and plated onto both

TSA and XLD plates. By day 3 the chitosan treated samples had average lower background microflora than the negative control with differences ranging from 0.5-1 log CFU/g. By day 7 both controls had counts higher than 8.00 log CFU/g, treatments 5s, 15s, and 25s had 7.78, 7.84, and 6.88 log CFU/g respectively. *Salmonella* counts showed little difference between the samples until day 5. At day 5 there was a decrease in the *Salmonella* with samples exposed to the chitosan for a longer period having a greater difference compared to the positive control. The chitosan appeared to lower *Salmonella* and proved to extend the catfish's shelf-life.

155

Name: Lampkin, Spencer

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Dr. Yeqing Wang, Aerospace Engineering

Project Category: Physical Sciences and Engineering

REU/Research Program: Undergraduate research stipend

Development of Hail Impact Tester for Carbon Fiber Composites

Experimentation has proven to be a beneficial resource in the composites field because composite structures can be very difficult to simulate. Predicting hail impacts on composite structures are not exempt from the simulation difficulties. An experimental procedure for medium velocity impacts is outlined in this paper. Strain data is collected and is used to determine the deflection the panel undergoes. Damage such as ply delamination is examined using C-SCAN, because this is a difficult property to identify with visual observations. The data gathered from this experiment will help determine the damage a composite structure experiences from a hail impact.

004

Name: Laudadio, Marisa

Major: Political Science

Faculty Advisor, Affiliation: Dr. Melanie Loehwing, Department of Communication

Project Category: Arts and Humanities (Oral Presentation)

Other Competition(s): Thesis Research Competition (TRC)

Examining the intentional use of rhetoric in legal argumentation to advocate for system-wide foster care reform

The purpose of this study is to examine the ways the rhetorical *pisteis* *logos* and *pathos* can intentionally be incorporated into legal argumentation to bring about positive social change. This paper examines the use of *pathos* and *logos* in legal rhetoric as expressed in five Children's Rights' complaints to answer the two main research questions: 1) What is the rhetorical situation within which these artifacts are situated and who is (are) the audience(s) being appealed to? and 2) How are *pathos*, *ethos*, and *logos* used in these artifacts?

This study first provides background information about Children's Rights' work and the way its advocacy strategy has evolved over the decades. It then presents a review of existing scholarship about the relationship between rhetoric and legal argumentation to give a big-picture view of the significance of Children's Rights innovative advocacy style. Next it contains a rhetorical analysis of the five legal complaints to answer the above-mentioned research questions. It concludes by discussing the implications of the paper and restating the main arguments and importance of this study.

The key takeaways are: 1) Children's Rights employs an effective, innovative advocacy approach that can be modeled by other activism groups to bring about lasting positive social change; 2) it is important to maintain a consistent advocacy model across cases; and 3) greater discussion is necessary about the combination of rhetoric and legal argumentation in both scholarly communities.

Ultimately, this paper argues that Children's Rights innovates an effective rhetorical structure for bringing about positive, lasting change through legal advocacy. Its numerous successes are evidence of this claim. This analysis indicates that Children's Rights' advocacy model of intentionally combining rhetoric with legal argumentation is invaluable, not only for future similar advocacy efforts, but also for saving and improving the lives of thousands of foster care children.

016

Name: Lee, Heather

Major: Anthropology

Faculty Advisor, Affiliation: Dr. James W. Hardin, Department of Anthropology and Middle Eastern Cultures, Cobb Institute

Project Category: Arts and Humanities (Poster)

Co-Author(s): Desiree Goodfellow, Kara Larson, Dr. James W. Hardin

Shedding Light on Authenticity: Morphometric Analyses on a Donated Roman Lamp Collection at the Cobb Institute of Archaeology

Robert C. West, a retired chemistry professor at the University of Wisconsin-Madison, donated a collection of Near Eastern artifacts to the Cobb Institute of Archaeology in 2014 for the purpose of teaching and research. The Robert C. West collection was accumulated through purchasing artifacts from merchants during multiple travels to Israel, and consists of ceramics, oil lamps, figurines, and various glass and metal objects across multiple cultural periods. The nature of the procurement of the collection raises questions regarding the artifacts' authenticity. Oil lamps, particularly those dating to the Roman period, make up a significant portion of the collection. The authors have chosen to focus on the Roman period lamps due to their distinctive style, prevalence in academic literature, and popularity in the black-market. Using morphometric methods and principle components analysis, the authors will determine if these oil lamps are indeed artifacts or are merely reproductions by identifying morphometric outliers. The authenticity of artifacts from donated collections is often unknown due to the prevalence of black-market trading, and many institutes and museums do not have the funds to subject artifacts to expensive tests to determine authenticity. By employing this method, institutions can determine the authenticity of artifacts which have been procured through similarly questionable circumstances in a cost-effective manner.

071

Name: Lee, Mary

Major: Biological Engineering

Faculty Advisor, Affiliation: Dr. Andy Perkins, Department of Computer Science and Engineering

Project Category: Biological Sciences and Engineering

Co-Author(s): CJ Nguyen

A Topological Analysis of Gene Co-Expression Networks from Brain Data

Gene expression data is a compilation of gene activity expressed in a certain tissue. This data has the potential to help uncover genes associated with some disease, stimulus, and treatment. The Allen Brain Atlas has made available gene expression data describing the activity of genes in individuals and tissues related to aging, dementia, traumatic brain injury, brain cancer, and many other brain-specific conditions. This project uses statistical and information-theoretic metrics like Pearson correlation and mutual information to build gene co-expression networks, which are represented by nodes on a graph that correspond to a gene. The nodes are connected when they show significant co-expression relationship between their respective genes. These networks are constructed from samples exhibiting a variety of brain injury and disease, as well as those that appear typical. Existing and novel graph algorithms will be used to compare the structure of these networks to extract structures possibly associated with brain disease or injury. Novel contributions of this project include comparing existing and developing new graph algorithms to determine network similarity and extract common structures, as well as investigating the use of various similarity metrics for network construction.

209

Name: Lee, Samantha

Major: Animal and Dairy Sciences (Pre-Vet)

Faculty Advisor, Affiliation: Dr. Molly Nicodemus, Animal Dairy Science

Project Category: Social Sciences

Co-Author(s): Katie Cagle-Holtcamp, Avery Walters, Holly Evans, Alicia Gilmore, Lori Irvin, Cassie Brunson, Molly Nicodemus

Does perceived confidence reflect actual skill level for students participating in equine laboratory courses?

In the hiring process, employers look for confidence in a potential employee. This confidence is particularly important in the equine industry when a lack of confidence can create safety issues for both the handler and horse. Earlier studies report previous exposure to horses gives students an advantage in the understanding of equine behavior and self-reported equine handling abilities. However, does this understanding and perceived ability reflect actual equine handling skills? Course assessments by instructors in determining student learning and abilities often defer to self-reporting by the student, but the exposure to the horse may only develop a perceived confidence and not an actual skill set. Therefore, the objective of the study was to compare students' perceived confidence in equine handling to actual skill level. Study participants were enrolled in equine laboratory courses (n=59) during the 2018-2019 fall semesters. Laboratories consisted of basic equine handling activities that were covered over 30 contact hours throughout the semester. Students worked with horses on a weekly basis for 2 hours each week for 10 weeks. A survey instrument consisting of 17 questions was given at the beginning (pre-) and end (post-) of the semester. Questions focused on the student's confidence in their perceived equine handling skills. Students ranked their confidence with a score from 1 to 5 with 5 indicating a high confidence level. Laboratory instructors completed a 15 question pre- and post-skill assessment. Each question ranked the students' skills 1-4 with 4 indicating a high skill level. Although paired samples t-test resulted in student-perceived confidence levels remaining consistent throughout the semester ($p>0.05$), skill levels assessed by the instructors showed significant improvement by the end of the semester ($p<0.05$). Thus, confidence surveys may not reflect improvement in actual skills, and so, instructors should defer to skill assessments to determine course impact.

210

Name: Lenoir, Charles

Major: Political Science

Faculty Advisor, Affiliation: Dr. James Chamberlain, Master of Arts in Political Science

Project Category: Social Sciences

The Theoretical Implications of Becoming a Horse: Becoming and Relationships in Deleuze and Guattari's *A Thousand Plateaus*

In their 1980 Postmodern political statement *A Thousand Plateaus: Capitalism and Schizophrenia*, Gilles Deleuze and Felix Guattari make a number of controversial and radical statements. The focus of this presentation is their statements that concern the relationships between individuals within a system, and the permeability of the divisions that humans tend to put in between these subclasses. This is in contrast to the highly segmented and rigorously enforced nature of what are considered to be "modern" human societies. Instead, they assert that the nature of the world and the relationships that we share with individual parts of the world are entirely interconnected in a way we have not considered before this point. The text makes the statement that the most beneficial action that could be taken in relation to these ideas of separation is to disintegrate the rigid lines that we have artificially used to create groups, and instead the separation should be recognized as a collection of individual beings. The individual being should be recognized in their being as an interconnected being, not simply as one that exists to be fit into a mold. The recognition of the outsider creates a flourishing of the individual and allows for the greatest amount of individual being possible, through the connection of the individual with all others. This concept does not only apply to people, as if a human and an animal share the same relationship to a concept, then that relationship is singular. This means that the human and animal are not entirely separate. This is a concept that can be applied to almost all fields of social science and the humanities, but this project will specifically focus on its relationship to humanity, and the importance of recognizing this intangibility.

072

Name: Leopard, Jacinda

Major: Animal & Dairy Sciences

Faculty Advisor, Affiliation: Dr. Derris Devost-Burnett, Animal and Dairy Science

Project Category: Biological Sciences and Engineering

Co-Author(s): Amberly Dennis

Examining the effect of Diet and Anatomical Location on Loin Eye Area, Marbling Score, and Lean color of the *Longissimus dorsi* muscle collected from finished market hogs.

The *longissimus dorsi*, commonly known as the loin muscle, is one of the most economically important cuts on the porcine carcass due to its muscle quality. The objective in this experiment is to evaluate the effects of dietary deficiencies on the location and parameters of pork loin, specifically Loin eye area (LEA), marbling, and lean muscle color in an attempt to understand when, where, and how marbling develops within the muscle. Our dietary model utilized 80 pigs randomly assigned to a control group, a lysine deficient group, a vitamin A deficient group, and a lysine and vitamin A deficient group to be fed throughout the nursery, feeder, and finishing stages of production. At day 160 pigs were harvested and the loin muscles were collected. To take our measurements for LEA we used the Plastic Grid for Quick Measurement of Loin Eye from Iowa State University. For marbling score and lean color, we conducted visual observation using the Pork Color and Marbling Wheel from Pork Checkoff. The lean color scoring guide ranged from 1-6 whereas the marbling guide ranged from 1-10. There were no significant differences in LEA, marbling score, or lean color in response to the dietary treatments ($P > 0.05$). However, location along the loin resulted in differences in each parameter. The medial location displayed the greatest LEA ($P < 0.001$), followed by the proximal and distal portions, respectively. The marbling score was the greatest in the proximal portion of the loin while lean color was greatest in the distal region. This data indicates that the location along the length of the loin has direct implications for measures of loin quality and by extension, the quality attributed to the overall carcass. These differences should be taken into consideration when assigning carcass values based on a single location in the economically important Loin muscle.

073

Name: Loftin, Margaret

Major: Animal & Dairy Sciences

Faculty Advisor, Affiliation: Dr. Trent Smith, Animal and Dairy Sciences

Project Category: Biological Sciences and Engineering

Evaluation of sire effect on growth and live animal carcass ultrasound traits in Brangus and Ultrablack beef calves.

The objective of this study was to evaluate the effect of sire on growth and live animal carcass ultrasound traits. Data were collected on fall-born Brangus ($n=130$) and Ultrablack ($n=19$) calves from 2016 to 2019. Calves were managed on similar diets from birth to yearling age. Growth measurements were taken at birth, weaning and at yearling age. Ultrasound measurements were taken by a trained technician to estimate live animal carcass traits. Measurements for growth included birth weight, weaning weight, and yearling weight and were adjusted for age in days of the calf and age of dam if appropriate. Adjusted records included adjusted birth weight (ADJBW), adjusted 205 day weight (D205WT), and adjusted 365 day weight (D365WT). Live animal carcass ultrasound measurements included ribeye area (REA), rump fat (RMP), intramuscular fat (IMF) and backfat thickness (FAT). Traits were analyzed using the MIXED procedure of SAS with ADJBW, D205WT, D365WT, REA, RMP, IMF, and FAT as response variables with breed and sire as fixed effects. Fourteen sires were represented in the data analysis. Simple correlations were also estimated among traits using the CORR procedure of SAS. Neither sire nor breed had a significant effect on ADJBW. Sire was a significant source of variation for D205WT, D365WT, REA, IMF, and RMP. Within this population, D205WT (0.35) was moderately positively correlated with REA ($P < 0.01$) and D365WT (0.55) was highly positively correlated with REA ($P < 0.01$). Adjusted birth weight was moderately negatively correlated with IMF (-0.20) ($P < 0.01$) and D365WT was moderately positively correlated with RMP (0.21) ($P < 0.01$). Breed significantly affected FAT with Ultrablack calves having larger values (0.86 ± 0.23) when compared to Brangus (0.19 ± 0.09) calves ($P < 0.05$). Sire had a significant effect on most traits in the study and gives evidence that sire selection can be used to make changes in a beef herd.

156

Name: Lopez, Marco

Major: Electrical Engineering

Faculty Advisor, Affiliation: Yu Luo, Electrical Engineering

Project Category: Physical Sciences and Engineering

Co-Author(s): Jing Yang, Ph.D.

REU/Research Program: ORED Undergraduate Research Program

Renewable Radio Energy IoT Network

Due to the ever-increasing demand for green and sustainability, the renewable energy harvesting technology has attracted much attention with its potential to self-power numerous Internet of things (IoT) nodes. Recently, both academia and industry developed many semiconductor modules to efficiently capture renewable radio-frequency (RF) energy radiated from TV towers, WiFi base stations, and wireless routers. The received energy can be stored in an energy storage component (ESC), like a supercapacitor or a small rechargeable battery, to power target systems for control, sensing, and wireless communications.

In the real world, RF energy powered IoT nodes need to synchronize their time with each other. In this way, the nodes can stay at the sleep mode most of the time and briefly wake up when communication are required. In this project, we develop a new time synchronization method, called the energy stimulated time sync (ESTS), for ultra-low-power IoT nodes with radio frequency (RF) energy harvesting ability. Compared with existing methods, ESTS does not rely on timestamp exchange between wireless nodes but uses short analog tones to synchronize the time across the network. ESTS can provide multiple degrees of sync accuracy to satisfy different application requirements while consuming much lower energy than timestamp-based synchronization methods. We have implemented ESTS on Microchip ATmega256RFR2 system-on-chip (SoC). According to experiment results, ESTS can achieve an average of 5 ms and 70 μ s time precision for rough synchronization and fine synchronization, respectively. Moreover, in the entire synchronization process, the rough synchronization only needs to be performed once, and the node consumes as low as 4 μ J of energy for each fine synchronization. The synchronization accuracy can be further improved by increasing the clock frequency of analog-to-digital converter (ADC) and using an external buffer op-amp.

074

Name: Lowery, Andrew

Major: Forestry/Environmental Conservation

Faculty Advisor, Affiliation: Dr. Courtney Siegert, College of Forest Resources

Project Category: Biological Sciences and Engineering

Hydrological Effects of Short Rotation Woody Crops

Around the world, short rotation woody crops (SRWCs) such as eastern cottonwood (*Populus deltoides*) and a variety of different hybrid poplar taxa are growing in popularity due to their rapid production of biomass and their viability to produce renewable bioproducts such as carbon fiber and polymers. This swift accumulation of biomass, however, can stress the water budget through increased canopy interception, leading to decreased canopy throughfall. Much research has been conducted on various aspects of SRWCs, however little information is available concerning the interactions between canopy throughfall and biomass production, especially with regards to the water budget of the surrounding ecosystem and landscape. This study sought to analyze net throughfall to determine the effects that short rotation woody crop plantations have on water partitioning and soil moisture availability. This study found that mean net throughfall was at 78.2% in the first year after establishment. It is predicted that net throughfall will decrease as the plantation grows in age. Due to the accelerated growth of SRWCs and the stresses on the hydrologic cycle that they place, this study quantifies their effects on the water budget that can be beneficial to both fellow researchers and landowners.

211

Name: Lowery, H. Addison

Major: Psychology

Faculty Advisor, Affiliation: Arazais Oliveros, Ph.D., Psychology

Project Category: Social Sciences

Co-Author(s): Deepali M. Dhruve, B.S., Gabby Homolka

REU/Research Program: Regulation & Resilience Lab

Other Competition(s): Community Engagement Research Track

Risky Drinking in Children who Experienced Parental Physical Abuse: The Role of Coping Motives

Children who have experienced parental physical abuse have a greater likelihood of risky drinking in adolescence (Balázs, et al., 2017) and a two-fold probability of developing alcohol dependence (Fuller-Thompson, et al., 2016). Problematic drinking is linked to injuries; violence; school failure; attempted or accidental suicide; and sex-related risks like unplanned pregnancy and sexually transmitted infections (Kuntsche, et al., 2005). The current study aimed to look at the interplay between physical abuse and coping motives in predicting risky drinking. Participants were 260 college students, part of a larger online study about cognitive and affective risk factors for interpersonal violence. Participants completed the Parent-Child Conflict Tactics Scales (Straus, 1979) to assess recalled childhood physical abuse, the Drinking Motives Questionnaire (Cooper, 1994) to measure coping motives for drinking, and the Alcohol Use Disorders Identification Test (World Health Organization, 1982) to obtain information about risky drinking. We utilized a mediation analysis with the PROCESS macro (Hayes, 2013; model 4) to examine the ability of coping motives to mediate, explain, the relation between childhood physical abuse and current risky drinking. Results indicated that coping motives significantly predicted risky drinking, $b = .68$, $SE = .09$. $p < 0.01$. Although ratings of childhood physical abuse and coping motives, combined, accounted for 30% of the variance in risky drinking one significant association was not in the expected direction. Contrary to expectations, higher ratings of childhood physical abuse were associated significantly with lower self-reported risky drinking. It may be that greater alcohol consumption facilitates under-reporting, or decreased recall, of parent-child difficulties. Results are discussed within the context of this particular sample, and the suggested directions for future research.

005

Name: Lucas, Elizabeth

Major: Biological Sciences/Biological Sciences

Faculty Advisor, Affiliation: Dr. Chris Snyder, Shackouls Honors College

Project Category: Arts and Humanities (Oral Presentation)

Matter and Spirit: The Re-Enchantment of Nature through the Literature of C. S. Lewis

Individuals can read volumes on of academic and scientific research on the importance of ecology and healthy environmental practices, but these do not always succeed in changing how people *live*. Changing how people relate to the earth must be accomplished through a shaping of imagination, and imagination is shaped through art and story. Lewis's environmental vision and ecological perspective are present in every story he wrote. In *That Hideous Strength* Lewis juxtaposes NICE at Belbury with their unhealthy ecology and relationship to nature against St. Anne's whose positive relationship with organic and inorganic nature reflects Lewis's environmental vision.

While the first two novels of *The Space Trilogy* take part on other planets, in *That Hideous Strength*, Lewis brings the ba0le to his home soil of England. In this way, he forces his readers to take everything they read and place it in their own world. With strong images of deforestation, vivisection, and disregard for nature, Lewis forces readers to consider their own non-fictional world in context of his made-up one. *That Hideous Strength* has one overarching theme: if nature is violated, it will be avenged. For Lewis, this vengeance comes in the form of an ancient and druidic Merlin who encourages the lab animals to burst free and kill their tormentors. Lewis is not simply trying to preach a message of doom, however. Juxtaposed against the brutality of Belbury and NICE is the sanity and healthy relationships of St. Anne's. Lewis presents an example of healthy life with nature and with other humans as he makes an argument for the re- enchantment of nature.

157

Name: Lucore, James

Major: Biochemistry

Faculty Advisor, Affiliation: Xin Cui, Chemistry Department

Project Category: Physical Sciences and Engineering

Co-Author(s): Hetti Handi Chaminda Lakmal

Synthetic routes toward a new type of chiral ligand

Catalysts are important for chemical transformations, which are important to forming chemicals for pharmaceuticals and manufacturing, with organometallic catalysts being one specific area of research. In this project we went through the synthesis of a chiral building block of one such organometallic catalyst. The synthesis begins with a simple bi-naphthol reagent. Through esterification, pivalic acid is added as a protecting group, and the resulting product is brominated. The chemical is then hydrolyzed to remove the protecting group, and the product is methylated on the two OH groups. Finally, the Bromine is replaced by BPin, completing the subunit of the catalyst. The products purified using columns and their structures are verified using proton NMR.

075

Name: Lynch, BreAnna

Major: Biochemistry (Pre-Vet)

Faculty Advisor, Affiliation: Dr. Jean Feugang, Animal and Dairy Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Robyn E. Hadden, Ayodele M. Popoola, Nasiru Ibrahim

Exploring the Biopolymeric effect of Gum Arabic on Boar Spermatozoa

Gum Arabic (GA) is an extract of the multipurpose arid and semi-arid Acacia Senegal tree. GA is a complex resin mixture of high molecular weight carbohydrates and a protein fraction. It is widely used in the food industry, and recent studies have reported its beneficial effects on cryopreservation of ram and stallion spermatozoa, leading to satisfactory fertility. Here we evaluated the effects of GA on boar sperm motility and morphology for preservation purposes. GA extract was provided by NABDA (Abuja, Nigeria), and extended pool semen was obtained from Prestage Farms (West Point, MS). In the laboratory, extended semen samples were centrifuged, sperm pellets were resuspended in a pre-warmed Phosphate-Buffered Saline solution (PBS), and spermatozoa adjusted to approximately 50×10^6 /mL. Sperm aliquots were constituted, and various volumes of GA stocks prepared with PBS (GA_p; 308 mOsmol/Kg) or water (GA_w; 32 mOsmol/Kg) were added for final amounts of 0, 25, 50, 100, and 200 μg GA/sperm aliquot. Mixtures were incubated at 30-35°C for 60 minutes, followed by sperm (total and progressive) motility and morphology analyses (Computer-Assisted Sperm Analyzer). Experiments were replicated 6 times, and data were statistically analyzed (T-test and ANOVA-1). P<0.05 was set for significant difference. GA dissolution in water procured better sperm motility than its PBS counterpart (83% vs. 68%; P<0.05), showing steady reduced motility to the control (Total: 86% and Progressive: 21%; P<0.05). Greatest motility parameters were observed with spermatozoa exposed to 50 μg GA_w (Total: 98% and Progressive: 27%; P<0.05). Motility data in the other GA_w groups were either equal (P>0.05) or significantly lower (P<0.05) to the control group. The proportions of morphologically normal sperm were comparable between GA_w and GA_p. We conclude that GA dissolved in water influences motility of boar spermatozoa. Ongoing studies examine the composition of the used GA and its effects as a sperm cryoprotectant.

076

Name: Magee, Elijah

Major: Computer Science

Faculty Advisor, Affiliation: Harun Pirim, Industrial Engineering

Project Category: Biological Sciences and Engineering

Clustering of the Hypothetical Proteins from the Aquaculture isolate strain *Edwardsiella ictaluri* 93-146

Edwardsiella ictaluri is the causative agent of extensive mortalities and economic losses to the channel catfish industry in the United States. However, many proteins from its genomes are not assigned a role. These unknown proteins are called hypothetical proteins and they remain to be elucidated so that their function and potential biological roles could be identified and assigned. In our study, we aimed to use multiple different bioinformatics approaches to assign roles for these hypothetical proteins. These proteins may play role in different important functions in the genome. In our analyses, we filtered 307 hypothetical proteins from *Edwardsiella ictaluri* 93-146 genome. Later, we used the OrthoDB database to obtain functional information on these proteins. This research considered the evolutionary characteristics of 226 of these proteins constructing a weighted network based on the evolutionary rate, length, and similarities to other proteins. Then lower weight connections were dropped, and several clustering algorithms were run on the trimmed network. Three clusters emerged from the trimmed network. Based on known functionalities of some of the proteins a chart was created showing the emergent functionalities of each group. This chart could be used in investigating further similarities (i.e. sequence similarity), or if the functionalities of a group of similar proteins were known these proteins could be placed in one of the existing functional groups. Further research will be conducted to analyze the amino acid composition of the proteins in each group. This would allow the classification of the hypothetical proteins for which there existed no functional information before.

077

Name: Marchant, Ali

Major: Wildlife & Fisheries Science/Aquaculture & Fisheries Science

Faculty Advisor, Affiliation: Dr. Kristine Evans, College of Forest Resources

Project Category: Biological Sciences and Engineering

Co-Author(s): Dr. Kristine Evans, Dr. Carlos Ramirez-Reyes

“Under Pressure” - behavioral implications of population augmentation in territorial species

Population translocation and augmentation are common management strategies to increase abundances of declining wildlife species in their natural habitats. However, little is known regarding how existing wild populations react to introduced individuals from translocation or augmentation efforts. This is of particular concern for species that exhibit complex social organization and/or strong territoriality whereby introduction of new individuals may disrupt social/territorial equilibriums. Many species exhibit a “dear-enemy” effect—where they tolerate known neighbors to avoid energy loss from stress of defending their territory against new “intruders”. This dear-enemy behavior may be disrupted by introduction of new individuals into a population; however it is unknown how stress from disruption cascades through the population nor how it may impact individual fitness in non-adjacent territories. We examined cascading effects of territorial behaviors using male *Betta splendens*, which exhibit extreme territoriality, as a model species to infer potential fitness consequences when individuals are introduced into adjacent and non-adjacent territories. We conducted two experimental trials replicated over 12 rounds whereby *Betta* were sequentially introduced into visually-adjacent territories over a 16-day trial period. We hypothesized center territory-holding fish would exhibit compounding increases in agonistic behaviors as territorial aggression cascaded following sequential introductions. We recorded agonistic behaviors of center territory-holding subject fish as new individuals were introduced via visual contact in directly adjacent or non- adjacent territories. We used a generalized linear mixed-modelling approach to examine effects of territory adjacency, time since visual introduction, and body mass on count of aggressive behaviors. We found introduction of neighbors adjacent to subject fish resulted in greater amounts of aggression but this effect diminished in the two-directional trial as non-adjacent territories were introduced. However, this was not observed in the one- directional trial. This suggests potential fitness benefits for individuals in the population center core when augmentation/translocation efforts introduce individuals on population fringes.

212

Name: Marri, Randeep Reddy

Major: Psychology

Faculty Advisor, Affiliation: Arazais Oliveros, Psychology

Project Category: Social Sciences

Co-Author(s): H. Addison Lowery, B.S., Deepali M. Dhruve, B.S.

Effect of Authoritarian Upbringing and Emotion Regulation Difficulties in Predicting Current Intimate Partner Psychological Abuse

Several factors are believed to affect intimate partner violence (IPV) perpetration. One such factor, difficulties in emotion regulation (DER), has been associated with increased perpetration of psychological IPV (PPIP) in both men and women (Shorey et al., 2011). Relatedly, previous studies have found that harsh parenting, (i.e., authoritarian style), may contribute to children's DER (Chang et al., 2003). The current study examined the role of authoritarian upbringing and current DER in predicting PPIP in current romantic relationships. Data were obtained from college students who participated in a larger online study about cognitive and affective risk factors for IPV. Participants completed the Parental Authority Questionnaire (Buri, 1991), Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004), and Abuse within Intimate Relationships Scale (Borjesson, Aarons, and Dunn, 2003). Correlational analyses indicated lack of emotional clarity (LEC; DERS subscale) was correlated with maternal authoritarian style ($r = .244, p < .05$) and PPIP ($r = .197, p < .01$). As such, we used the PROCESS macro (Hayes, 2013; model 4) to examine the role of LEC in explaining the relation between authoritarian parenting and PPIP. As expected, higher ratings of authoritarian upbringing significantly predicted difficulty with lacking emotional clarity, $b = 0.07, SE = 0.03, p < 0.05$. Furthermore, LEC significantly predicted PPIP, $b = 1.12, SE = 0.46, p < 0.02$. The variables accounted for 4% of the variance in PPIP. Although there was not a significant direct or indirect association between authoritarian parenting and PPIP, authoritarian upbringing appeared to increase the risk of LEC, which in turn was a risk factor for PPIP. Future studies should measure the effect of interventions to reduce authoritarian style, and whether that helps youth avoid some forms of DER which may contribute to PPIP.

017

Name: Marshall, Samantha

Major: Landscape Architecture

Faculty Advisor, Affiliation: Cory Gallo, Landscape Architecture

Project Category: Arts and Humanities (Poster)

Student Farm Organization

This case study research explores how university student farms are organized, managed, and programmed for student experiential learning. Case studies were developed for three structurally unique student farms which included: The University of Kentucky, University of Oregon, and the University of Georgia. The case studies evaluate how each farm is managed, how the farms involved students, how the farms made profits, and the administrative connection of the farms to their affiliated universities. Through comparative analysis, the case studies reveal a range of possible typologies that farms could fall into. The results also highlight the potential differences and missions of student farms and how the farm can support other academic, research, and outreach goals. Lastly, the results indicate that not all student farms have the same level of student interaction, which highlights the need for further exploration of how and why student farms should be managed to provide a student driven learning experience.

158

Name: Matranga, Robert

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Rani Sullivan Rob Wolz, Aerospace Engineering

Project Category: Physical Sciences and Engineering

Co-Author(s): Daniel Hall

Environmental Effects on Rohacell Foam Cores

Boeing has experienced some problems with sandwich composite panels having reduced structural integrity immediately after fabrication. This degradation of the panel is thought to be caused by outgassing of the Rohacell 51 Hero foam core. As such, this experiment seeks to discover what causes this outgassing by observing the effects of environmental conditions, such as temperature and moisture, on the material. To observe this, the foam cores were placed within a humidity tent for moisture exposure, and then immediately vacuum bagged and placed within an oven for heat treatment. Heat treatment times and temperatures, as well as humidity tent times were based on a design of experiment. The foam cores' lengths, widths, and thicknesses were measured prior to humidity exposure, after humidity exposure, and again after heat treatment. This data was analyzed to make a prediction of the best possible combination of heat treatment time and temperature to avoid outgassing, as well as to see what temperature and time combination led to the most extreme cases of outgassing.

159

Name: McCartney, Conner

Major: Mechanical Engineering

Faculty Advisor, Affiliation: Prashant Singh, Mechanical Engineering

Project Category: Physical Sciences and Engineering

Design and Development of Experimental Facility for Thermal Conductance Measurement of Composites

This project's goal was to develop a system for evaluating the performance of various Thermal Interface Materials (TIMs). These TIMs would be used in electronic devices to facilitate more efficient cooling of processing units. This system must be capable of testing both paste, and metallic foam TIMs. The thermal conductance of composite was found by sandwiching it between two aluminum blocks, where the top aluminum block was heated by a patch heater and the bottom aluminum block was attached to a constant temperature cold heat sink such that the heat can essentially be driven in one direction. Under steady state condition, the temperature drop across the composite was measured by thermocouples and with the knowledge of the heat flux across the composite, the thermal conductance was determined using Fourier's law of conduction.

078

Name: McCreary, Caleb

Major: Biological Engineering

Faculty Advisor, Affiliation: Stamatis Agiovlasis, Kinesiology

Project Category: Biological Sciences and Engineering

Co-Author(s): Slater Richardson, Poram Choi, Supreete Ghosh, Anthony T. Allred, Stamatis Agiovlasis

Other Competition(s): Public Health Research Competition

Prediction of Oxygen Uptake from Accelerometer Output in Adults with Down Syndrome: Vector Magnitude vs. Vertical Axis

Adults with Down syndrome (DS) have altered movement patterns. Especially during walking, their altered mediolateral and anteroposterior body motion predicts their elevated energy cost. Triaxial accelerometers provide a metric of three-dimensional acceleration—Vector Magnitude (VM) counts—which may better estimate the rate of oxygen uptake (VO₂) during physical activities and sedentary behaviors than the traditionally used Vertical Axis (VA) counts.

This study examined if VM counts are more accurate than VA counts in estimating VO₂ across different physical activities and sedentary behaviors in adults with DS.

Sixteen adults with DS (10 men; age 31 ± 15 years) performed 12 tasks: sitting; playing app; drawing; folding clothes; sweeping; fitness circuit; moving box; basketball; standing; and walking at the preferred speed and at 0.8 and $1.4 \text{ m}\cdot\text{s}^{-1}$. We measured VO_2 with a spirometer (K4b², Cosmed) and VA and VM with an accelerometer (wGT3X-BT, Actigraph) on the non-dominant hip. We used two separate multi-level regression models to predict VO_2 from VA or VM. We evaluated the fit of models with the R^2 , and accuracy with Bland-Altman plots and absolute percent error.

Both VM and VA significantly predicted VO_2 in separate models ($p < 0.001$; $R^2 = 0.74$ and 0.65 , respectively). Across all tasks combined, absolute percent error was lower for the VM than the VA model (23.7 ± 26.2 and 33.6 ± 35.9 , respectively). Absolute error was lower for the VM than the VA model for sitting, playing an app, drawing, and standing ($p \leq 0.004$), but did not differ for other tasks. Bland-Altman plots indicated zero mean error for both models; however, the limits of agreement were narrower for the VM than the VA model.

Both VA and VM counts predict VO_2 in adults with DS; however, prediction is more accurate for a VM than a VA model during sedentary behaviors.

VM counts should be used in developing accelerometer-based prediction of physical activity and sedentary behavior in adults with DS.

160

Name: McCullough, Byron

Major: Electrical Engineering

Faculty Advisor, Affiliation: Dr. Chanyeop Park, Electrical and Computer Engineering

Project Category: Physical Sciences and Engineering

Co-Author(s): Mojtaba Rostaghi-Chalaki

Dielectric Surface Characterization for Naval Shipboard Power Systems

The key trends that drive technological advancements and innovations in recent years have been high power density and direct current (DC) systems. On the power system side, DC systems driven by power electronic converters, have been increasing their footprints. These include medium-voltage direct current (MVDC) systems that are considered promising for electric ships and electric aircraft applications. Growing number of distributed renewable energy and high-voltage direct current (HVDC) power transmission systems are also continuing to introduce more DC into the grid. The increasing use of DC introduces new dielectric challenges that threaten device lifetime and undermine system resiliency. To develop an understanding on dielectric failures pertaining to DC naval shipboard power systems, we systematically investigate the dielectric surface characteristics under both AC and DC electric stresses. We use a multi-test set control module (MTSCM) that supplies high voltage to test the difference between AC and DC surface flashover characteristics of dielectric samples. The measurement of the applied high voltage is performed through a capacitive voltage divider that reduces voltage by a factor of 1,000. Based on the findings, a distinction between surface flashover under AC and DC electric stresses will be made. The developed understanding will be used for informing the U.S. Navy regarding the emerging dielectric challenges that may have been overlooked in hopes a better solution can be found.

079

Name: McDonald, Amye

Major: Microbiology

Faculty Advisor, Affiliation: Barbara Kaplan, Department of Basic Sciences, Center for Environmental Health Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Erin Rushing, Ashleigh Nicaise, Abigail Bell, Evangel Kummari

Effect of TCDD on Antibody Production in Various Anatomic Locations in Experimental Autoimmune Encephalomyelitis

The prototypical AhR ligand, TCDD, has been well characterized to be immunosuppressive. It has been determined that TCDD robustly attenuates the autoimmune disease experimental autoimmune encephalomyelitis (EAE), a mouse model to study multiple sclerosis. The purpose of this study was to evaluate IgG production in different anatomic locations including spleen, lymph node, bone marrow, spinal cord, and blood. In each location, specific B cell populations, including CD19, B220, and

CD5, were analyzed in mice induced with EAE disease and treated with TCDD. CD19 and B220, an isoform of CD45, are B cell markers expressed at all stages of B cell development but lost upon plasma cell differentiation. CD5 is an indicator of one population of innate B cells. To evaluate antibody production in the B cell populations of TCDD-treated mice, disease was induced and 2.5ug/kg/day of TCDD was orally administered for 12 days, for a total of 30 ug of TCDD. It was hypothesized that TCDD would downregulate IgG production in all anatomic locations. TCDD was very effective in suppressing MOG specific IgG in serum. Overall, IgG was suppressed by TCDD in splenocytes. Interestingly, IgG was most affected by TCDD in CD19, B220, and CD5 negative populations. TCDD did not affect IgG production in bone marrow or lymph node derived B cells but did suppress IgG production in B cell populations in the spinal cord. In conclusion, these data show that TCDD's target tissues at end-stage disease are spleen and spinal cord. These results provide valuable insight into the mechanism of immunotoxicity of TCDD. In addition, the findings contribute to the understanding of how AhR ligands affect EAE and may help us develop a less toxic treatment for autoimmune disease. (Supported by NIH R15ES027650).

213

Name: McLaurin, Meredith

Major: Educational Psychology

Faculty Advisor, Affiliation: Dr. Kasia Gallo, Department of Counseling, Educational Psychology, & Foundations

Project Category: Social Sciences

Effectiveness of Treatment Techniques for Sexual Assault Survivors

The US Department of Justice has found that every 73 seconds an American is sexually assaulted; that is 433,648 victims each year. Sexual assault is defined as any nonconsensual sexual act proscribed by federal, tribal or state law; this applies when the victim is unable to provide consent or if consent is not given freely. Though the definition of sexual assault varies by culture and studies, sexual assault is associated with the highest rate of Post-Traumatic Stress Disorder (PTSD) compared to any other trauma. In addition, survivors of sexual assault have higher reports of being diagnosed with other mental health disorders than individuals who have not experienced sexual assault. This has led to more research on counseling and therapeutic techniques used to treat survivors of sexual assault to provide the most effective treatment techniques for survivors. The therapeutic techniques include, but are not limited to: Cognitive Behavior Therapy, Cognitive Processing Therapy, Imagery Rehearsal, Art Therapy, and Exposure Therapy. The literature suggests that each survivor of sexual assault benefits differently from various treatment techniques. Further research is essential to find the most beneficial forms of therapy for all survivors. To achieve this, large and longitudinal studies are needed, with diverse participants.

080

Name: Meeks, Addison

Major: Agricultural Engineering Technology & Business

Faculty Advisor, Affiliation: Amelia Fox, Plant and Soil Sciences

Project Category: Biological Sciences and Engineering

REU/Research Program: Advancing Canopy Reflectance-based Variable Rate Fertilizer N Application in Cotton with sUAS-RedEdge Camera Technology

Other Competition(s): Community Engagement Research Track

Advancing Canopy Reflectance-based Variable Rate Fertilizer N Application in Cotton with sUAS-RedEdge Camera Technology

Commercial nitrogen (N) fertilizers are a necessity in modern day crop production. Current N fertilizer practices result in low nitrogen use efficiency (NUE). Common farm practice is to make blanket rate, or excessive, fertilizer applications. In a blanket rate application, the entirety of the field is given one high fertilizer treatment. A blanket rate does not take variation into account natural N variation in soils. Low NUE creates environmental hazards in waterways, such as hypoxic zones, and has a detrimental effect on crop yield. Contrarily, excessive N fertilizer may result in yield reductions related to plant reversion of vegetative growth and postponed fruit production. Variable rate fertilizer application, based on remotely sensed assessment

of early canopy N status, may provide a means to adjust N fertilizer across a varied landscape. This study was created to determine if small unmanned aerial systems (sUAS) remote sensing technology will predict N status in early cotton in order to create a VRA (N) fertilizer map.

Cotton was planted on May 16, 2019 on 38-inch rows. Canopy reflectance at early bloom was collected with DJI M100[®] sUAS with MicaSense RedEdge[®] sensor on 06/24/2019. On 06/25/2019 a VRA N fertilizer map was delivered to service provider for application. This study includes a similar early cotton sensing and VRN prescription data set from 2018. Cotton yield was measured in October of 2018 and 2019. In 2018, the mean NUE was 11.41 and 14.53 for fixed and VRN rates, respectively. In 2019, mean NUE was 11.19 and 14.0 for fixed and VRN rates, respectively. Increase in NUE suggests sUAS remote sensing technology can predict N status in early cotton and may aid in reducing over application of N fertilizer in a large landscape.

161

Name: Mees, David

Major: Biological Sciences/Biological Sciences

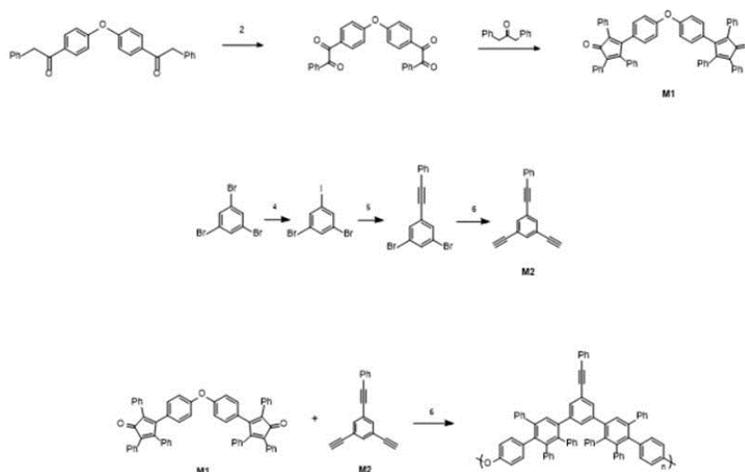
Faculty Advisor, Affiliation: Ernesto Borrego, MSU Department of Chemistry

Project Category: Physical Sciences and Engineering

Co-Author(s): David Mees, Ernesto Borrego, Solomon Tesfaye, Gustavo Munoz

Synthesis and Characterization of New Precursor for Glassy Carbons and Carbon-Carbon Matrices

Glassy carbons are a special class of carbon allotrope that are characterized by great heat conductivity and low electric resistivities which make them good matrix materials in advanced carbon fiber- reinforced composites. Herein, we describe the cyclopolymerization of alkynylbenzene – cyclopentadienone derivatives (**M1** and **M2**) using a modified procedure that was originally defined by John Stille and Frank Harris in the 1960's. Through the Diels-Alder reaction, **M1** and **M2** were thermally polymerized for the purpose of making processable and high carbon yielding glassy carbon precursors. (**Scheme 1**) The strategy employed was to synthesize a cross-linkable *m*-alkynylbenzene monomer with latent reactivity, which takes advantage of the differing activation temperatures of the two ethynyl groups (~100 °C) and the *m*-phenylethynyl group (~200 °C). Such structural features are expected to impart significant control over branching and cross-linking, and thereby also improve processability. Coupling these features with the theoretical carbon yield of these alkynyl-cyclopentadienones with the state-of-the-art resins will prove useful for applications in carbon-carbon composites (CCC) matrix materials. The polymerization and structural profile of our product are monitored by ¹H and ¹³C-NMR and FT-IR. For the reactivity profiles of our product, we use data compiled from DSC to get the melting point (if present), glass transition temperature (T_g), and polymerization exotherm. The char-yields of our product – the weight of the polymer lost at high temperature (~1000 °C) - are determined by TGA data. We track the purity of our monomers before we polymerize them using GC-MS, and we monitor the degree of polymerization, molecular weight growth, branching, etc. for our product using GPC analysis.



Scheme 1: Synthesis of M1, M2 and polymerization of M1 and M2 to form the cyclopentadienone-alkynylbenzene polymer

081

Name: Mercer, Kayla

Major: Animal and Dairy Sciences (Pre-Vet)

Faculty Advisor, Affiliation: Brittnei Littlejohn, Department of Animal and Dairy Sciences; Caleb Lemley, Department of Animal and Dairy Sciences

Project Category: Biological Sciences and Engineering

REU/Research Program: URSP

Impact of prenatal and postnatal melatonin supplementation on bovine testis physiology

Chronic melatonin supplementation of pregnant cattle is associated with increased uterine artery blood flow and increased scrotal circumferences in weaned calves born to melatonin-supplemented dams. The objective was to evaluate the influence of prenatal and postnatal melatonin supplementation on bovine seminiferous tubule diameter (DIA). In Experiment 1, pregnant heifers were assigned treatment groups in a 2 x 2 factorial with 2 planes of nutrition (adequate-fed [ADQ] or nutrient-restricted [RES]) with (MEL) or without (CON) dietary melatonin (20 mg). Treatments were administered between 160 and 240 d of gestation. Cesarean sections were conducted at 240 d of gestation and paired testis weights (PTW) recorded from male fetuses (n=4 RES-MEL, n=5 ADQ-MEL, n=5 RES-CON, n=3 ADQ-CON). MIXED procedures of SAS were employed with melatonin supplementation, nutrient restriction, and the interaction as fixed effects. In Experiment 2, peri-pubertal bulls were assigned to receive four 24 mg subdermal melatonin implants (MEL; n=6) or a placebo (CON; n=6) in the dorsal ear every 30 d for a 120-d period. On d 120, bulls were castrated and PTW recorded. MIXED procedures of SAS were employed with treatment as a fixed effect and sire as random. In both experiments, cryopreserved tissues (8 µm sections) were stained (hematoxylin and eosin). For each bull, ≥ 100 individual DIA were measured and averaged. In Experiment 1, there was no difference in DIA for MEL vs. CON fetuses (47.11±1.24 and 49.84±1.33 nm, respectively; $P=0.16$) or in DIA/PTW for MEL vs. CON fetuses (8.23±0.65 and 9.43±0.70 nm/g, respectively; $P=0.24$). There was no difference in nutrient-restriction status or the interaction ($P>0.1$). In Experiment 2, there was no difference ($P=0.94$) in DIA for MEL (205.20±12.70 nm) vs. CON (206.68±12.70 nm) bulls or in DIA/PTW for MEL (0.67±0.07 nm/g) vs. CON (0.56±0.07 nm/g) bulls ($P=0.27$). In summary, neither prenatal nor postnatal melatonin supplementation influenced DIA.

Keywords: Cattle, Nutrient Restriction, Seminiferous Tubule Diameter

082

Name: Metcalfe, Abbie

Major: Animal & Dairy Sciences

Faculty Advisor, Affiliation: Caleb O. Lemley, Department of Animal and Dairy Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Zully E. Contreras-Correa, Darcie R. Sidelinger, E. Heath King, Derris D. Burnett

REU/Research Program: Undergraduate Research Scholars Program

Examining melatonin-mediated changes in bovine placental vascularity during maternal nutrient restriction

Photoperiod and nutrition are among the major regulators of circadian rhythms, but their effects on the bovine placenta have not been investigated extensively. Therefore, the objective of this study was to examine the influence of maternal nutrient restriction, dietary melatonin supplementation, and the time of day on macroscopic cotyledonary vascular density in pregnant beef heifers. At day 160 of gestation, 29 Brangus heifers were utilized in a 2 x 2 factorial design, in which animals were assigned to either an adequate (n=14) or restricted (n=15) nutritional plane and were either supplemented dietary melatonin (n=15) or control (n=14). On day 240 of gestation, placentomes were collected via Cesarean section either in the morning approximately 4 hours prior to feeding (n=15) or in the afternoon 4 hours after feeding (n=14). The placentomes were perfused via the cotyledonary artery with Concanavalin A, Alexa Fluor 647 Conjugate and analyzed using an In Vivo Imaging System in order to determine differences in macroscopic blood vessel density of the cotyledon, indicated by total flux and average radiance. There were no significant differences or interactions between nutritional plane or dietary melatonin treatment groups ($P>0.05$). However, time of placentome collection significantly impacted total flux (1.37E13±0.197E13 vs. 2.12E13±0.205E13; $P=0.0137$), total flux relative to

placental weight ($1.45E11 \pm 0.370E11$ vs. $2.88E11 \pm 0.363E11$; $P=0.0124$), and average radiance ($2.87E10 \pm 0.424E10$ vs. $4.39E10 \pm 0.440E10$; $P=0.0199$), for morning versus afternoon, respectively. Compared to placentomes obtained in the morning, placentomes collected after feeding displayed greater cotyledonary blood vessel density. Based on these results, neither melatonin nor nutritional plane influenced cotyledonary vascularity; however, the significant changes within a day could directly inform the development of guidelines for the proper temporal administration of placental blood flow therapeutics.

083

Name: Middleton, John

Major: Electrical Engineering

Faculty Advisor, Affiliation: Dr. John Ball, Electrical and Computer Engineering

Project Category: Biological Sciences and Engineering

Hardware and CAD Design for Wearable Ankle Stretch Sensor Technology

With the use of technology becoming more prominent in the world of athletics, wearable sensors have become a valuable asset to different programs providing a myriad of benefits, such as data collection for training and performance and injury monitoring for anticipation and recovery. However, alongside this technological development have been a host of concerns about the accuracy and usability of the data collected with wearables. Knowing this, our study has been predicated on the basis of replicating a widely used method of measuring the movement of the human body: Motion Capture. Though the system is regarded as an industry standard for this type of data collection, one of the downsides to Motion Capture is its space restrictions, which limit its usability in the world of athletic training. Our solution is to mimic the kinesiological data of the Motion Capture system using wearable stretch sensors attached to an athletic compression sock. The sensors hook onto the sock in predetermined locations based on bony landmarks for measuring the plantar flexion, dorsiflexion, inversion, and eversion of the ankle. Early testing has shown promising results as to the likelihood of the method. Analysis of these experiments has determined the requirements of improving the case design for the data collection and transmission device and creating different sized models for diverse testing, which are being implemented using CAD software and 3D printing. My role has been to design and improve 3D printable and electrical components to assist in the testing and development of the wearable technology. Going forward, further testing will be required to ensure the accuracy and longevity of the sensors. Our research of this technology will help continue to redefine the way athletic training is being conducted by providing information on performance and injury reliably and practically.

084

Name: Miller, Nathaniel

Major: Poultry Science

Faculty Advisor, Affiliation: David Peebles, Poultry Science

Project Category: Biological Sciences and Engineering

Co-Author(s): N Miller, A. Mousstaid, B.R. Oakes, S.A. Fatemi, A Alqhtani, K.E.C. Elliott, W Miller, E.D. Peebles

The effects of supplementary *in ovo* and dietary ascorbic acid on broiler performance

The use of supplementary L-ascorbic acid (AA) may benefit the broiler industry by improving broiler feed efficiency (FE), body weight (BW) gain, and eye health. Therefore, the effects of supplemental *in ovo*-injected and dietary AA on the eye and body weights, feed intake (FI), and FE of broiler chickens were determined. Four *in ovo* treatments were administered at 18 days of incubation: non-injected, saline injected, 12 mg AA/egg, or 25 mg AA/egg. Two dietary treatments, with or without 200 mg/kg of supplemental AA, were provided from 0 to 14 days post hatch. Nine males and nine females were placed in each of 48 pens. Body and eye weights were determined for 2 birds from each pen at days 7 and 14. Body weight gain was determined between 0 and 7, 7 and 14, and 0 and 14 days. Eye weight was calculated as a percentage of BW. The BW of males were heavier than females only on day 14 ($P = 0.0055$). Birds that were fed diets without supplemental AA had a greater BW ($P = 0.0002$) on day 7 and a greater overall FI ($P = 0.0198$) than birds fed supplemental AA. Supplemental dietary AA improved ($P = 0.0407$) FE between 7 and 14 days. The absolute eye weights of males were heavier than females on day

7 ($P = 0.0005$) and 14 ($P = 0.0046$). Birds given the highest level of *in ovo*-injected AA had the lowest absolute eye weights at 14 days ($P = 0.0434$). However, relative eye weights in birds fed supplemental AA were higher at day 7 ($P = 0.0007$). In conclusion, AA administered by *in ovo*-injection did not influence broiler performance. However, supplemental dietary AA improved the FE of the birds in the second week.

162

Name: Mills, Julianna

Major: Chemistry

Faculty Advisor, Affiliation: Todd Mlsna, Chemistry

Project Category: Physical Sciences and Engineering

Co-Author(s): Beatrice Arwenyo, Jac J. Varco, Andrew Dyger

The effects of P enrichment on liming capacity of modified biochar

The capacity of biochar to buffer soil due to its liming ability is known. Recently, the potential of nutrient laden biochar for soil amendment has been reported. However, knowledge of influence of biochar enrichment with plant nutrients on its liming ability is still scanty. This study investigated effects of biochar modification and P enrichment on its liming capacity. Whereas sequential modification of biochar with magnesium chloride and potassium hydroxide enhanced liming ability by 34%, enrichment with potassium phosphate solution lowered liming capacity by 7%. Measurement of soil pH after amendments with modified biochar and P enriched biochar confirmed the alteration of soil pH and hence liming ability. More studies should be done to examine the effects of biochar enrichment for different feedstocks and modification methods

085

Name: Mitchell, Blaklie

Major: Biological Sciences/Biological Sciences

Faculty Advisor, Affiliation: Dr. Mark Welch, Biological Sciences

Project Category: Biological Sciences and Engineering

A Genetic Analysis of the Invasive Green Iguana (*Iguana iguana*) on Grand Cayman

This project seeks to further evaluate the patterns of genetic variability among invasive Green Iguana populations in the Cayman Islands of the Caribbean. The Green Iguana (*Iguana iguana*) is a highly invasive species that has been introduced to multiple regions outside of its native range of Central and South America. In its introduced range, the Green Iguana has negatively impacted several native species, many of which are endangered endemics such as the Sister Isles Rock Iguana (*Cyclura nubila caymanensis*). In a previous project, the genotypes of Green Iguana individuals from both Little Cayman and Cayman Brac (i.e. the Sister Isles) were analyzed while assessing the sibship and parentage of putative hybrids between the invasive iguana and the endemic species. The analysis revealed a similar lack of nuclear molecular variation across all individuals from both islands yet notable differences in mtDNA haplotype frequencies. Given this finding, we hypothesized that individuals colonizing both islands were of similar genetic stock originating from the island of Grand Cayman, where this species has been firmly established, but only a few females have successfully reproduced on Little Cayman and Cayman Brac. To further test this hypothesis, the genetic variation of invasive Green Iguanas found on the island of Grand Cayman will be characterized. If far more molecular variation is uncovered on this island, it would be clear that a limited sample of genetically similar individuals is reaching the Sister Isles. These results would provide the opportunity to assess the effectiveness of current control methods in reducing the number of Green Iguanas arriving and propagating on Little Cayman and Cayman Brac from Grand Cayman. Continued analysis of the genetic variation of this invasive species in the Cayman Islands will yield a better understanding of how successful introductions and colonization events occur.

214

Name: Mizell, Hannah

Major: Geosciences/Geography

Faculty Advisor, Affiliation: Taylor Shelton, Department of Geosciences

Project Category: Social Sciences

Mapping Post-Disaster Property Speculation in Houston, Texas, 2014-2018

From 2015 to 2017, the city of Houston, Texas experienced three consecutive years with 500 year-floods, culminating in record-setting damage caused by Hurricane Harvey in 2017. While natural disasters have long facilitated opportunities for profiteering, anthropogenic climate change and rapid urban development in Houston have further exacerbated the impacts of disasters through the increased intensity and elevation of flooding. As a result, disaster-induced damage has primed the Houston housing market for speculative activity by investors and developers seeking to profit off of these crisis events. This poster analyzes how housing speculation has manifest following the three major floods in Harris County from 2015 to 2017. To do this, we identify four indicators of housing speculation and map them across Harris County: corporate- owned properties, absentee-owned properties, concentrated property ownership, and significant changes in value. This analysis attempts to identify the spatiality of speculative activity in relation to flood inundation from 2015-2017, with results showing that three out of four indicators demonstrate an upward trend of housing speculation following each of the floods, with speculative activity being most concentrated in southwest Harris County.

215

Name: Moak, Reagan

Major: Biochemistry

Faculty Advisor, Affiliation: Ann Sansing, Food Science, Nutrition, and Health Promotion

Project Category: Social Sciences

Other Competition(s): Community Engagement Research Track, Public Health Research Competition

An Illness and Injury Simulation: Can Adolescent Health Promoters and Educators Learn Empathy?

Mississippi State University Extension Service's Rural Medical and Science Scholars (RMSS) program is designed for high school juniors interested in pursuing a career in the healthcare field. Scholars were trained as Junior Master Wellness Volunteers to promote health literacy and educate their own communities on chronic disease. In order to better understand the impact of the common illnesses and injuries seen in their communities, our project aimed to teach empathy to scholars through simulation training exercises. Each scholar (n=21) was assigned an illness or injury to simulate living with for 24 hours. Quantitative empathy scores were recorded for each scholar prior to and after the simulation using the Toronto Empathy Questionnaire. Empathy scores increased on average by 3.9%. The majority of scholars (95.2%) agreed/strongly agreed with the statement that empathy can be learned, and 90.5% of participants agreed that this experience positively impacted their empathy. By researching an individual's ability to learn empathy, we are able to understand methods to train more compassionate and empathetic educators and leaders for the future of healthcare fields. The students returned to partnering communities to increase health literacy and chronic disease knowledge with more empathetic delivery methods. Moving forward we will expand the injuries and illnesses simulated and increase the duration of the simulation.

163

Name: Moffat, Cameron

Major: Political Science

Faculty Advisor, Affiliation: Dipangkar Dutta, Department of Physics and Astronomy

Project Category: Physical Sciences and Engineering

Bayesian vs. Frequentist: A Robust Extraction of the Proton Charge Radius

Statistical analysis based on the Bayesian interpretation of probability is increasingly popular in areas such as data science, healthcare, and finance. We have compared the frequentist and Bayesian methods in the extraction of the root-mean-square charge radius of the proton. Using simulated and experimental data sets, the proton radius was extracted via ordinary linear regression. For the Bayesian computation, a model is obtained through Markov Chain Monte Carlo (MCMC) sampling. We quantify the figure of merit of the frequentist and Bayesian methods in terms of the variance in the value of the extracted radius using each approach.

164

Name: Moffett, Zavion

Major: Chemical Engineering

Faculty Advisor, Affiliation: Dong Meng, Chemical Engineering

Project Category: Physical Sciences and Engineering

Telechic Polymers

Hydrogen bonding is a simple concept in lower level sciences that can grow to being very complicated the more that it is investigated. Telechelic polymers are large molecules that are apart group of polymers that can enter other reactions through its reactive end groups. They carry Hydrogen bonding sites at each of the chain ends. The most important job is to function as a building block and connect to each other by completing these Hydrogen bonds. Not all building blocks are the same. They can vary in assimilation such as arranged order and its current molecular weight or physical properties like density and viscosity. For the research that I am currently doing, I am using a system to correlate the assembly process by changing the hydrogen strength, molecular weight, and the concentration of the polymer itself. The end goal of this whole process is to have ultimate control of the ability to restrict these properties. It shows that with the right combination of controls that these polymers can be calibrated to be more useful and more secure for future research.

086

Name: Moran, Drew

Major: Biological Engineering

Faculty Advisor, Affiliation: Dr. Ariunbold Gombojav, Department of Physics and Astronomy

Project Category: Biological Sciences and Engineering

Co-Author(s): Nappall, Supriya, Semon, Bryan

Optical Trapping for Future Biological Applications

Current study employs fundamental concepts and applications such as performing single micro-nano organism force of an Optical tweezing system. A red diode laser is used as the source following which, the beam is expanded and focused onto the sample using a microscope objective with magnification on 63X. This focused beam was used to trap 3 μ m polystyrene beads. The experiment is aimed to calculate the maximum holding force of the laser on polystyrene beads. This preliminary study provided a template for calculating the viscosity and thus the maximum holding force of the laser based off plotting the Brownian Motion of the beads. Moving forward the holding force of the laser will be applied to other microparticles, specifically a bacteriophage, whose importance is increasing exponentially in the field of biomedicine due to its application in treating infections. A combination of label-free chemical spectroscopy based on coherent Raman scattering (CRS) and Optical tweezing system will be used to trap the bacteriophage microparticles and record CRS spectra of the trapped particles

simultaneously. The above-mentioned method is a highly sensitive technique and is a novel approach to gain insight on microparticles behavior and chemical status under trapped conditions.

216

Name: Moss, Nicole

Major: Human Sciences/Human Dev & Family Studies

Faculty Advisor, Affiliation: Joe Wilmoth, School of Human Science

Project Category: Social Sciences

Co-Author(s): Starren Jones, Emilie Cox, Kayley Loggins, Taylor Skinner

Closeness of parent/adult child relationship is positively related to the parent that had primary custody of the adult child

The purpose of this study is to explore the closeness of parent- adult child relationship, and how it relates to the parent that is ordered primary custody and partial custody of the child in their adult years. Previous research suggests that the child, in their adult years, is closer to the parent who was ordered primary custody. Based on what research has told us, we hypothesize that the closeness of parent-adult child relationship is positively related to the parent who had primary custody of the adult when they were a child. The following variables were measured using the Parent-Child Relationship Schema Scale and the Model of Relationships Survey. Asking participants what kind of custody their parents have (joint, residential, sole, legal, etc.) using a sliding scale for approximation of how many nights was spent with each parent during the year. The state of their parent's divorce will be measured by asking participants how acrimonious it was. Gender will be a dichotomous variable with male and female as choices. Length of parent's divorce will be measured by asking participants to choose a windowed time frame using a sliding scale. Parent Involvement will be measured by asking participants to choose the activities that they did with their parents before and after the divorce. Survey links will be shared on Facebook for college students to participate in. We predict to find a positive correlation between the primary custody parent and adult child.

018

Name: Mullins, Jacquelyn

Major: Art/Fine Arts

Faculty Advisor, Affiliation: Jenna Altomonte, Department of Art

Project Category: Arts and Humanities (Poster)

Blurred Reality

My maternal grandmother helped raise me and played a crucial role in my upbringing. In her seventies, she was diagnosed with macular degeneration. Macular Degeneration, an inherited, degenerative disorder, results in complete blindness. The macula, located in the back of the eye, deteriorates over time causing gradual blindness. In my thesis, I work in collaboration with her to juxtapose her *field of vision* with my own. I am developing a series of images that represent the limited amount of sight my grandmother possesses before complete blindness. Considering her limited field of vision, she remains independent and cooks, reads, watches TV, and attends church functions.

My poster will exemplify my thesis project and the various stages of completion. For my show, I want to document my grandmother's routine and represent how she visualizes the world. Her field of vision comprises of shapes and colors, lacking detail and quantifiable forms. In my paintings, the images will explore color fields and the exaggeration of shapes. I plan to use imagery that is sentimental to both of us, focusing on people and places we share fond memories about. Using her verbal cues, I will juxtapose the forms and shapes that represent her visual field with how I envision the world. I plan to paint spaces that represent my visual field, then using shadow boxing with plexiglass slides to show the gradual effects of macular degeneration. I want the audience to be engaged and thoughtful of how blindness affects daily life.

087

Name: Nation, Rachel

Major: Forestry/Wildlife Management

Faculty Advisor, Affiliation: Heather D. Alexander, Department of Forestry

Project Category: Biological Sciences and Engineering

Co-Author(s): Jennifer K. McDaniel, Courtney Siegert

REU/Research Program: College of Forest Resources Undergraduate Research Scholars Program

Other Competition(s): Thesis Research Competition (TRC)

Impacts of Single and Mixed Tree Species Composition on Leaf Litter Decomposition Rates

Upland oak forests in the central and eastern United States are experiencing changes in species composition that could lead to changes in fuel loads, flammability, and nutrient loading over time. Because decomposition rates can influence these factors, we are exploring the effects of tree species composition on leaf litter decomposition rates by testing the rate of litter decomposition in samples composed of mixed or single species leaf litter in northern Mississippi. The mixed samples included four treatments of varying proportions (0%, 33%, 66%, 100%) of non-oak versus oak litter, and the single species samples included hickory (*Carya* spp.), post oak (*Quercus stellata*), sweetgum (*Liquidambar styraciflua*), southern red oak (*Q. falcata*), and winged elm (*Ulmus alata*) litter. We placed ~5 g of litter into 265 mesh bags and deposited them on the ground in locations around upland oak forests. At three-month intervals, we collected one bag of each treatment from each location and oven-dried and weighed the samples. Sample weights were later ash corrected to account for inorganic material present in the samples. After one year, the 33% non-oak treatment had the lowest mass remaining at $45.2\% \pm 1.2\%$, and the 0% non-oak treatment had the highest mass remaining at $54.7\% \pm 0.8\%$. For single species treatments, post oak had the lowest mass remaining at $56.4\% \pm 5.8\%$, and winged elm had the highest mass remaining at $61.5\% \pm 2.4\%$. Litter that decomposes more quickly can lead to reductions in fuel loads, while litter that decomposes more slowly can lead to longer retention of larger fuel loads. Decomposition rates can influence flammability by changing the moisture content of the leaf litter on the forest floor, and nutrients can be cycled back into the soil more quickly in species that decompose more quickly.

088

Name: Nicaise, Ashleigh

Major: Biological Engineering

Faculty Advisor, Affiliation: Barbara Kaplan, Center for Environmental Health Sciences, Department of Basic Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Abigail Bell, Amye McDonald, Erin Rushing, Evangel Kummari

Effect of Environmental Contaminant TCDD on Antibodies IgG1 AND IgG3 In Vitro

Experimental autoimmune encephalomyelitis (EAE) can be induced in mice using the myelin oligodendrocyte glycoprotein (MOG) peptide. Previously we showed that TCDD inhibited MOG-specific IgG and decreased disease at 18 days. IgG antibodies in EAE can be pathogenic by recruiting cytolytic cells to destroy MOG-expressing cells in the myelin. The purpose of this study is to use an in vitro model of IgG production to further investigate the mechanism behind TCDD's known immune suppression. We hypothesize that TCDD would inhibit IgG1 and IgG3 subclasses. LPS and LPS plus IL-4 were used to stimulate IgG1 and IgG3, respectively. ELISA analyses showed that TCDD inhibited total IgG in mouse splenocytes or purified B cells stimulated with LPS or LPS plus IL-4 for 4 days. Flow cytometry analyses showed TCDD predominantly inhibited IgG1, but had no significant change in IgG3. These results were similar for CD19+ or B220+ cells. These results establish an in vitro model in which IgG1 is inhibited by TCDD, which would allow us to investigate mechanisms in a more time-effective manner than the EAE model requires. (Support: NIH R15 027650)

089

Name: Nichols, Luke

Major: Biological Engineering

Faculty Advisor, Affiliation: Dr. Lauren B. Priddy, Department of Agricultural and Biological Engineering; Dr. Steven H. Elder, Department of Agricultural and Biological Engineering

Project Category: Biological Sciences and Engineering

REU/Research Program: Bagley College of Engineering Undergraduate Research Stipend

Biocompatibility of surface modified Ti6Al4V for dental implants

Titanium is regarded as one of the most biocompatible materials used for orthopedic implants due to its favorable properties such as high strength, low density, and low corrosion. Dental implants are a popular use of titanium due to its high fracture resistance, wettability, and osseointegration (being able to bind well with the tooth). Specifically, the most commonly used titanium alloy is Ti-6Al-4V (Ti64), which contains ~90% titanium, ~6% aluminum, and ~4% vanadium. BioHorizons®, a dental implant company that utilizes Ti64 for their osseointegrated dental implants, modifies the surface of the implants through a technique known as Laser-Lok®, which uses a laser to create precise, organized cell-sized channels on the surface. The technique produces an area of adjacent long channels that allow for both high bone cell attachment and soft tissue attachment. In this study, the biological properties of the Laser-Lok® modified Ti64 surface were compared with machined (flat) Ti64 and tissue culture plastic (TCP) controls through cell attachment, proliferation, and differentiation assays. Our hypothesis was that the Laser-Lok® surface would promote enhanced cell proliferation and differentiation. Tests were conducted with pre-osteoblast MC3T3-E1 cells to evaluate the *in vitro* osseointegrative properties of both surface types, using CCK-8 assays to analyze cell attachment and proliferation and an In Vitro Osteogenesis Assay Kit to observe the differentiation of the cells. Overall, the Laser-Lok® surface resulted in higher cell proliferation compared to machined surfaces, but no differences in differentiation were observed. The cells seeded on the LaserLok® surface were also more highly aligned than cells on both the machined Ti64 and the TCP, due to the aligned cell-sized channels on the LaserLok® surface. The results of this study will further the understanding of how Laser-Lok®, along with other surface modification techniques, affect the biological properties of metal implants and devices.

019

Name: Nickels, Hailey

Major: Art/Fine Arts

Faculty Advisor, Affiliation: Dominic Lippillo, College of Art, Architecture, and Design

Project Category: Arts and Humanities (Poster)

Using Abstracted Organic Forms to Personify the Effects of Domestic Violence Between Partners

Photographers have the ability to dive deep into the emotions of others and tell a narrative, good or bad. Photography that is centered around difficult subject matter, such as domestic violence, tends to involve people to tell this narrative. Logically people help but they are not required. This thesis project is about showing the effects that are left on victims of domestic abuse, specifically between romantic partners, in an abstracted manner. In order to convey this thought I have chosen to use three items in my photographs; a variety of plant life, fire, and water. These forms highlight this concept well in the fact that plant life, while resilient, is fragile. Fire and water convey the idea of a damaging force and lack of control in a way that many tend not to consider. In my visual research there are a few damaging trends I wish to depict. Typically, before the physical abuse sets in there is mental abuse, emotional abuse, gaslighting, and several other mental factors that are to be taken into consideration. Physical abuse tends to set in later on in the relationship; sometimes it is blatantly obvious and other times it is not. Overall, I wish to use this project as a chance to make a complicated subject easier to discuss as well as easier for the public to digest.

217

Name: Norton, Breana

Major: Kinesiology

Faculty Advisor, Affiliation: Dr. Dallas Breen, Political Science and Public Administration

Project Category: Social Sciences

Title IX and NIL: Predicting the Effects of Player Compensation

Title IX's purpose in 1972 was to bar discrimination on the basis of sex in educational programs or activities that receive federal funding. This statute still attempts to bridge the gap in the inequality and inequity of gender, especially in the sphere of collegiate athletics. While the gap has decreased since 1972, Title IX issues are still prevalent in NCAA institutions today. The NCAA has begun discussions on allowing student-athletes to benefit off their name, image, and likeness. Student-athletes could soon be able to market themselves for advertisements and merchandise, or to profit off individual winnings or salaries. Should this become legal, the gap Title IX is attempting to close would widen further. This research uses data from the United States Department of Education that gives the gender participation for each sport in four different NCAA conferences and divisions from 2003-2017. This data will be used to compare the number of male student-athletes to female student-athletes to evaluate if Title IX is effective in narrowing the gap. Also, the revenue from advertisement for professional athletes will be examined to see if there is a difference in pay for similar advertisements between male and female professional athletes. Based on the data, most schools do not have relative equal number of male student-athletes to female student-athletes; therefore, Title IX is not effectively doing the job it was put into place for. The payment for male professional athletes is much higher than female professional athletes based on the data. This pattern suggests the same may be true of payment for likeness at the collegiate level. Scholarships in the legislative budgets for universities may also be impacted. This research will examine the levels of which the NIL may negatively affect female's participation in sport, as well as economic opportunities for female student-athletes.

090

Name: Nuss, Andrew

Major: Agronomy

Faculty Advisor, Affiliation: Dr. Te-Ming Paul Tseng, Plant Soil Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): IS Werle, SL Meyers, T Tseng

REU/Research Program: Undergraduate Research Scholars Program (URSP)

Evaluating Weed Suppressive Sweet Potato Cultivars and Cover Crops for Weed Management in Sweet Potato

Studies were conducted in a field production system in Pontotoc, MS, 2019, to determine the effect of spring and fall cover crops on weed density and yield of three sweet potato cultivars. The fall cover crop treatments were a combination of four species: rye (*Secale cereal*) + clover (*Trifolium spp.*); rye + vetch (*Vicia spp.*); rye + radish (*Raphanus raphanistrum*) + vetch, and a weedy fallow treatment. In the spring and summer, fields were plowed with a monoculture of buckwheat (*Fagopyrum esculentum*) or weedy fallow treatments. Three sweet potato cultivars were used: Beauregard, Heart-O-Gold, and 529, and each plot was broadcasted with a mixture of three weed species: yellow nutsedge, large crabgrass, and Palmer amaranth. Data collected included weed counts (% plants per plot, by weed species), and total storage root yield was recorded at harvesting. Weeds were entirely suppressed in the presence of buckwheat as a cover crop in all treatment plots. Analysis of the fall cover crops varied across smallflower morningglory and palmer amaranth coverage. The cultivars Heart-O-Gold, 529, and Beauregard affected the coverage of carpetweed and large crabgrass. These cultivars, however, did not influence the yellow nutsedge, Palmer amaranth, and smallflower morningglory coverage.

218

Name: Park, Bohyun

Major: Psychology

Faculty Advisor, Affiliation: E. Samuel Winer, Psychology

Project Category: Social Sciences

Co-Author(s): Alisson N. S. Lass, Brooke Berry

A Cross-Cultural Examination of the Effects of Self-Discrepancy on Symptoms of Depression

Although striving for one's aspiration improves an individual's quality of life, a large discrepancy between one's real and ideal self-concept can lead to depression. Although the association between self-discrepancy and depression across culturally diverse racial groups is unclear, one relevant study found that, unlike White Americans, African Americans adopted self-protective strategies about mainstream standard of beauty by disregarding them (Evans & McConnell, 2003). Another study found that, White Americans tended to be more negatively impacted by goal striving stress than African Americans (Neighbors et al., 2011).

Building off of findings from these studies, current study recruited 173 White American and 173 African American college students to examine the relationship between actual/ideal self-discrepancy and depressive symptoms by administering Integrated Self-Discrepancy Index Measure (ISDI) and Quick Inventory of Depression Symptomatology (QIDS) (Mason et al., 2019). Researchers predicted smaller association between self-discrepancy and depression among African Americans than White Americans.

Simple moderation that examined the relationship between self-discrepancy and depression, with race as the moderator revealed association between Self-discrepancy and depression, but not with race. Despite the insignificant interaction, the association between self-discrepancy and depression at each level of race was probed. White Americans and African Americans both displayed positive associations between self-discrepancy and depressive symptoms, with the between group difference yielding a small effect size in the predicted direction. It is consistent with previous findings that the relationship between negative mental health and goal striving is more strongly associated among White Americans than African Americans.

The measurement of actual/ideal self-discrepancy limited the conceptualization of the values held by each participant in comparison to societal ideals. Future work will examine this effect with a larger sample to see if the relationship between self-discrepancy and depression differs among African Americans and White Americans.

020

Name: Parker, Allyson

Major: Art/Fine Arts

Faculty Advisor, Affiliation: Dominic Lippillo, Art

Project Category: Arts and Humanities (Poster)

Loneliness in Public Spaces

Through manipulation of found photographic images, I will demonstrate how common it is to feel lonely while in public spaces and while being surrounded by others. Feeling lonely in public is not spoken about often but it is very common. It is not limited to a particular age group or group of people. Research has shown that people are much lonelier now than in previous years. A study done by Cigna results showed that nearly half of Americans (46%) report that they have felt alone sometime or always. This feeling is something that I have chosen to create art about because it is a topic that I can personally relate to. I have chosen to work with found family photographs to show how personal and common it is. Through my research I have found that the reasons why people feel lonely in public are different depending on that person. By manipulating found photographs, I will depict how loneliness in public differs from one person to the next. Using various techniques, I will remove a person or several people from the photographs to show them as feeling lonely. I want viewers to walk away from my work being aware of just how common public loneliness is and see how it may vary from person to person.

091

Name: Parker, Erin

Major: Computer Engineering

Faculty Advisor, Affiliation: John Ball, Electrical and Computer Engineering

Project Category: Biological Sciences and Engineering

Placement and Mounting of Elastomeric Sensors on the Ankle for Gait Data Collection

Gait refers to the study of human locomotion, the way we move in order to walk. Gait is an important for many areas of study, but our research focuses on gait for athletics, including improving performance, preventing injury, and injury recovery. Currently, gait analysis includes bringing participants into a lab with a Motion Capture system. Motion Capture is expensive, and laboratories limit the movements that can be studied due to limited space within the area, so it is desirable to have a product that can be used anywhere an athlete may be training. Our purpose is to test the reliability and plausibility of Elastomeric Sensors in gaining gait cycle data. Our current sensors are fitted with metal eyes, and hook onto our compression sock fitted with metal hooks. This allows the sensors to be removed after testing which is a necessity of our research, due to continual testing and limited supplies. The sock we are using is a standard compression sock outfitted with reinforcements behind the hooks to provide stability of the prototype. Throughout testing we have found that the sensors need to start in an already stretched position so that little changes in movement can be detected. We are also seeing the need for an expanded size range, and a possible need for different sensor configurations based on the gait of the individual. Our goal is to create a product that is comfortable for an athlete to wear, easy to use and at a comfortable price for an athletics program. Current research requires testing with Elastomeric sensors and verification by Motion Capture in order to revise and create new prototypes. This research will lead to advancements in athletic training based on each athlete, and also has applications stemming into fall prevention and injury recovery.

219

Name: Parker, Lauren

Major: Human Sciences/Food Nutrition & Dietetics

Faculty Advisor, Affiliation: Rahel Mathews, PhD, MPH, RDN, Food Science, Nutrition, and Health Promotion

Project Category: Social Sciences

Co-Author(s): Brad Brazzeal

Other Competition(s): Public Health Research Competition

Assessing the effects of universal school meals through the Community Eligibility Provision: A systematic review

Food insecurity is a major problem in the United States and is estimated to affect 18% of children. In 2010, the Healthy, Hunger-Free Kids Act (HHFKA) was enacted to address childhood food insecurity and to improve the nutrition and health status of children. The Community Eligibility Provision (CEP) in the HHFKA allows schools to provide universal meal service to the entirety of their student populations through the National School Lunch Program and School Breakfast Program. To qualify, schools must have an identified student population eligible for free meals equal to 40% or greater. The purpose of this study was to assess the utilization of CEP and its impacts. In November 2019, a systematic review was conducted according to PRISMA guidelines using nine databases. A total of 697 articles were retrieved, and 11 were included in our final review. Five were dissertations or theses, and six were peer-reviewed articles. Meal participation was the most common focus among studies, and higher rates were documented in schools that utilize CEP. Across studies, CEP implementation is low among eligible schools; however, only one study addressed the potential administrative benefits and barriers of implementation. Other factors that were addressed in studies include attendance, test scores, college enrollment, and suspension rates, but conclusions could not be drawn due to limited data. Since CEP was not available nationwide until the 2014-2015 school year, peer-reviewed studies on CEP implementation are lacking, and more are needed to evaluate the efficacy of this policy and its effects on student outcomes.

165

Name: Patterson, McKenna

Major: Mechanical Engineering

Faculty Advisor, Affiliation: Dr. HeeJin Cho, Mechanical Engineering

Project Category: Physical Sciences and Engineering

Co-Author(s): Gentry Berry, Charles Waggoner

REU/Research Program: Institute for Clean Energy Technology

Proposed Analytical Methods for Determining Filter Media Properties

High Efficiency Particulate Air (HEPA) filters, commonly used in nuclear filtration applications, are an integral part of the waste management processes in nuclear plants. HEPA filters are 99.97% efficient filtration devices characterized by their high resistance to air flow, or pressure drop. From theoretical models, the initial pressure drop across a clean filter is proven to be a function of the filter media fiber diameters and porosity of the media. These filter properties are relatively difficult to obtain with traditional manual methods; therefore, there is a need to develop analytical methods to find the fiber diameter and porosity to determine the pressure drop. Typically, these values can be found by substituting a calculated representative value based upon measured values, such as equivalent fiber diameter based upon a clean pressure drop. However, these values may also be directly recorded and measured by incorporating Scanning Electron Microscope (SEM) image analysis and other measurement methods to analyze the filter media and determine its physical properties without the need for media testing. DiameterJ, an open source Java plugin, used with ImageJ, can process images of filter media taken by an SEM to find statistical data such as mean fiber diameter and porosity. To produce the raw data, SEM images of two filter media type samples are taken and segmented in DiameterJ using the traditional and statistical region merging segmentation algorithms. Manual segmentation is necessary after the initial segmentation by the algorithms as the images tend to be too complex for the algorithms to output with the necessary accuracy. However, complications exist in the manual segmentation process as these methods can be time intensive and prone to the individual bias of the user. This in turn can skew the final mean fiber diameter result, and lead to either an over or under prediction of the pressure drop. It was also discovered that the porosity data produced by DiameterJ is inaccurate, as the SEM analyzes the three-dimensional filter media by projecting its geometry onto a plane and analyzing it as a two-dimensional binary image. Thus, the porosity is artificially inflated through the segmentation process, rendering this result incorrect. Alternatively, density determination, gravimetric analysis, and thickness testing of the filter media is collectively used to determine the filter fiber porosity. Together, the SEM image analysis and analytical lab methods produce results through direct measurements which allow for the prediction of the initial pressure drop from clean filter media without the need for prior media testing to collect pressure data. By improving upon this proposed analytical method in the future, there is potential to streamline the process of finding these filter properties into a more direct methodology for determining the pressure drop across HEPA filters.

220

Name: Penniman, George

Major: Psychology

Faculty Advisor, Affiliation: Dr. Sinclair, Psychology

Project Category: Social Sciences

Co-Author(s): Jessica Weiss Utley

REU/Research Program: Social Relations Lab

Other Competition(s): Public Health Research Competition

Partners in Crime: Comparing Dyadic vs. Individual Prosocial and Antisocial Responses to a Cyberball Paradigm

Studies examining effects of rejection on behavior often limit participant behavioral responses to aggression, thus neglecting other behavioral responses (e.g., prosocial, asocial). We used a modified version of the Cyberball paradigm wherein participants (n = 215, both high school and college students) were told it was a part of a larger game of "Survivor." After the initial inclusion or exclusion experience with their "teammates" they were given 9 tasks in random order to rank as far as what they wanted to do for the next round. Options included "challenges" that helped all, only helped the self, hurt teammates, or hurt the self. Regardless of inclusion or exclusion condition, participants chose prosocial or "play by myself"

options first. Options to harm others (e.g., subjecting them to “pain endurance tasks”) were ranked 5th through 7th. However choices did vary depending on whether the participant played cyberball alone or with a randomly assigned partner. Those with a partner chose aggression against everyone else over cooperating. Results point to potential operational limitations in rejection- aggression research, but supports peer deviance theories.

Abbreviated Abstract

We diversified behavioral responses options for a Cyberball paradigm, expanding to include more than just aggressive options. High school and college students then participated pairs or alone. Inclusion or exclusion did not significantly affect ranking of behavioral responses. Most chose to be prosocial. When in pairs, though, the presence of a peer enhanced aggressive responding.

221

Name: Persell, Anna

Major: Human Sciences/Food Nutrition & Dietetics

Faculty Advisor, Affiliation: Terezie Tolar-Peterson, EdD, MS, RDN, LD, FAND, Food Science, Nutrition, and Health Promotion

Project Category: Social Sciences

Co-Author(s): Nicole Reeder

REU/Research Program: Undergraduate Research Scholar

Other Competition(s): Public Health Research Competition

Prevalence and Consequences associated with Food Insecurity among Students at Mississippi State University

Food insecurity is defined by the USDA as a “household-level economic and social condition of limited or uncertain access to adequate food.” In the state of Mississippi, the rate of food insecurity is well above the national average, with 19.2% of residents experiencing food insecurity in 2017, according to a study conducted by Feeding America. The purpose of this study was to evaluate the prevalence and consequences associated with food insecurity among students at Mississippi State University. Participants (n=202) completed the National Cancer Institute’s Diet History Questionnaire and the USDA’s Six-item Short Form Food Security Survey Module. Results indicated that 66.98% of students had high or marginal food security, 20.09% had low food security, and 12.92% had very low food security. 37.56% of students reported they sometimes or often ran out of food and didn’t have money to get more. There was a significant difference in food security scores between Caucasian and African American students ($p < 0.004$), with African American students having a greater degree of food insecurity than Caucasian students (scores of 2.44 ± 2.34 vs. 1.24 ± 1.76 , respectively). Regarding dietary intake, the food secure group consumed significantly more calcium ($p=0.018$) and fatty fish/seafood ($p=0.021$) than the food insecure group. Mean calcium intake for the food secure group was $1,090.1 \pm 870.72$ mg and 781.69 ± 403.29 mg for the food insecure group. Mean intake for high omega-3 fish/seafood was 0.16 ± 0.31 ounces/day for the food secure group and 0.08 ± 0.13 ounces/day for the food insecure group. This indicates that the food insecure group is not meeting the Recommended Dietary Allowance for calcium, and that the food insecure group falls further behind the food secure group in consuming the recommended ounces of fatty fish/seafood per week. These findings support the need for continued efforts to ensure that food insecure students have access to well-balanced meals.

092

Name: Pham, Amy

Major: Human Sciences/Food Nutrition & Dietetics

Faculty Advisor, Affiliation: Dr. Matthew Donahue, Department of Chemistry and Biochemistry

Project Category: Biological Sciences and Engineering

Co-Author(s): Nicholas G. Jentsch, Jared Hume, Jian Sun, Julie Pigza, Jacques Kessl

Other Competition(s): Public Health Research Competition, Thesis Research Competition (TRC)

Development of Synthesis Strategies of Quinoline for Inhibition of HIV-Integrase

According to the World Health Organization, approximately 40 million people worldwide are infected with Human Immunodeficiency Virus (HIV). While there is no cure for HIV, Highly Active Antiretroviral Therapy (HAART) is currently the only method of treatment that manages the infection giving the patient an improved quality of life and a longer lifespan. As viral resistance increases existing medications lose efficacy therefore there is a continual need for the development of new prescription drugs. Currently, the lab is investigating chemical synthesis strategies of novel quinolines to be tested against the HIV-integrase enzyme. Starting from commercially available substituted anthranilic acids, the researchers have prepared a series of multi-substituted quinolines over a nine steps linear synthesis. These compounds have been assayed for inhibition against HIV integrase and multimerization in Professor Jacques Kessl's laboratory.

166

Name: Pham, Michael

Major: Biochemistry

Faculty Advisor, Affiliation: Todd E. Mlsna, Chemistry

Project Category: Physical Sciences and Engineering

Co-Author(s): Chanaka M. Navarathna, Prashan M. Rodrigo, Charles U. Pittman Jr., Todd E. Mlsna

Removal of per/polyfluoro alkyl (PFAS) substances from water using engineered Douglas fir biochar and solvated electron reductive defluorination

PFAS are a group of manmade surfactant chemicals with zwitter-ionic, excellent chemical and thermal stable properties used in the US and globally for non-stick, stain resistant coatings, firefighting foams, microwaveable food packaging, cosmetics, electronics, waterproof clothing etc. The most common PFASs are the perfluorinated carboxylic acids (PFCAs) and perfluorocarbonsulfonic acids (PFSAs). Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) are the most well-known. These compounds are highly persistent because of their stable C-F backbones and high fat solubility. At levels exceeding 70 ng/L (EPA) in drinking waters, they cause deleterious health effects to humans. PFAS analysis and remediation is challenging and tedious because of their low advisory limits. Efforts to remediate to these levels have been met with mixed success. PFOS and PFOA sorption onto the biochar and its magnetic variants were studied along with a developed rapid, robust and quantitative LC-MS² technique. The starting biochar is a waste product of syn-gas from Douglas fir wood produced at 900-1000 °C from wet feed in 1-20 seconds in large-scale which generates a high surface area (>700 m²/g) large pore volume (~0.25 cm³/g). This biochar and its magnetic analogue adsorbed PFOS (~44.9-96.9 %) and PFOA (~99.9 %) from water at 1000 ppb level at pH ~6. Mainly, the hydrophobic and electrostatic interactions are thought to drive the sorption. Varying the % wt oxygen on biochar pore surfaces by thermal tailoring and optimizing sorption conditions will likely lead to improved performance in order to reach low federal and state limits. This makes this high temperature pyrolysis Douglas fir biochar or its variants as potential candidates for PFAS remediation. Further, the safe disposal of PFAS from PFAS-loaded adsorbents was demonstrated using solvated electron defluorination.

Keywords: PFAS, biochar, adsorption, solvated electron, defluorination

006

Name: Phillips, Hannah

Major: English

Faculty Advisor, Affiliation: Kelly Marsh, English

Project Category: Arts and Humanities (Oral Presentation)

The New *Künstlerroman* by Women Immigrant Writers

This paper responds to the changes within the genre of the *künstlerroman* by women writers as contemporary literature depicts female protagonists who are both artists and immigrants to the United States. The paper analyzes Julia Alvarez' works *How the García Girls Lost Their Accents* and *¡Yo!* in conjunction with Chimamanda Ngozi Adichie's *Americanah*. This paper contends that, while the Alvarez novels and the Adichie novel were not written in the same decade nor about immigrants from the same country, they nonetheless are examples of how the tradition of the *künstlerroman* by women writers has changed in light of globalization and modern immigration. Rachel Bau DuPlessis published a paper in 1985 that traces the motif of women artists in bourgeois literature from the nineteenth century into the mid-twentieth century. William Boelhower published "The Immigrant Novel as Genre" in 1981 in which he defines the genre of immigrant literature and reveals the verisimilitude of the work. Nevertheless, these works exceed what DuPlessis and Boelhower could have intended in the 1980s. This paper analyzes what happens at the intersection of the immigrant novel and the *künstlerroman* by women writers. DuPlessis discusses texts in which the female artist is responsible for representing herself and is inevitably creative in the private sphere, but the characters of Yolanda and Ifemelu, as immigrant woman artists, are responsible for representing themselves and their people group. Additionally, since the 1980s, the global bourgeoisie has become more culturally diverse and a transnational middle class has been established. Globalization, technology, and equality movements have given women and minorities a voice. Therefore, this paper argues that the middle-class female artist as protagonist in popular literature is allowed to represent themselves and their people in the public realm regardless of gender or ethnicity.

167

Name: Polderman, Tyler

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Adrian Sescu, Aerospace Engineering

Project Category: Physical Sciences and Engineering

Co-Author(s): Dr. David Thompson

Aerodynamic Analysis of Wingtip Vortices

For years, many advancements of technology have been inspired by nature. Since the airplane was invented, people have been studying birds to develop new flight advancements. Now that planes have been around for over a hundred years, a leading design point for many aircraft is increased efficiency, especially in commercial aviation. This experiment will attempt to capture the same flight efficiency that migratory birds achieve in formation flight. For aircraft, this improved efficiency is attained by optimally positioning the trailing aircraft in the wake of the leading aircraft. If done properly, the trailing aircraft will experience an increase in its lift to drag ratio. As a result, the aircraft will also see an increase in fuel efficiency, where just one aircraft could save millions of dollars in fuel costs per year. However, there are other variables to consider when determining the viability of formation flight. Particularly in commercial flight, passenger safety and comfort are very important factors. To perform these analyses, a program called XFLR5 was utilized. This program uses vortex-lattice and 3D panel methods to analyze the aerodynamic performance of wings and planes. The longitudinal, vertical, and lateral positioning of the leading body(s) were adjusted and analyzed to determine which position(s) presented the best performance results for formation flight.

093

Name: Pray, Hannah

Major: Biological Sciences/Biological Sciences

Faculty Advisor, Affiliation: Dr. Attila Karsi, Basic Sciences Department at MSU-CVM

Project Category: Biological Sciences and Engineering

Macrophage-mediated immune responses against ESC in channel catfish

Edwardsiella ictaluri is a Gram-negative intracellular fish pathogen that causes enteric septicemia of catfish (ESC), a disease that results in substantial economic loss in the catfish farming industry annually. Macrophages play an important role in immune responses to bacterial infections by sensing the presence of pathogens in tissues, initiating and regulating innate immune mechanisms, engulfing and killing pathogens, and stimulating adaptive immune responses. Recently, our research group developed two *E. ictaluri* live attenuated vaccine (LAV) strains that provide effective protection in catfish fry and fingerlings *in vitro*. However, the effects of these LAVs on phagocytosis, bacterial killing, and apoptotic changes in catfish anterior kidney (AK) macrophages are still unexplored. In this study, we assessed the effect of *E. ictaluri* wild type (WT) and two LAVs on antigen uptake, bactericidal activity, and early as well as late apoptotic changes in catfish AK macrophages. First, we determined the uptake of *E. ictaluri* WT and two LAVs by catfish AK macrophages through flow cytometry and light microscopy. We documented that phagocytosis of the two LAV strains was significantly higher than the WT counterpart. Then, we demonstrated that catfish AK macrophages were capable of killing the phagocytized *E. ictaluri* WT and two LAVs efficiently. Finally, we assessed the early and late apoptotic changes in catfish AK macrophages exposed to *E. ictaluri* WT and LAV strains. In conclusion, our results suggest that increased phagocytic and killing capabilities in catfish AK macrophages of the two LAV strains provide advantages in both innate and adaptive immune responses, indicating the importance of macrophage-mediated immune responses against ESC in catfish.

094

Name: Provine, Katelyn

Major: Microbiology

Faculty Advisor, Affiliation: Dr. Mark Welch, Biological Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Anna Jackson, Mallory McKinney

Nasty Neighbors: DNA Barcoding Mosquito Blood Meals to Determine the Epidemiological Threat of the Invasive Green Iguana (*Iguana iguana*) to Two Endemic Iguana Species in the Cayman Islands

The Cayman Islands host three iguana species: the endangered Grand Cayman Blue Iguana, *Cyclura lewisi*, the endangered Sister Isles Rock Iguana, *Cyclura nubila caymanensis*, and the invasive Green Iguana, *Iguana iguana*. Invasive species pose clear threats to their endangered relatives. These threats include competition, as well as hybridization that can ultimately lead to the replacement of native species via genetic swamping. However, the epidemiological threat of invasive species often remains overlooked. DNA analysis of arthropod blood meals to identify vertebrate hosts may provide insight to vector-host relationships. Our working hypothesis is that mosquitoes facilitate disease transmission between invasive and native iguana species; therefore, we predict that mosquito blood meals from Grand Cayman will contain the DNA of both species. To test our hypothesis, we have successfully performed DNA extraction on mosquito blood meals provided by the Mosquito Research and Control Unit (MRCU) of Grand Cayman and compared DNA sequences following standard polymerase chain reaction (PCR) and gel electrophoresis of the vertebrate *cytochrome oxidase I* (COI). DNA sequences, forward and reverse, were aligned using Sequencher, and contigs were compared to other COI genes available on the NCBI Basic Local Alignment Search Tool (BLAST). The presence of COI genes reliably identified as *Iguana iguana* and *Cyclura lewisi* within the blood meals illustrates that mosquitoes are in fact feeding on both Blue and Green Iguanas. Samples containing iguana DNA also underwent PCR to detect the presence of *Helicobacter pylori*, a pathogen that has recently caused septicemia and consequent mortality among Blue Iguanas in the captive population. The study will aid in assessing the epidemiological threat that the Green Iguana poses to its endangered relatives.

222

Name: Reed, Delaney

Major: Psychology

Faculty Advisor, Affiliation: Hilary DeShong, Psychology

Project Category: Social Sciences

Co-Author(s): Courtney K Mason

Other Competition(s): Public Health Research Competition, Thesis Research Competition (TRC)

Mindfulness tempers the relationship between conscientiousness and BPD symptoms

Research has demonstrated that borderline personality disorder (BPD) is associated with low conscientiousness, openness, extraversion, agreeableness and with high neuroticism (Clarkin et al., 1993). Additionally, BPD symptoms are correlated with low levels of mindfulness (Wupperman et al., 2009). In line with this, previous research has found a strong positive relation between mindfulness and conscientiousness (Giluk, 2009). While there has been research of trait mindfulness moderating the influence of neuroticism and extraversion on suicidal ideation (Tucker et al., 2014), research has yet to assess how mindfulness may be influencing the link between personality traits such as conscientiousness and BPD. The purpose of this study is to examine the link between conscientiousness, mindfulness, and BPD symptoms. It was hypothesized that the association between conscientiousness and BPD would be weakened by high levels of mindfulness. Participants completed the following self-report measures: the Personality Assessment Inventory (PAI; Morey, 1991), the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006), and the IPIP NEO 120 (IPIP-NEO 120; Maples et al., 2014). The sample ($N=52$) had an average age of 19.35 ($SD=1.40$) with 71.20% female and 67.30% Caucasian/European White. Using PROCESS in SPSS (Hayes, 2014), our results indicated conscientiousness significantly predicted BPD symptoms, $\beta = -.267$, $t(52) = -2.64$, $p = .011$. When mindfulness was included in the model, the interaction between conscientiousness and BPD symptoms was insignificant, $\beta = .006$, $t(52) = 1.32$, $p = .195$. The results demonstrated that at high levels of mindfulness, the interaction between conscientiousness and BPD was weakened, while at low levels of mindfulness, the relation was strengthened. This study demonstrated how different levels of mindfulness and personality traits could be predictive of BPD symptoms.

095

Name: Reese, Austin

Major: Forestry/Environmental Conservation

Faculty Advisor, Affiliation: Dr. Joshua J Granger, FWRC-Forestry; Dr. Sandra Correa, FWRC-Wildlife, Fisheries & Aquaculture

Project Category: Biological Sciences and Engineering

Co-Author(s): Clayton Hale

Plant diversity along a successional gradient on the Pascagoula River

The Pascagoula River of Southern Mississippi is the largest hydrologically unaltered river systems in North America. It stretches over 130 km and is home to diverse plant and animal communities. Allowing hydrological processes to naturally persist has enabled all stages of succession to exist along the river. Successional dynamics on the Pascagoula are driven by the erosion of the outside of river bends and the sediment deposition on the inside of the river bends. Erosion cuts into the riverbank disturbing older forest communities while sediment deposition allows for early successional floodplain communities. The fully intact of the hydrological system of the Pascagoula allows researchersto study the effects of the natural flooding cycles, riverbank erosion, and sediment deposition on the succession of floodplain plant communities. This study presents plant diversity along a successional gradient on the PascagoulaRiver. Documenting the current biodiversity within a fully intact hydrological system such as the Pascagoula allows for the monitoring of these systems as they face mounting outside threats such as biological invasion, changes in hydrology, and climate change.

168

Name: Richardson, Ramon

Major: Geosciences/Environmental Geoscience

Faculty Advisor, Affiliation: Varun Paul, Department of Geosciences

Project Category: Physical Sciences and Engineering

Co-Author(s): Jason Barrett

Other Competition(s): Thesis Research Competition (TRC)

Land Usage Correlation to Groundwater Quality

Aquifers are recharged when groundwater infiltrates from the surface and are very susceptible to contamination and pollution. This contamination of the water changes the water quality and properties within aquifers. Land usage has a very important role in the groundwater quality as the surficial water contaminants can percolate into the subsurface affecting the quality of the water. We studied how three different land cover/use (vegetation dominant, urban, agriculture) correlated with groundwater quality. Since different land cover/use have different percolation rates we predicted a statistically significant difference in water quality associated with cover/use types. We evaluated this correlation by collecting well water samples across the state of Mississippi and performing standard quality tests and then compared them to land cover/use models. The parameters that were tested include conductivity, pH, hardness, alkalinity, nitrate, phosphate, and sulfate. Some results of the study show that the groundwater in the agricultural area had a much lower pH (5.79) when compared to the vegetation dominant (7.29) and urban (7.25) systems. Alkalinity, capacity of water to resist changes in pH, was lower for agricultural (80.00 mg/l) compared to vegetation dominant (121.85 mg/l) and urban (94.42 mg/l) this shows a relation to the pH and further solidifies land use effect on groundwater. Having a correlation of water quality with land use brings to light the anthropogenic impact on groundwater quality.

169

Name: Richardson, Sarah

Major: Chemistry

Faculty Advisor, Affiliation: Todd Mlsna, Chemistry

Project Category: Physical Sciences and Engineering

Co-Author(s): Chathuri Gamlath Mohottige, Dr. Richard Baird

Detecting Sweet Potato Soft Tissue Disease Through Analysis of Volatile Organic Compounds

Rhizopus stolonifera, also known as common bread mold, can affect a wide variety of farm plants, including sweet potatoes. *Rhizopus* in sweet potatoes causes a watery rot, called sweet potato soft tissue disease, that produces visible lesions on the potato, as well as making the potato soft to the touch. Mississippi's sweet potato industry brings in over \$123 million annually, but not all of the potatoes grown make it to market since some become infected. Since sweet potatoes are one of Mississippi's biggest markets, it is important to understand why so many sweet potatoes become infected during long-term storing in warehouses. In order to better understand how *Rhizopus* effects infect the sweet potatoes, we used head space solid phase microextraction HS-SPME by using SPME PDMS/CAR fibers to analyze the VOCs (volatile organic compounds) of the sweet potatoes in a warehouse stimulated environment. The VOCs of regular healthy sweet potatoes and sweet potatoes infected inoculated with *Rhizopus stolonifera* were periodically analyzed during the sweet potatoes soft tissue disease progressing. After the fibers collected the VOCs, they were run through GCMS to get a reading. VOC extracted PDMS/CAR fiber was desorbed in an injector of the Agilent GC/MS in order to analyze the volatile and semi volatile compounds released from healthy and infected sweet potatoes. By analyzing the volatile compounds of the infected sweet potatoes, we will be able to find volatile biological markers that indicate the presence of sweet potato soft tissue disease.

096

Name: Richardson, Slater

Major: Kinesiology

Faculty Advisor, Affiliation: Stamatis Agiovlasitis, Kinesiology

Project Category: Biological Sciences and Engineering

Co-Author(s): Caleb McCreary, Poram Choi, Supreete Ghosh

Other Competition(s): Public Health Research Competition

Does Heart Rate Improve Prediction Of Oxygen Uptake From Hip Or Wrist Accelerometer Output In Adults With Down Syndrome?

Heart rate (HR) may improve the prediction of the rate of oxygen uptake (VO_2) from accelerometer output, but this has not been examined in adults with Down syndrome (DS). Addressing this issue may have implications for accelerometer-based measurement of physical activity and sedentary behavior in adults with DS.

The purpose of this study was to examine if HR improves VO_2 prediction from hip- and wrist- accelerometer output in adults with DS.

Sixteen adults with DS (10 men; age 31 ± 15 years) performed 12 tasks including physical activities and sedentary behaviors. VO_2 was measured with a portable metabolic system and accelerometer output (Vector Magnitude [VM]) with a hip- and a wrist-worn accelerometer. We used regression models to predict VO_2 from VM alone and VM and HR together. We evaluated prediction accuracy with the absolute percent error and Bland-Altman plots.

Both hip- and wrist-derived VM significantly predicted VO_2 ($p < 0.001$; $R^2 = 0.74$ and 0.49 for hip and wrist model, respectively). HR significantly contributed to both models ($p < 0.001$; $R^2 = 0.73$ and 0.55 for hip and wrist model, respectively). For hip data, absolute error did not differ significantly between the model with VM alone and the model with VM and HR (24 ± 27 vs. $26 \pm 27\%$; $p = 0.15$). For wrist data, absolute error was higher for the model with VM alone than the model with VM and HR (43 ± 39 vs. $37 \pm 38\%$; $p = 0.017$). Bland-Altman plots indicated zero mean error for all models and limits of agreement were wider for wrist- than hip-models.

Inclusion of HR does not improve prediction of VO_2 from hip accelerometer VM in adults with DS. HR may slightly improve prediction of VO_2 from wrist-accelerometer VM. Hip-accelerometer VM is better than wrist-accelerometer VM at predicting VO_2 in adults with DS.

223

Name: Robertson, Mia

Major: Political Science

Faculty Advisor, Affiliation: Brian Shoup, Political Science

Project Category: Social Sciences

REU/Research Program: ORED Undergraduate Research Program

Meet The New Boss, Same As the Old Boss; Rejuvenating Elite Theory In Our Populist Present

The literature regarding the characterization of American elites has fallen to the wayside in recent years. This is surprising, considering that discussion of political and economic elites infiltrates political discourse at every turn. This is partly a result of the theoretical paucity of elite theories and the felt need among social scientists to privilege institutional and structural explanations. In this project, I seek to cultivate a theoretical framework that can enable social scientists to more fruitfully use elite-based explanations to understand contemporary social science problems, most especially political polarization. At root, I suggest that "elitism," as it is understood by most Americans, is actually a critique of the universality of the rule of law. Elites are, broadly construed, perceived as individuals who are insulated from the consequences of negative actions or choices that "average Americans" would suffer. In this framework, it is possible to capture the widescale mistrust of elites among citizens who perceive a dual-class structure in American political life as well as to illuminate the source of resentments among Americans.

Speculative and exploratory, my research will propose a modern definition of elitism as it is perceived among average Americans. In the future, I will be conducting on-the-ground research studying the ways in which typical Americans perceive elitism and characteristics of who really "rules" America. Such research is essential for the contemporary political moment,

for this area of study is grossly under-researched in modern social science, but it is vital that researchers seek to understand the perception of elitism among the American population. My hypothesis is that this perception of elitism impacts the formulated ideologies of everyday Americans and the ways in which they vote and engage in civic life, necessitating that researchers understand how elitism is perceived in the contemporary moment.

170

Name: Robertson, Preston

Major: Industrial Engineering

Faculty Advisor, Affiliation: Reuben Burch, Industrial and Systems Engineering

Project Category: Physical Sciences and Engineering

Co-Author(s): Coach Collin Crane

Jump Study Analysis

For my research, I assisted Dr. Reuben Burch and Coach Colin Crane with their jump study research of the Mississippi State University (MSU) Men's and Women's Basketball teams. The purpose of this data analysis was to study movement patterns in high-performance athletes to better assess differences in body type, positions played, and lower body symmetry. Critical metrics often identified through jump tests are differences in lower-body symmetry and consistency in jump height and explosiveness (how much power and acceleration can a player output). This data was captured through force plates and the information learned through these jump tests can be applied to current players through their training workouts as well as when scouting new athletes. Per Coach Crane, finding the optimal load for the players during practices relative to upcoming games can maximize both training and recovery throughout the long basketball season. In order to understand potential injury mitigating opportunities, my primary focus is looking into consistency and asymmetry. Consistency in explosive movements is a sign of an elite athlete. Asymmetry studies can be used to predict lower-body injury risk of a student athlete. My job was to assist with data collection while the athletes perform the jump tests and to analyze then report findings from the jump data using the ForceDecks force plate software. Overall, the research that we conducted will allow us to apply movement research to the benefit of the safety of our student athletes.

171

Name: Robertson, Ross

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Dr. Yeqing Wang, Aerospace Engineering; Dr. Jichul Kim, Aerospace Engineering

Project Category: Physical Sciences and Engineering

Human Habitation Sizing Tool for Lunar Applications

Both private and governmental aerospace agencies are directing their efforts to establish lunar and Martian settlements in the coming years. To support these efforts, there has been a large amount of research to gain more understanding of how to design habitats that are suitable for human habitation on these bodies. My research aims to create a habitat sizing tool that can be used by these agencies to aid them in their design efforts. The sizing tool uses both analytical and empirical methods of modeling while also combining established methods with updated methods based on new research. Given inputs such as the expected number of crew members and mission duration, the sizing tool outputs parameters including volume allocation, radiation protection requirements, mass requirements, and power requirements. The results are compiled into an excel document for easy reference, and a conceptual design provided by the sizing tool is validated by launching it as a payload on an STK model to the moon. Using the results from the program, tradeoffs between different missions can be observed to select a design that best fits the mission parameters. With this tool, it will be possible to rapidly design conceptual habitats while also implementing an emphasis on human-centered design practices.

224

Name: Rogers, Anastasia

Major: Biochemistry

Faculty Advisor, Affiliation: Ashli Brown, Biochemistry, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Project Category: Social Sciences

Other Competition(s): Community Engagement Research Track

Teamwork and Team Building Strategies in Healthcare

A team is only as strong as its communication. Communication is a critical part of working as a team, yet it is absent in so many workplaces. Its absence is most strikingly seen in healthcare where it can have grievous repercussions. Healthcare is more prone to this problem because of the hierarchical structure, lack of respect, differing objectives between healthcare workers, and the greatly distributed team of professionals who work with a single patient. Modern healthcare must be made up of an interdisciplinary team to adequately support the medical needs of individual patients. Health cannot be approached from only one specialty, instead all aspects must be considered before a treatment can be determined. Research has shown that implementing teambuilding exercises and communication strategies can greatly reduce the risk of error. This research will highlight the reasons for the lack of communication in healthcare, discuss personal experiences in a variety of healthcare fields, and lastly, discuss solutions that aim to alleviate this disconnect between health professionals. If the techniques discussed are effectively implemented then the interdisciplinary team will learn to decrease tension, miscommunication, and disrespect in the workplace. As a result, medical errors will decrease, efficiency will increase, and the quality of patient care will continue to increase as communication is improved.

097

Name: Rogers, Thomas

Major: Wildlife & Fisheries Science/Aquaculture & Fisheries Science

Faculty Advisor, Affiliation: Scott Rush, Wildlife, Fisheries, and Aquaculture

Project Category: Biological Sciences and Engineering

Co-Author(s): Caleb Aldridge, Taylor Banks

Improving Early Detection Surveys for a Non-native Gecko, *Hemidactylus turcicus*

Hemidactylus turcicus (Reptilia: Gekkonidae; Mediterranean Gecko) is a small, nocturnal lizard native to the Mediterranean Basin and Western Asia, found almost exclusively on buildings. It was discovered in Key West, Florida in the early 20th century and has since spread throughout the Southeast. Evidence suggests the Mediterranean Gecko may outcompete native treefrogs (Hylidae) and a lizard, the Green Anole (*Anolis carolinensis*), for habitat and food. Therefore, a rapid survey methodology is necessary to track and manage the invasion of Mediterranean Gecko. From 24 September to 4 October 2019 we conducted six visual encounter surveys at 20 sites in downtown Starkville, measuring: presence or absence of Mediterranean Gecko; site covariates (e.g., presence of awning/overhang); and survey covariates (viz., light intensity, search effort, minutes after sunset, air temperature, and pedestrian traffic). We estimated detection probability using site-occupancy models and used AIC values to evaluate covariates most influential to detection. The naïve detection probability Mediterranean Gecko in downtown Starkville is 77.5%. The detection probability was improved to 98.2% when surveys were conducted 90 min or more after sunset in locations free of pedestrians and with awnings/overhangs. Our study implies that survey efficiency can be improved by simply accounting for easy to-measure site and survey covariates. We plan to use our results to prototype an early detection survey protocol and apply it to the nearby cities of Columbus and West Point. The objectives of this protocol are to minimize time spent searching in new locations and maximize the number of new locations (i.e., area of coverage), therefore increasing the chances of early detection.

172

Name: Rohling, Britain

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Dr. Rani Sullivan, Aerospace Engineering

Project Category: Physical Sciences and Engineering

Development of a Combined Loading Fixture

Pressurization of an aircraft causes a complex stress state on its primary load-bearing structural members. T-joints are structural members that are often used to join adjacent parts of an aircraft structure. The primary objective of this research study is to create a test fixture that can apply both tensile and flexural loads simultaneously. The t-joint was designed using Solidworks and fabricated from steel. A finite element analysis of the T-joint confirmed that a load applied at an angle produces a combined load state. An aluminum T-joint will be tested in the High Performance Advanced Composite Materials Laboratory. Test results will be compared to the finite element analysis results and further testing will be performed on composite T-joints using the combined loading fixture.

098

Name: Rourke, Anna

Major: Biological Engineering

Faculty Advisor, Affiliation: Lauren B. Priddy, Agricultural and Biological Engineering

Project Category: Biological Sciences and Engineering

Co-Author(s): Victoria Scites-Renner, Amol Janorkar, Alicia K. Olivier

A Doxycycline-Loaded Composite Hydrogel for Treatment of Osteomyelitis in a Rat Model

Osteomyelitis is infection of bone characterized by osteolysis and its difficulty to treat with current antibiotics and delivery methods. In this study, a rat osteomyelitis model was used to investigate the efficacy of a collagen- elastin-like polypeptide (ELP) composite hydrogel containing doxycycline and bone morphogenetic protein-2 (BMP-2). Our hypothesis was that hydrogels with doxycycline would lessen the bacterial load in bone and soft tissue.

Collagen-ELP composite hydrogels containing BMP-2 with or without doxycycline (+/-Dox) were prepared in a dual-tube mixing method. *In vitro* analyses were performed to measure the antibacterial efficacy of doxycycline at 24 hours and the release of the drug from the biomaterial over 7 days. *In vivo*, Sprague-Dawley rats were infected using a bacteria-soaked screw implanted bicortically in the mid-diaphysis of the femur. After 1 week, the screw was removed, and the hydrogel (+/-Dox, n=4-5) was injected. Animals underwent longitudinal fluorescent and radiographic imaging (IVIS Lumina XRMS II) on days 1, 3, 7, 14, 21, and 28, postoperatively. At day 28, bone and soft tissue samples were collected to obtain bacterial counts (n=3-4) or for histology (n=1).

From the *in vitro* work, *S. aureus* was susceptible to doxycycline at high concentrations and the composite hydrogels released sufficient doxycycline to combat the bacteria. Doxycycline had a small, although not significant, effect on bone and soft tissue infection *in vivo*. This chronic osteomyelitis model was further validated through IVIS imaging demonstrating localized infection persisting through 4 weeks. Future *in vitro* work includes evaluation of antimicrobial effects of doxycycline released from hydrogels over 3 days. This work also serves as a platform for future *in vivo* studies including dosing studies and a combination bone healing and infection treatment model. Support for this work was provided by USDA-ARS Biophotonics Initiative (58-6402-3- 018), NIH grant P20GM103646-07, and the Intramural Research Support Program at the University of Mississippi Medical Center.

225

Name: Rush, Sommer

Major: Social Work

Faculty Advisor, Affiliation: Dr. Anglea Savage, Arts & Sciences-SW Meridian Campus

Project Category: Social Sciences

School Related Bullying

A countless number of children all over the world have been involved in some form of bullying. Based on statistics, bullying is a problem globally, within the United States, in Mississippi, and in local communities in rural counties. A great percentage of bullying takes place in the school setting, which is the most common place for bullying incidents to happen. There have been reported cases of students who feel unsafe and do not want to attend school because of the fear of being bullied. Bullying is a concern that should not be taken lightly and determining the reasoning of why this is a continuous problem is of utmost importance.

The overall purpose of this project is to gather data to determine what factors likely contribute to a student bullying other students. The project will view schools in a rural area in Mississippi and its impact of bullying in children. Data will be collected to determine the interventions schools used in rural Mississippi to combat this growing problem.

099

Name: Rushing, Erin

Major: Biochemistry

Faculty Advisor, Affiliation: Barbara Kaplan, Department of Basic Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Amye McDonald, Ashleigh Nicaise, Abigail Bell, Evangel Kummari

TCDD-mediated Upregulation of FasL on B cells Triggers Apoptosis in T Cells in EAE

Previous results from our laboratory showed TCDD suppressing the autoimmune disease experimental autoimmune encephalomyelitis (EAE). Specifically, TCDD suppressed T cell function in the spleen, which correlated with decreased neuroinflammation and clinical scores. This project aims to determine if TCDD-treated B cells contribute to decreased T cell function. We hypothesize that TCDD will induce Fas ligand (FasL) regulatory B cells in EAE, which could induce apoptosis in Fas-expressing cells, such as T cells. We developed the JC-1 assay, which measures mitochondrial membrane potential as a cell viability indicator. Optimization was done in vitro using FCCP, a positive control. We then conducted studies using TCDD-treated lymphocytes, B cells or IgM-depleted B cells mixed with target T cells that were prestained with CD4. The rationale for depleting IgM for some B cell preparations is that TCDD upregulates FasL to a greater degree on follicular B cells, which express more IgD than IgM. We first used lymphocytes from spinal cord following an 18-day EAE disease course with 30 µg/kg TCDD given i.p. on day 1 but did not detect apoptosis in CD4+ T cells in the presence of EAE plus TCDD-treated spinal cord lymphocytes. We then used cells from spleen following an 18-day disease course with 30 µg/kg TCDD given orally over 12 days at 2.5 µg/kg/day. We mixed EAE plus TCDD-treated splenocytes, purified B cells or IgM-depleted B cells with CD4+ T cells. In two replicates of the experiment, mitochondrial membrane potential in the CD4+ T cells was lower in the presence of TCDD-treated cells as compared to corn oil vehicle-treated cells. This occurred with splenocytes, B cells and IgM-depleted B cells. These results demonstrate that the mechanism by which TCDD suppresses T cell function involves its ability to induce FasL on B cells, triggering apoptosis in T cells. (Supported by NIH R15ES027650).

100

Name: Schaade, Caroline

Major: Mechanical Engineering

Faculty Advisor, Affiliation: Dr. Matthew Priddy, Mechanical Engineering

Project Category: Biological Sciences and Engineering

Using Finite Element Analysis to Estimate the Mechanical Response of Ti-64 Porous Hip Implants

A common issue in current clinical orthopedic implants is that the implant stiffness often leads to device failure, causing patients to endure corrective surgeries. Implant stiffness causes stress shielding, which is a decrease in physiological loading of the bone and can lead to mechanical loosening of the prosthetic implant and osteolysis. A possible solution is introducing porosity into the device, which will reduce the overall stiffness of the device. However, in order to accomplish this, the geometry of the lattice structure affects the strength and stiffness of the hip implants. For example, depending on the orientation of layers of pore fibers, the greater the impact on pore size and the stiffer the implant becomes. In this study, a porous Ti-64 hip implant was designed through additive manufacturing (AM), which allows for the implementation of customized shapes and geometry. Through a literature review performed this past summer, it has been determined that the implant should be designed to withstand compression forces from two to eight times the body weight while closely matching the stiffness of native bone. Therefore, four daily tasks (standing, walking, jumping, and swimming) have been selected to be modeled using finite element analysis (FEA) in order to observe a range of activities with different hip orientations and loading scenarios. These four spatiotemporal models will then be compared to show the relationship between porosity and stiffness and determine if the effects of stress shielding will be reduced.

007

Name: Schalski, Ella

Major: English

Faculty Advisor, Affiliation: Peter DeGabriele, English

Project Category: Arts and Humanities (Oral Presentation)

Woman's Work, Woman's Worth: Innovations to Romance in Mary Wroth's *The Countess of Montgomery* and Aphra Behn's *The Fair Jilt*

Mary Wroth's prose romance *The Countess of Montgomery's Urania*, the first published by a woman, employed many specific romance conventions. By the time Aphra Behn wrote and published *The Fair Jilt* as the first paid female writer, there was altogether a lack of those same conventions. This paper provides evidence of both Wroth and Behn's important contributions and innovations to prose romance.

Wroth's significant contribution to romance is her portrayal of the virtue of constancy. For her female characters, such a virtue is an active will that gives them a type of agency that they would not have had otherwise. While Wroth uses the virtue of constancy so her female characters can have a sense of agency, Behn uses constancy as a means to weaken her male characters' power and, in some ways, feminize them. By weakening the power of the male characters, Behn is able to give more power and agency to her female characters.

Both authors apply the virtue of constancy in very different ways to different types of characters. Despite this, they both use constancy as a means to give their female characters agency and power. As a result, I argue that these innovations highlight the explicitly gendered cultural connotations through their representation of female characters and their subsequent feminine desire.

101

Name: Scheaffer, Hannah

Major: Biochemistry

Faculty Advisor, Affiliation: Matthew Ross, Department of Basic Sciences, Center for Environmental Health Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Abdolsamad Borazjani

Prostaglandins and Prostaglandin Glyceryl Esters Bind to and Activate PPAR-gamma in Human Macrophage-like Cells

Prostaglandins (PGs) are endogenous immunomodulatory lipids that are produced when macrophages are activated by inflammatory stimuli. They are formed from arachidonic acid by the action of cyclooxygenase (COX) enzymes. In addition, other lipid mediators called endocannabinoids (e.g., 2-arachidonoylglycerol) can be oxidized by COX to give prostaglandin glyceryl esters (PG-Gs). PG-Gs are degraded in part by a hydrolytic enzyme called carboxylesterase 1 (CES1). Peroxisome proliferator-activated receptor gamma (PPAR γ) is a ligand-activated transcription factor and member of the nuclear receptor superfamily that senses a variety of oxidized lipid molecules in the macrophage microenvironment, thereby shaping the phenotype of these immune cells. In this study, we discovered that treatment of human THP-1 macrophage-like cells with specific PGs or PG-Gs could activate PPAR γ and increase the mRNA levels of the PPAR γ target genes, *FABP4* and *CD36*. PGD₂ was more potent than its glyceryl ester, PGD₂-G, which in turn was greater than either PGE₂ or PGE₂-G. Macrophages were also stimulated with interleukin 4 (IL-4), a Th2 cell-derived anti-inflammatory cytokine that promotes alternative macrophage activation (M2 polarization), in the presence and absence of PG-Gs and PGs. IL-4-induced expression of the M2 marker gene *arachidonate lipoxygenase-15* was significantly attenuated by both PGD₂ and PGD₂-G (EC₅₀ values were ~0.3 μ M and 3 μ M, respectively), an effect that was recapitulated by a synthetic PPAR γ ligand (GW1929) and by CES1 small-molecule inhibitors (WWL113 or WWL229). The significance of our results is that both PGD₂ and PGD₂-G are shown for the first time to be endogenous PPAR γ ligands. In addition, a complex crosstalk between PPAR γ and CES1 seems to exist during M2 macrophage polarization; a process that is paradoxically attenuated by PPAR γ in our experimental model. [Supported by NIH [R15GM128206](#)].

226

Name: Seamon, Samantha

Major: Forestry/Forest Management

Faculty Advisor, Affiliation: Dr. Elizabeth Canales Medina, Agricultural Economics

Project Category: Social Sciences

Co-Author(s): Dr. Alan Barefield

Other Competition(s): Public Health Research Competition

Estimating the Economic Burden of Hypertension in Mississippi

Hypertension is a chronic health problem that affected approximately 40.8% of the population in Mississippi in 2017. Often called the “silent killer,” hypertension affects the lives of individuals both as a sole chronic condition and as a comorbidity that exacerbates the debilitating effects of other chronic conditions and diseases. There is an economic burden associated with the prevalence of hypertension including direct costs (e.g., medical treatment) and indirect costs (e.g., absenteeism, disability, premature mortality). The objective of this study is estimating the economic impact of hypertension using a prevalence based approach. Regression analysis is used to identify the costs attributable to the disease.

We used national survey panel datasets including the National Health Interview Survey (NHIS), the Medical Expenditure Panel Survey (MEPS), and the Behavioral Risk Factor Surveillance System (BRFSS) to derive estimates. As robustness checks, we estimate different model specifications including Tobit and two-stage models to control for zero mass and skewed health expenditures. The models control for socio-demographic factors, health insurance coverage, and costs attributable to health status and other diseases and chronic health conditions.

We use regression results to predict hypertension cost in Mississippi based on population characteristics and hypertension prevalence in the state. While older individuals experience higher costs than younger individuals, individuals suffering from hypertension across all age groups experience an increase of approximately \$1,000 in direct costs attributable to hypertension. This translates to a total increase in hypertension attributable direct costs of \$926,000,000 for the state. The

goal of the study is to increase awareness of the economic burden of hypertension on Mississippi's economy. The outcome of the study will aid policymakers, health providers, and public health professionals better understand the economic burden this chronic health condition places on the state's economy.

173

Name: Sen, Chirantan

Major: Electrical Engineering

Faculty Advisor, Affiliation: John Ball, Electrical Engineering

Project Category: Physical Sciences and Engineering

Road Sign Detection of Speed Limits Using Separate Detection and Classifications Approach

Using the Faster RCNN architecture of object detection, our research is based on creating a vision algorithm for autonomous recognition and classification of road signs, specifically speed limits. We are using original footage taken by cameras (which were mounted on top of a vehicle) of traffic signs on Highway 12 to train the neural network. Our goal in the research is to detect the speed limit sign and classify it by extracting the alphanumeric on the sign itself. The characterization of numbers and letters on specific signs are being done in a separate network from the detection. The overarching goal of the study is to explore the capabilities of neural networks in their applications to autonomous vehicles.

Acknowledgement: CS likes to thank the Dean's research stipend award at MSState for support.

102

Name: Sette, Katelyn

Major: Biochemistry

Faculty Advisor, Affiliation: Dr. Russell Carr, Center for Environmental Health Sciences, Department of Basic Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Shirley X. Guo-Ross

The Biochemical Basis for the Toxicity Differences between Juvenile Rats and Mice exposed to the Insecticide Chlorpyrifos

One of the most common classes of agricultural insecticides is the organophosphorus pesticides (OPs) which exert their toxicity through inhibition of brain cholinesterase (ChE) leading to hyperactivity in the nervous system. Currently, there is a growing concern that exposure to low levels of OPs induces negative impacts in developing children. The chemical most commonly linked to these issues is chlorpyrifos (CPF). Recently, we observed that there was a difference in susceptibility to CPF between juvenile mice and rat. The basis for this difference is unknown, but we hypothesized that it could be due to differences in detoxification mechanisms. In the blood, certain enzymes act as alternative binding sites which removes the chemical from circulation. To investigate this, 10-day old rats and mice were exposed daily for 7 days to corn oil or a range of dosages of CPF via oral gavage. Pups were sacrificed on day 16 and brain and blood were collected. The effects of CPF on juvenile rat brain ChE activity was greater than that observed in juvenile mice. In the blood, there were higher carboxyl esterase and ChE activities in the juvenile mice than in the juvenile rats. The level of inhibition of these enzymes was also found to be higher in rats than in mice following oral exposure to the same dosages of CPF. The higher level of inhibition in rats indicates that the protective function of these enzymes is overwhelmed faster in rats than in mice. This allowed more compound to reach the brain and inhibit ChE resulting in higher toxicity in rats as compared to mice.

174

Name: Shaffer, James

Major: Mechanical Engineering

Faculty Advisor, Affiliation: Omid Askari, Mechanical Engineering

Project Category: Physical Sciences and Engineering

Co-Author(s): Saeid Zare, Kwonse Kim

REU/Research Program: Undergraduate Research Program

Investigation of MEHV Hybrid Ignition System

Capacitive discharge ignition (CDI) is widely used in applications from traditional combustion engines to turbine engines. The goal to improve the quality and combustion characteristics of such a widely used system is important for consumers and manufacturers alike. A modified CDI system is explored in this research and compared to a standard CDI system. The modified ignition system utilizes a secondary circuit to supply energy to the plasma where the second circuit Matches the Effective High Voltage (MEHV) of the plasma discharge after breakdown. This changes the method of power delivery to the plasma and results in discharge characteristics that are potentially more efficient in thermal energy conversion which could result in improved combustion characteristics in future studies. Experimentation evaluates the CDI and CDI modified with MEHV in atmospheric conditions on an energy basis comparing the total energy deposited to the plasma discharge and studying the modes of plasma achieved on a visual and numerical basis. The visual data is captured using a phantom high speed camera and Schlieren photography techniques. A correlation between input voltage and output energy for both systems is created based on experimental data captured via an oscilloscope to better understand each system and the change in the ignition mechanism characteristics. An internal plasma model of the conventional CDI system is used and modified to describe the new hybrid CDI system and aid in defining the modes of plasma that occur in each system and the potential benefits the new system can provide. Other results include the overall size and duration of the plasma as well as the efficiency of each system. Once each system is defined the improvements to combustion such as ignition delay and combustion rate can be explored.

103

Name: Shearer, Katie

Major: Biochemistry

Faculty Advisor, Affiliation: Dr. Florencia Meyer, Biochemistry

Project Category: Biological Sciences and Engineering

Trace metal salts inhibit the growth of *Mannheimia haemolytica* and *Pasteurella multocida*

Mannheimia haemolytica is an opportunistic pathogen that proliferates in the nasal pharynx of cattle. When the animal is under stress and its immune system is compromised, the bacteria is able to invade the lower respiratory tract and cause pneumonia. *M. haemolytica* is a known contributor to bovine respiratory disease (BRD), also known as shipping fever, which costs the cattle industry up to one billion dollars annually. *Pasteurella multocida* is also a known contributor of BRD. Cobalt has been shown to improve the immune system and is also a metal that is known to inhibit bacterial growth. A study done by Paterson & MacPherson (1990) showed that cattle on a depleted Co diet had a lowered immune response and more severe bacterial infection than Co supplemented cattle. However, when too much cobalt is taken into the body, it can cause harmful effects. Other trace metal salts are also known to inhibit bacterial growth. Zinc has an inhibitory effect against many strains of bacteria, while zinc and copper have both been shown to inhibit bacterial growth, specifically against biofilm formation.

The goal of this experiment is to find the optimal concentrations of CoCl_2 , ZnCl_2 , and CuCl_2 that inhibit the growth of *M. haemolytica* and *P. multocida*. The bacteria was grown in the presence of different concentrations of these metal salts under varying cell density conditions. A spectrophotometer was used to measure the optical density of the samples. In addition, we are testing the metals on the growth of bovine cells (MDBK).

The effect of metal salts on *M. haemolytica* and *P. multocida* growth is concentration dependent and cell density dependent.

104

Name: Sherman, Emily

Major: Animal and Dairy Sciences (Pre-Vet)

Faculty Advisor, Affiliation: Shecoya White, FNH

Project Category: Biological Sciences and Engineering

Co-Author(s): Jessa Goodeaux

Effect of Temperature on Spoilage Rate of Natural or Zero Preservative Commercial Moist Dog Food

Due to increased demand for all natural pet foods, commercial producers are using strictly all natural or zero preservatives in raw and wet dog foods. In this refrigerated shelf-life study, the rate of spoilage was determined for 4 types of natural or no preservative moist dog foods. Samples were derived from the following brands: FreshPet Slice and Serve, FreshPet Small Bites, Beneful Meals, and Rachel Ray Nutrish. Both of the FreshPet products advertise zero preservatives, relying solely on refrigeration and use within 7 days of opening. Beneful and Rachel Ray advertise only natural preservatives and use within 2-3 days of opening. All 4 samples were stored in original packaging, placed in whirl pak bags, and refrigerated for 7 days. Microbial evaluations were performed on Days 3, 5, and 7. By day 7, Rachel Ray and FreshPet Bites showed no detectable microbial growth. Microbial counts for Beneful and FreshPet Slice and Serve had the following counts, 1.52 log CFU/g and 6.16 log CFU/g, respectively. Once Day 7 samples were taken, products were removed from refrigeration and left at room temperature to simulate customer product handling. Spoilage was further evaluated on Days 9 and 12. FreshPet Bites showed no growth throughout the refrigerated portion, yet after 2 sampling points at room temperature the counts reached above 5 log CFU/g. The only brand to show consistent presence of microbes during refrigeration was FreshPet Slice and Serve, ending Day 12 with 7.43 log CFU/g. The preservation techniques utilized by the companies limited the initial microbes found in the products. As expected, refrigeration was the main preservative limiting the growth. This study shows that when a customer doesn't follow the suggested instructions, the rate at which spoilage would occur in these natural or zero preservative products.

175

Name: Shine, Matthew

Major: Aerospace Engineering

Faculty Advisor, Affiliation: Adrian Sescu, Aerospace Engineering

Project Category: Physical Sciences and Engineering

Building a Small-Scale Demonstration Wind Tunnel

Wind tunnel testing at Mississippi State University is required for continuing education. The best alternative to a large-scale wind tunnel for educational demonstrations is a small portable wind tunnel. The small wind tunnel is open circuit, and using traditional tunnel design methods, able to carry out small-scale tests. The tunnel is easy to relocate and replace parts, with minimal time between experiments. The mechanisms are easily seen and demonstrate the physical properties of airfoil tests to observers. The tunnel is made of transparent materials and provides an engaging view of the test as it occurs.

176

Name: Shober, Alex

Major: Aerospace Engineering

Faculty Advisor, Affiliation: David S. Thompson, Ph.D., Aerospace Engineering

Project Category: Physical Sciences and Engineering

How Nature can influence Aerodynamic Performance on Aircraft Wings

Aeronautical engineers are constantly looking for ideas to improve the efficiency of aircraft and decrease the environmental impact of air travel. These engineers are taking ideas from nature and applying them to aircraft design to improve these issues. Taking elements inspired by nature may reduce the drag and alleviate turbulence along the body of an aircraft. By looking at an albatross and shark skin, wings will be developed and put through an air flow simulation, similar to a wind

tunnel, to determine if the drag decreases across the wing with the added natural elements. These wing designs will be compared to a baseline wing with no added elements. The albatross-inspired wing design has a freely flapping wing tip which accounts for approximately a quarter the length of the wing. The idea of the free moving wing tips is to significantly reduce the loads applied on the wing by variations in wind direction and magnitude. The shark skin- inspired wing will include evenly spaced ridges or riblets across the span of the wing. The riblets across the wing may reduce the drag and increase lift. After completion of the wings, modelled in CAD software, their aerodynamic performance will be tested by creating an air flow simulation. At the completion of this simulation, the aerodynamic performance of the wings with added natural elements will be compared to the baseline wing. Positive results will demonstrate that bio-inspired inspired wings improve the performance of an aircraft.

105

Name: Siders, W. Casey

Major: Biochemistry

Faculty Advisor, Affiliation: Dr. Nicholas Fitzkee, Chemistry

Project Category: Biological Sciences and Engineering

Co-Author(s): Baylee N. McIntyre, Md. Siddik Alom

Residue Interaction Preferences for Protein-Gold Nanoparticle Interactions

The understanding of biophysics in protein-nanoparticle (NP) interactions is essential to employ NPs as drug carriers and for the designing of biosensors. This understanding is more relevant when gold nanoparticles (AuNPs) interact with multiple proteins at the same time, as is common in biological fluids, because competition between proteins will occur. We hypothesize that the amino acid residues on each protein's surface will determine which proteins are favored during competitive binding. A quantitative scale of residue preferences could be used to predict the outcome of competition if this hypothesis holds. We are studying the protein GB3, a small model protein, and we have found that lysine at position 13 in GB3 plays a crucial role in binding with AuNPs. In this work, we have engineered a library of variants at position 13 using PCR-based site-directed mutagenesis. We have started the expression and purification of variants to study each residue's contribution to competitive binding. In these studies, GB3 with glycine at position 13 (K13G) are mixed with other variants (K13X) to see which residues favor binding in competitive situations. So far, we have purified the K13E, K13A, and K13Y GB3 variants and started to study with proteins bind most favorably compared to K13G. Glutamate competition experiments (K13E/K13G) result in a 0.75 binding ratio, which is what we expect for a negatively charged side chain interacting with a negatively charged AuNP. Our results support the idea that surface residues strongly influence protein-nanoparticle adsorption, and future work will test whether quantitative predictions about adsorption can be made using our residue-based framework.

106

Name: Simmons, Cheyenne

Major: Agricultural Engineering Technology & Business

Faculty Advisor, Affiliation: Rocky Lemus, Plant and Soil Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): J. Brett Rushing

REU/Research Program: Research and Extension Experiential Learning for Undergraduate Fellowships Program

Influence of Fertilizer Additives on Crabgrass (*Digitaria sanguinalis*) Biomass Production

Crabgrass is a valuable summer annual forage that can be used for grazing or hay production. The objective of the study was to evaluate cultivar response to nitrogen fertilizer additives. The study was conducted at Mississippi State University in a Marietta Fine Sandy loam soil (Fine-loamy, siliceous, active, thermic Fluvaquent Eutrudepts). The experimental design was a randomized complete block in a 4 x 5 factorial and replicated three times. Five crabgrass cultivars 'Dal's Big River (DBR),' 'Impact (I),' 'Quick-N-Big (QNB),' 'Quick-N-Big Spreader (QNBS),' and 'Red River (RR)' were planted in a prepared seed bed at a rate of 8 lb PLS/ac using an Almaco Drill (Nevada, IA). Cultivars were treated with four nitrogen combinations: control,

urea ammonium nitrate (UAN 32-0-0, C), UAN plus N-Veil® (26.7% NBTP, NVEIL), and UAN plus Preserve N™ (18-0-0, PN). Nitrogen was applied at rate of 50 lb N/ac. UAN was treated with N-Veil® and Preserve N™ at a rate of 2.0 qt/ton and applied using a backpack sprayer when plants reached a height of three inches to supply a rate of 25 gal/ac. Lime, phosphorus (P₂O₅), and potassium (K₂O) were applied based on soil test recommendations. Whole plots (6 ft x 10 ft) were harvested three times in 2019 and subsamples were dried at 130 °F for 72 h, ground to pass a 2-mm screen, and analyzed for nutritive value using NIRS and the 2017 grass hay equation developed by the Forage and Feed Testing Consortium (Hillsboro, WI). Biomass was not affected by cultivars. 'Impact' had 10% greater yield than DBR. There was no N treatment effect, but treatments containing PN fertilizer additive was lower yielding than the control. Nutritive value (CP, ADF, NDF, and WSC) was not affected. No significant differences were noted for cultivar and treatment effects on CP, ADF, NDF and SWC.

107

Name: Smith, Jacob

Major: Microbiology

***Home Institution:** The University of Alabama

Faculty Advisor, Affiliation: Anathbandhu Chaudhuri, Biological Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Kim Lackey, Laura Reed, Birton O'Shields

Herbicide Induced Reproductive Dysfunction in *Drosophila melanogaster*

Spectracide a commonly used herbicide that contains four harmful ingredients (atrazine, diquat dibromide, fluazifop-p-butyle and dicamba) that are banned in various European countries due to their significant health hazards [3]. Our previous experiments report that Spectracide disrupts the biological clock in the fly model and creates oxidative stress. This experiment is designed to find out the effects of Spectracide on reproductive behavior and performances using the fruit fly, *Drosophila melanogaster*.

Young adult male and female flies (5-7 days old) were fed with 10% Spectracide mixed with 5% sucrose for 6hrs and 24hrs. The flies were allowed to mate immediately after being fed with the herbicide. The control flies were fed with only 5% sucrose solution. We observed that male grooming behavior in the presence of females is severely affected by Spectracide when adult flies were fed for a period of 6hrs. Also, Spectracide significantly delayed the larval development in the subsequent generation. However, we did not find any significant differences in pupa and adult count upon immediate exposure to Spectracide.

In another set of experiments, the flies were fed with 10% Spectracide for 6 hours then fed 5% sucrose for three days prior to mating. During this time we cultured the male and female flies in 5% sucrose separately. We recorded a significant decline in the production of offspring (pupal and adult count) by Spectracide fed P generation. Interestingly, we observed that ovarian and ovum length are significantly reduced in Spectracide fed flies. Taken together, these results suggest that Spectracide has a negative effect on reproductive behavior and outcome in *Drosophila* which could also be harmful to humans. Histopathology of the adult reproductive system and the sperm motility will help in better understanding the actual deleterious effect of Spectracide which is under progress.

227

Name: Strickland, Eliza

Major: Educational Psychology

Faculty Advisor, Affiliation: Dr. Kasia Gallo, Department of Counseling, Educational Psychology, and Foundation

Project Category: Social Sciences

Exploring the Underpinnings of Psychology in Speech Language Pathology

The present research demonstrates the role of psychology in the field of Speech Language Pathology. The relationship between Speech Language Pathology and Psychology is intuitively obvious. However, though most practicing speech therapists use these techniques daily, no research has directly investigated how powerful psychological practices can be when applied by speech therapists. This literature review summarizes 15 empirical studies to support the clear implications

of psychology on Speech Language Pathology practice. Most studies used children or speech language pathologists as participants, others used teachers and educators. Two psychological domains were identified: cognitive practices and behavioral practices. Research suggests that Speech Language Pathologists use behaviorist principles like positive and negative reinforcement and token economies to modify behavior and reach desired goals in therapy. Research also demonstrates that most children who are diagnosed with speech language delays are also commonly diagnosed with behavior problems. In terms of cognitivism, having even a small bit of knowledge of neuroscience gives educators useful tools they need to be better teachers. Understanding attention, memory, and motivation allows speech therapists to keep their clients' attention and to ensure long-term change in speech. The review also explores the aspect of counseling in Speech Language Pathology, especially in therapy with children. The literature suggests creating positive environments and positive platonic relationships with children builds trust and leads to more effective therapy. Fostering self-efficacy and self-esteem in children is an important aspect of learning new speech skills. Having academic knowledge of psychology and of these domains offers an immense advantage for practicing Speech Language Pathologists.

108

Name: Sublett, Jennifer

Major: Wildlife & Fisheries Science/Wildlife Science

Faculty Advisor, Affiliation: Garrett Street, College of Forest Resources

Project Category: Biological Sciences and Engineering

Co-Author(s): Natraj Krishnan

REU/Research Program: The CFR Undergraduate Research Scholars Program

Other Competition(s): Thesis Research Competition (TRC)

A Changing World: Population Responses to False Environmental Signaling

The use of environmental cues enable species to identify resources that will help (or hinder) their survival. It is an advantage for populations to distribute themselves according to resource quality. Our research examines the ways this behavior could fail to result in an ideal free distribution due to environmental change. If the signals given off by resources become misleading, how do populations react? We observed whether our experimental populations adapted to false environmental signaling or failed to maintain true fitness over generations. Using common fruit flies (*Drosophila melanogaster*) in a laboratory setting, we created model habitats to allow individual choice across gradients of perceived and actual resource quality. Actual quality of resources was represented via low and high proportions of sugar/carbohydrate/yeast in diets, while perceived quality was manipulated through the use of attractants and repellants. We collected data on the use of these 24 resource treatments over 8 generations of fruit flies, recording both the fecundity of fly larvae deposited on each resource and the behavior of the flies (using egg counts and image-analysis technology). This is a replication-extension experiment designed to clarify the results obtained from previous student Isabella Durham in her presentation "Adaptations to dishonest environmental signals: insights from an experimental microcosm". Our analysis will provide more insight into how the fitness of wild populations could react to a changing climate and world.

109

Name: Sunil, Advait

Major: Biological Engineering

Faculty Advisor, Affiliation: Jean-Francois Gout, Biology

Project Category: Biological Sciences and Engineering

Phylogenetic Distributions of RNAPII subunits

Transcription, while generally an incredibly precise process, can sometimes make mistakes. These mistakes interfere with proper protein formation and can have catastrophic implications for cellular health. The research being done on transcription error is still in its early stages, but it has been observed that the error rate in *Saccharomyces cerevisiae* is about 1/250,000. Transcription of protein coding genes is carried out by RNA Polymerase II (RNAPII), a large enzyme composed of 12 distinct subunits. It is known that some of these subunits are involved in the fidelity of transcription, and, as such, research into their

function is vital to investigating error rate. My research in this subject has been surveying the phylogenetic distributions of several genes coding for these RNAPII subunits. Through using model organisms from across the tree of life, the evolutionary histories of several subunits have been mapped on phylogenetic trees. The goal of this research was to identify species with abnormal RNAPII structures and gain insight into which subunits are more/less conserved than others. This research will pave the way for future research into a more detailed analysis of the relationship between RNAPII subunit variance and transcription error rate.

228

Name: Swan, Georgiana

Major: Political Science

Faculty Advisor, Affiliation: Dr. Melanie Loewhing, Communications; Dr. Brian Shoup, Political Science

Project Category: Social Sciences

Is it Harder to Run for Office if You are A Woman?

I will test to see if women and men differ in their attitudes towards the electibility of female presidential candidates. While there exists a robust literature on gender and politics that measures the propensity for female candidates to seek and win office, there exists relatively little work in terms of determining whether there is a propensity to be more positively or negatively predisposed towards female candidates relative to male candidates among voters of different genders. Political knowledge about the gender of sitting incumbents is already known to be influenced by gender. Dolan (2010), for example, notes that “for respondents who live in states with at least one woman Senator, women are significantly more likely to correctly identify that situation than are men, 61% to 57%.”

That said, these studies do little to illuminate whether female and male voters have, *ex-ante*, differing predispositions to supporting female candidates. To test this I will analyze whether respondents have differing attitudes towards the electibility of female candidates while also controlling for other mitigating factors including partisanship, education level, ideology, and socio-economic status.

229

Name: Taylor, Allyson

Major: Agricultural Information Science

Faculty Advisor, Affiliation: Dr. Carley Calico Morrison, Agriculture Education, Leadership, and Communications

Project Category: Social Sciences

MAFES Discovers: A Readership Study

This study was conducted to identify the readership of the MAFES Discovers publication within the university and determine a way to broaden the reach of its followership. An online survey was conducted to allow readers to share their perspectives of the magazine and determine what is currently preferred and what can be improved upon to better meet their needs. Factors researched include the impact online publications have on print readership, social media influence, and overall audience preferences. All of these lent the proper information for aiding in increasing the continued followership of the magazine. The link to this survey was sent out within the December 2019 issue. Participants were also encouraged to participate with the incentive of possibly winning a gift basket from MAFES that is to be given away at the closure of the survey period. Posts were also made on social media and the website to encourage participation, along with postcards sent in the mail for those that may not relate to the university through other outlets. Participants were very responsive with both positive comments and critiques, both of which were very beneficial. Statements included their appreciation for MAFES, enjoyment of articles and covers, and preferences for certain themed articles. Suggestions of improvement included dispersal methods and making readers aware that there is a website where information can be found because many were unaware of this fact. Each one of these factors is discussed within the research to allow for the understanding of who is reading the MAFES publication currently, along with how the audience can further grow as modifications are made soon.

110

Name: Taylor, Madison

Major: Biological Engineering

Faculty Advisor, Affiliation: Dr. Steve Elder, Agricultural & Biological Engineering

Project Category: Biological Sciences and Engineering

REU/Research Program: BCoE Undergraduate Research Program

Decellularized Cartilage Microparticles as a Filler in Self-assembled Scaffolds

A self-assembly approach to cartilage tissue engineering evades factors associated with scaffold formation such as degradability, biocompatibility, porosity, and more, but the resulting construct is prone to contraction. Decellularized cartilage acts as a native extracellular matrix, increasing compatibility with the host tissue, and can be atomized to allow for cells to attach and infiltrate the tissue. This experiment is aimed to enhance the construction of cartilage composites by augmenting the self-assembly strategy with DCM as a bulking agent to prevent scaffold contraction. It is hypothesized that stem cells will attach to the DCM and then form cell-cell connections to result in chondrogenic differentiation and a structure that is mechanically and functionally comparable to cartilage.

Microarticulated and decellularized porcine meniscus was cultured with Passage 3 MC3T3 murine stem cells and allowed to interact for three days in medium containing only DMEM, 10% FBS, and 1% AB/AM in transwell inserts before being spun into a pellet and cultured in chondrogenic differentiation medium (CDM) containing TGF- β 3 in 15 mL conical tubes until formation of 3D neotissue constructs occurred. To serve as a negative control, P3 MC3T3 cell pellets in the same environment are being cultured without the cartilage microparticles. In a preliminary experiment, scanning electron microscopy confirmed cell envelopment of DCM and knitting together of a 3D structure through cell-cell interaction. Furthermore, the constructs maintained their original shape and did not significantly contract, an observation which supports our hypothesis. Current work is being done to determine how the addition of DCM affects the overall process of cartilage formation as indicated by histology and glycosaminoglycan synthesis.

111

Name: Teer, Landon

Major: Biological Engineering

Faculty Advisor, Affiliation: Lauren Priddy, Agricultural and Biological Engineering

Project Category: Biological Sciences and Engineering

Co-Author(s): Weitong Chen, Luke Tucker

Dopamine-Assisted Nano-Hydroxyapatite Coating on 3D Printed Poly(lactic-co-glycolic Acid) Scaffolds

Damage to bone caused by trauma or disease continues to be a challenge for orthopedic surgeons to treat. Currently, autologous bone from non-load-bearing regions is the gold standard but is limited by donor site pain/morbidity and volume of tissue that can be harvested. 3D printed, biodegradable thermoplastic polymers such as poly(lactic-co-glycolic acid) (PLGA) may serve as an alternative solution to replace the damaged bone and encourage bone growth. However, polymer surfaces are naturally smooth and hydrophobic which is not ideal for osteoblast adhesion and proliferation. In this study, nano-hydroxyapatite (nHA) and polydopamine (PDA) were used to coat the PLGA with the goal of improving surface properties. nHA is a biocompatible ceramic material known for its similarity to natural bone and its osteoconductive properties, and PDA is capable of coating on both hydrophobic and hydrophilic surfaces through oxidative self-polymerization under room temperature in a single step. Also, PDA has been shown to significantly improve the immobilization of nHA. Our hypothesis was that PDA would enhance nHA coating of PLGA, leading to improved hydrophilicity in PLGA/PDA-nHA scaffolds compared to PLGA/nHA scaffolds. The nHA and PDA were combined in solution, and 3D printed PLGA scaffolds were soaked in this solution for 12 hours to create PLGA/PDA-nHA scaffolds. These were compared to PLGA, PLGA/nHA, and PLGA/PDA scaffolds and imaged using scanning electron microscopy (SEM), energy-dispersive x-ray spectroscopy (EDX), and Fourier Transform Infrared Spectroscopy (FTIR) to observe the PDA/nHA coating. Water contact angle was measured to quantify surface hydrophilicity. The PLGA/PDA-nHA had a thicker coating and more calcium, phosphorus, and nitrogen present on the surface, confirming the presence of nHA (Ca, P) and dopamine (N). Water contact angle decreased with both nHA and PDA, and was lowest for PLGA/PDA-nHA, indicating a more hydrophilic surface for cell attachment.

177

Name: Thankachan, Mariat

Major: Biological Sciences/Biological Sciences

Faculty Advisor, Affiliation: Colleen Scott, Department of Chemistry

Project Category: Physical Sciences and Engineering

Co-Author(s): Mohammed Almtiri

Mimicking Polyaniline Using Phenoxazine and Carbazole Derivatives for Biosensor Applications

Conjugated polymers, characterized by a backbone of alternating single and double bonds, are effective electrical conductors. Due to their electrochemical and photophysical properties, conjugated polymers have been used in artificial muscles, fabrication of electronic devices, solar energy conversion, rechargeable batteries, and even biosensors. Our group has been focusing on mimicking polyaniline, which is a conducting polymer that has captured the interest of the scientific community due to its environmental stability, high electrical conductivity and low cost. It is being explored for many applications, including replacement usage of rare transition metals in devices. Phenoxazine and carbazole were used as starting materials as both are suitable for biosensor applications due to their conjugation of electrons. Phenoxazine and carbazole are conjugated, polyaromatic, heterocyclic compounds that are commonly found in dyes, naturally occurring antibiotics, and anti-cancer agents. Our polymer was synthesized as a step-growth polymerization with *p*-phenylenediamine as the co-monomer via a Buchwald/Hartwig reaction. Electrochemical measurement, such as cyclic voltammetry and conductivity studies, show high electrochemical stability of the emeraldine salt, which is obtained from acid doping and is the conducting form of the polymer and high electrical conductivity of the polymer. Finally, we present the comparison of electrochemical properties and morphology of polyphenoxazine doped film using a variety of dopants such as polystyrene sulfonic acid (PSS), trifluoroacetic acid (TFA), and camphorsulfonic acid (CSA).

178

Name: Thomas, Kimberly

Major: Biological Sciences/Biological Sciences

Faculty Advisor, Affiliation: Benjamin P. Crider, PhD, Department of Physics and Astronomy

Project Category: Physical Sciences and Engineering

Co-Author(s): R. Unz

Enhanced Soil Sample Preparation Procedures for Laboratory and In-Situ Gamma Ray Spectroscopy

The Multi-Agency Radiological Site and Survey Investigation Manual (MARSSIM) recommends procedures and methods for collecting soil samples in radioisotope impacted areas. Individual survey units can potentially have as few as ten soil samples that need to be collected and analyzed but can potentially have more than 100. Some sites might have a single survey unit or hundred, leading to the potential of remediation manager having to collect hundreds or thousands of soil samples and then having them analyzed. The associated cost of manpower, radioactive material shipping, waste disposal, laboratory overhead, and equipment maintenance can be a significant contribution to remediation costs. This poster discusses the development of baseline procedures for conducting gamma ray spectroscopy analysis of soil samples using traditional techniques and how they can be implemented at the Institute for Clean Energy Technology (ICET). Methods for collecting, drying, milling, and packing the soil samples are discussed. Procedures for collection of the gamma ray spectral data and methods used for analysis are described. A newly developed Germanium Gamma Imaging (GeGI) system is being tested at ICET for its functionality for measuring radioisotope concentrations in-situ. It has been hypothesized that the GeGI system can be used to conduct in-situ soil sample analysis, removing the necessity to collect, transfer, process, and analyze the soil samples, potentially producing significant cost savings for remediation managers. Initial testing and imaging of soil samples using the GeGI system is presented. The traditional baseline procedures will be used to determine the effectiveness of the GeGI system for performing in-situ soil sample analysis.

112

Name: Thompson, Brooklyn

Major: Biochemistry

Faculty Advisor, Affiliation: Dr. Florencia Meyer, Biochemistry, Molecular Biology, Entomology and Plant Pathology

Project Category: Biological Sciences and Engineering

Co-Author(s): Karson Pettit, Dr. Jerome Goddard

Fire ant (*Solenopsis* spp.) diet at the decomposing carcass

Within the realm of forensic science, the basic understanding of the decomposition process for a body is both widely- known and crucial to determining a post-mortem interval. While many studies have shown the impact of insects like the blow fly and carrion beetle on decomposition, there are still many questions surrounding the role and effects of fire ants (*Solenopsis* spp.) on this process. We have recently published a study showing that fire ants feed on the carrion, creating open lesions that may speed up the breakdown of the carcass in its given environment. The objective of this experiment is to determine whether the ants are feeding on the carrion, the fly larva, or both through the molecular analysis of DNA extracted from fire ant guts. Using PCR amplification and gel electrophoresis of the DNA of ants removed from a decomposing pig carcass, our results suggest that the ants are feeding on the pig carrion.

230

Name: Tingle, Emily

Major: Sociology

Faculty Advisor, Affiliation: Margaret Hagerman, Sociology

Project Category: Social Sciences

Other Competition(s): Thesis Research Competition (TRC)

Grass Roots Organizing and Colorblind Ideology in Association with the Maintenance of White Womanhood

Progressive grass roots organizations in Mississippi attempt to address inequity in public education through campaigning for fully funding education, striving for more funding for children in impoverished areas, and promoting pro-public education candidates for state legislature. However, to what extent do these groups confront the role that race and racism play within individual schools and how do they perpetuate the maintenance of white privilege while advocating for equality in statewide education policy? This paper is rooted in the sociology of race. Drawing on preliminary participant observations of progressive political organizations in Mississippi as well as in depth qualitative interviews from white women in various organizations across the state of Mississippi, this paper argues that white women activists perpetuate racial privileges within schools while simultaneously advocating for better statewide public education policies using Colorblind Ideology. This research is necessary because without directly confronting the realities of race in America, activists may shift attention in other directions, which may not lead to the goal of equity that they otherwise seek to achieve.

113

Name: Tomasi, Jessica

Major: Wildlife & Fisheries Science/Aquaculture & Fisheries Science

Faculty Advisor, Affiliation: John J. Riggins, Biochemistry, Molecular Biology, Entomology, and Plant Pathology

Project Category: Biological Sciences and Engineering

Co-Author(s): John Thomason and Kristy McAndrew

Effects of Blue Stain Fungus on the Presence of Termites in Dead Wood

In coniferous forests of the southeastern US, subterranean termites (*Coptotermes* and *Reticulitermes* spp.) prefer feeding on dead wood where blue stain (Ascomycota: Ophiostomatales) fungal associates of bark beetles (Coleoptera: Curculionidae) is present. We tested this relationship in pine forests in south Mississippi and Honduras. Tree "cookies" (8cm thick cross sections, N=40) from one healthy tree (n=20) and one bark beetle tree (n=20, containing blue stain fungi) were set out in forests for two years. One-half of each wood type was partially caged from above with metal screen to exclude interference

from aboveground invertebrates, and the other half was not caged. Wooden cookies were collected from the field after two years, and invertebrates present were extracted using Berlese funnels. Preliminary presence/absence of termites was noted in samples, and a chi-squared analysis was conducted to determine the effect of treatments on termite presence. For this preliminary analysis, all blue stain samples (half caged and uncaged) were combined into one “blue stain” treatment, and all control samples (half caged and uncaged) were combined into one “control” treatment. In this experiment, the presence of blue stain fungi did not impact termite presence in samples from Mississippi (DF= 1, $\chi^2= 0.25$, P= 0.6175) or Honduras (DF= 1, $\chi^2= 0.53$, P= 0.4652). Future work will determine if the caging treatments had an effect and if the presence of blue stain fungi effected the abundance of termites, abundance of other invertebrates, abundance of decay fungi, and rate of wood decomposition. Findings of this study will provide a greater understanding of the role of biological communities in wood decomposition, which could help make terrestrial carbon models more accurate.

114

Name: Tucker, Luke

Major: Biological Engineering

Faculty Advisor, Affiliation: Dr. Lauren Priddy, Agricultural and Biological Engineering

Project Category: Biological Sciences and Engineering

Combination of electrospinning and 3D printing to create a multilayered poly(caprolactone) scaffold

Anterior Cruciate Ligament (ACL) sprains are one of the most common knee injuries in the United States today. While corrective surgery is quick and successful, the quality of implanted ligament hinder patients’ activity levels, and combined with the risk implant failure, necessitates the development of a biocompatible, bioresorbable scaffold that will enable patients to return to preinjury activities. To improve the biocompatibility of synthetic scaffolds, electrospinning of nanofibers is used to increase cell attachment rates as well as filopodia development. Our preliminary data shows the fibers deposited in a preferred orientation based on underlying structure. The other part of the project was the design, optimization of print parameters, and 3D printing of a scaffold that would allow for cell intrusion, and ultimately, for the creation of patient specific scaffolds. In this work, scaffolds were 3D printed; then nano fibers were electrospun onto the surface. Both 3D printed scaffolds and electrospun nanofibers were made layer-wise from poly(caprolactone) (PCL) where 3D printed scaffolds will provide mechanical support, and nanofibers will encourage cell attachment. PCL was chosen due to its mechanical properties and degradation rates appropriate for a temporary (9-12 months) ACL implant, and thermal properties as determined through differential scanning calorimetry and thermogravimetry, conducive to 3D printing. We developed two methods for fusing polymer constructs: solvent melt adhesion and solvent polymer matrix glue. Our hypothesis is there will be no difference in mechanical properties between melt solvent and solvent polymer matrix. We used ASTM International standard D3846-08 to guide the design of samples and grips for shear testing. The methods for electrospinning, 3D printing, and adhesion of the layers are complete; fabricating the composite electrospun+3D printed scaffolds and testing their shear strength. The results will inform future polymer fusing procedures and improve our understand of 3D printed, electrospun composite scaffolds for ACL repair.

231

Name: Turbeville, Gracie

Major: Human Sciences/Human Dev & Family Studies

Faculty Advisor, Affiliation: Joe Wilmoth, School of Human Sciences; JuYoung Lee, School of Human Sciences

Project Category: Social Sciences

Co-Author(s): Savannah Blair, Cassie Gordon, Osirus Mitchell, Alisha McDougal

The relationship between self-care and GPA among college students

The purpose of this research project is to identify the relationship between self-care of a college student and their grade point average (GPA). To measure self-care, we will use The Mindful Self-Care Scale (Cook- Cottone, & Guyker 2016), and we will measure GPA based on a 0-4.0 scale. Our hypothesis is that there will be a positive correlation between student’s self-care and GPA. Survey links will be distributed to at least 50 college students through emails and social media. The college

students participating will be both male and female whose age ranges from 18-25 years old. We predict that higher levels of self-care will be positively correlated with grade point average.

115

Name: Turnipseed, Alexis

Major: Poultry Science

Faculty Advisor, Affiliation: Dr. Pratima Adhikari, Poultry Science

Project Category: Biological Sciences and Engineering

Assessment of Perch Height in Hyline W-36 Laying Hens Housed in Free-Range System

Commercial laying hens are known to exhibit natural perching behavior that is native to their species. With rising concerns regarding welfare issues within the commercial egg industry in the United States, it is important to research the perch height preferences that birds possess. This 6-week study compared two perch heights inside a cage-free housing system and utilized 72-week-old Hy-Line 36 commercial laying hens. The design was completely randomized and contained eight birds in twelve replicates to obtain the summation of ninety-six birds in the study. Variables measured throughout the experiment included production data, feed intake, bird weight, welfare score, and HDEP; feed weigh back and HDEM were calculated weekly. Perch usage was measured for the last 10 days of the experiment and data were averaged. High and low perch heights were 72x30 and 72x17 inches, respectively. Twelve individual video cameras (Hikvision Night Vision) were utilized to take photos at 1 a.m., 4 a.m., 6 a.m., 1 p.m., 8 p.m. and 10 p.m. in each replicate. The average HDEP was 86% across all pens. Feed intake varied among pens although all hens were housed in identical conditions ($P=0.0002$). It was found that most birds were on the higher perch at 1 a.m., 4 a.m. and 10 p.m. ($P < 0.001$). In contrast, most birds were found on the ground during the 6 a.m., 1 p.m. and 8 p.m. periods ($P < 0.001$). It was also found that as HDEP increased, HDEM also increased ($P < 0.0001$). The majority of the hens consistently favored the higher perch height over nearly all the observed time periods.

116

Name: Vonkchalee, Natalene

Major: Microbiology

Faculty Advisor, Affiliation: Dr. Justin Thornton, Department of Biological Sciences

Project Category: Biological Sciences and Engineering

Co-Author(s): Yoonsung Hu, Mary A. Carr, Keun Seok Seo

Expression of Pneumococcal Surface Proteins in a Staphylococcal Expression System for Host Cell Receptor Identification by Far-Western Blot

Streptococcus pneumoniae is the leading cause of community-acquired pneumonia and acute otitis media in young children and elderly adults. Diseases due to *S. pneumoniae* results in a large economic burden resulting in more than 1 millions deaths per year, primarily in developing countries. Due to the limitations of current pneumococcal vaccines, it is imperative that we identify novel ways to reduce the ability for pneumococcus to colonize and bind to host tissue.

We hypothesize expression of pneumococcal surface proteins in a staphylococcal expression system is a more relevant and efficient method of producing recombinant for identifying eukaryotic ligands by Far-west blot and mass spectrometry analysis.

pOS1 staphylococcal expression vector was used to express pneumococcal surface proteins in the *S. aureus* protein expression system for secretion into the growth medium BHI. Supernatant was sterile-filtered and proteins were purified by affinity chromatography. Protein expression was verified by coomassie blue-stained SDS-PAGE. The total proteins of human pharynx cell (Detroit 562) was extracted and transferred onto PVDF membrane by standard techniques. PVDF membranes were probed with biotinylated pneumococcal proteins and reactive bands were detected by chemiluminescent detection following probing for 1 hr with HRP-conjugated streptavidin. PsaA (SP_1650) purified from *S. aureus* expression system was found by Far-western blot to interact with one of Detroit cell protein (Annexin A2). To characterize the interaction of PsaA with Annexin A2, we created a clean deletion mutant of *psaA* using the pMBSacB plasmid system. We will use this PsaA mutant and Annexin A2 blocking antibodies in adhesion assays to human nasopharyngeal epithelial cells in vitro. Identifying a host cell receptor that can interact with

pneumococcal surface proteins can lead to creating a vaccine specifically designed to target such factors, thus limiting *S. pneumoniae*'s ability to colonize and cause invasive disease.

117

Name: Wade, Adam

Major: Forestry/Forest Management

Faculty Advisor, Affiliation: Dr. Courtney Siegert, Forestry

Project Category: Biological Sciences and Engineering

Co-Author(s): Dr. Anna Ilek

REU/Research Program: CFR Undergraduate Research Program

How Much Water Does Your Bark Hold? Bark Moisture Intake and Retention in Common Southeastern Tree Species

In the eastern United States, the use of prescribed fire as a silvicultural technique to manage for desirable upland hardwood species is becoming more and more popular. Bark characteristics such as thickness and texture have been shown to affect the resistance a species has to prescribed burning. However, the specific mechanisms of this protection are not well understood. Species with thick bark characteristics receive more protection from fire, and it is hypothesized that part of this protection is derived from water that permanently resides in bark tissue. Thus we pose the following question: do differences in bark structure among species lead to differences in efficiency of water absorption and subsequent drying? To answer these questions, a series of tests were conducted by saturating and simulating rain fall on bark samples from 6 common southeastern tree species, then measuring rates of drying over time and climate conditions. Total porosity, which is the percent of bark volume occupied by pore space, of each species ranged from 0.82 mm³/mm³ for loblolly pine (*Pinus taeda*) to 0.60 mm³/mm³ for pignut hickory (*Carya glabra*). Specific density of bark samples ranged from 1.699 g/cm³ for post oak (*Quercus stellata*) to 1.600 g/cm³ for white oak (*Quercus alba*). Bulk density ranged from 0.653 g/cm³ for pignut hickory to 0.307 g/cm³ for loblolly pine. Results from rainfall simulations are currently pending. The information gained in these experiments can be used to further understand how to promote desirable forest species in upland sites.

232

Name: Walters, Avery

Major: Animal and Dairy Sciences (Pre-Vet)

Faculty Advisor, Affiliation: Molly Nicodemus, Instructor

Project Category: Social Sciences

Benefits of community engagement courses over traditional laboratories in the development of student confidence and skill level in equines

Vocational training is essential in developing both the skills and confidence to perform these skills within a profession. This type of training can be achieved through a traditional laboratory setting or within a laboratory centered around community engagement activities. While the benefits of both types of pedagogical strategies have been documented, comparison of these approaches to teaching in the equine environment is limited, and yet, development of skills and confidence is essential to the equine student as they step into the equine industry. Therefore, the objective of this study was to compare development of students' confidence levels and skills through a traditional equine laboratory-setting to that of a community engaged pedagogy. The study was conducted over the 2018-2019 fall semesters. A survey instrument was given at the beginning (pre-) and end (post-) of each semester for a weekly 2-hour traditional equine laboratory (TL) (n=54) and an equine course with a weekly 2-hour equine community engagement activity (CE) (n=50). Students in both courses completed a total of 30 hours handling horses during the semester. The survey consisted of 17 questions evaluating the student's confidence in their perceived equine horsemanship skills. Students ranked their confidence from 1-5 with 5 indicating higher confidence. A skill assessment was completed by course instructors at the same time as the students' self-evaluation surveys. The skill assessment consisted of 15 questions with instructors ranking skills from 1-4 with 4 indicating higher skill level. Paired samples t-tests showed significant differences by the end of the semester in the skill assessment scores for both the TL and

CE courses ($p < 0.01$) and in the student-perceived confidence levels for the CE course ($p < 0.01$). While results indicate that both pedagogical strategies can be beneficial in equine skill development, community engagement programs offer the students the additional benefit of confidence development.

118

Name: Warren, James

Major: Biological Engineering

Faculty Advisor, Affiliation: Steve Elder, Biological Engineering

Project Category: Biological Sciences and Engineering

Co-Author(s): Allie Kerby

Other Competition(s): Public Health Research Competition

Use of chondroinductive kartogenin to enhance microfracture-based repair of articular cartilage

Microfracture is a common surgical technique used to treat focal cartilage lesions that will naturally progress to osteoarthritis. This technique is fairly successful for smaller lesions, but often fails when used for larger lesions due to the inferior fibrocartilage generated, which is not as durable or mechanically sound as healthy hyaline cartilage.

Our approach to improving the outcomes of microfracture includes the introduction of a chondrogenic differentiation factor, kartogenin, through a sustained delivery mechanism. Kartogenin is a small molecule that has been previously shown to stimulate hyaline cartilage differentiation of stem cells.

Kartogenin-conjugated chitosan microparticles were created following published methods of ionic gelation with TPP, with minor modification. By complexing kartogenin with 2-hydroxypropyl-beta-cyclodextrin, the solubility of kartogenin in aqueous solution was increased. Through measurement of optical absorbance at 284 nm, the release profile of kartogenin from the microparticles was determined, confirming sustained release for up to two weeks. Investigation is ongoing into the effects of chitosan molecular weight and TPP concentration on the efficiency of kartogenin loading and release kinetics. These microparticles would be suitable for injection into a joint and would presumably be retained in the joint for much longer than direct drug delivery methods.

Further research will aim to confirm the chondrogenic activity of released kartogenin in vitro using MC2T2-E1 fibroblasts with multilineage potential. Beyond this confirmation, further research will be explored regarding the use of these microparticles as an augmentation to current viscosupplementation methods involving hyaluronic acid.

233

Name: West, Hayley

Major: Psychology

Faculty Advisor, Affiliation: Mary E. Dozier, Psychology

Project Category: Social Sciences

Other Competition(s): Public Health Research Competition

Hoarding and the Reasons for Clutter

Hoarding disorder is classified by the refusal to dispose of or separate from belongings regardless of their objective value. Previous research on hoarding disorder has examined four primary motives for why a person who hoards obtains and conserves items (i.e., emotional attachment, informational fulfillment, refrain from waste, and aesthetic significance). The purpose of the current research was to explore the possible reasons for clutter endorsed by individuals with a range of hoarding symptom severity. Participants ($N = 400$) were recruited using the undergraduate psychology research pool at a large public university and completed all study procedures online. Hoarding severity was assessed using the Saving Inventory-Revised (SI-R; Frost et al., 2004). Reasons for clutter were assessed by asking participants to select and rate the percentage of different reasons that might be responsible for clutter in their lives. Twenty-nine percent of participants ($n = 117$) reported hoarding symptoms on the SI-R in the clinical range. The most prevalent reasons for clutter endorsed by participants were "Not enjoyable to sort items into what to keep and what to discard" ($n = 311$), "Distress when making decisions about what to keep and what to discard" ($n = 297$), "Prefer to spend time doing something other than sorting items" ($n = 365$), and

“Distress when discarding possessions” ($n = 257$). Of those four reasons, “Prefer to spend time doing something other than sorting items” had the highest average percentage of responsibility for clutter endorsed by participants (44%). Ten participants indicated that school activities (e.g., studying, athletic competitions) was a reason they had clutter. This study increased our overall knowledge about the perception of individuals with and without compulsive hoarding problems for why they have clutter in their homes. Future studies of hoarding should focus on insight as a treatment focus.

119

Name: White, Sadie

Major: Food Science & Technology

Faculty Advisor, Affiliation: Li Zhang, Poultry Science

Project Category: Biological Sciences and Engineering

Co-Author(s): Tianmin Li, Sabin Poudel, Aaron Kiess

REU/Research Program: 2019 CALS URSP

Other Competition(s): Public Health Research Competition

Comparison of four bacterial DNA extraction methods in poultry litter and fecal samples

Bacterial pathogens are prevalent in the poultry industry; the rapid detection of these pathogens is crucial to monitor and control of bacterial infection. The PCR-based method requires high quality DNA for accurate results, but some samples, such as litter and feces, contain large numbers of PCR inhibitors which render the PCR amplification process inaccurate. DNA extraction and purification methods should be assessed to establish the appropriateness and effectiveness for these types of samples. The objective of this study was to assess four methods in their performance and effectiveness in the extraction of bacterial DNA to build a reliable technique for detection of specific pathogens in the poultry environmental samples. The four methods: phenol-chloroform, salt precipitation (Wizard), silica membrane (Qiagen), and magnetic beads-based (MagMAX), were evaluated for the yield, purity, and quality of extracted genomic DNA from litter and fecal samples collected from a commercial broiler farm. A Qubit fluorometer and NanoDrop spectrophotometer were used to measure yield and purity; the quality was evaluated via agarose gel electrophoresis. The processing time and cost for each method was compared. The data was analyzed by SAS 9.4 using a 2 x 4 factorial arrangement and a completely randomized experimental design. The means were separated by Fisher's LSD at $P < 0.05$. The results showed that the four methods produced significantly different yields and purity of extracted DNA ($P < 0.05$). The Wizard method produced the highest DNA yield ($P < 0.05$) while the Qiagen method produced the highest DNA purity ($P < 0.05$). The phenol-chloroform method is the least expensive but is the most time and labor-intensive method. The sample type significantly impacted the yield and purity for each method; the fecal samples resulted in higher ($P < 0.05$) DNA yield and purity than the litter samples. Further research will focus on the detection of specific pathogens in poultry fecal and litter samples.

234

Name: Wicks, Sydney

Major: Psychology

Faculty Advisor, Affiliation: Cliff McKinney, Psychology

Project Category: Social Sciences

Co-Author(s): Erica Szkody

Family Cohesion and Flexibility, Conformity, and Emotion Regulation in Emerging Adults

Greater family cohesion encourages family communication that emphasizes family values and a hierarchical family structure consistent with the conformity orientation of Family Communication Pattern Theory. The level of conformity orientation may limit the possibility to seek help from family members, thus negatively affecting emotion regulation in emerging adults. The current study examined the mediational relationship of family cohesion and flexibility on emotion regulation through conformity orientation. We recruited 100 emerging adults from a large Southern university in the United States. Data was collected between January 2019 and December 2019. We hypothesized that family cohesion will be positively associated with conformity orientation and negatively associated with emotion regulation. Family flexibility will be negatively associated with conformity orientation and positively associated with emotion regulation. Conformity orientation will mediate the

relationship between family cohesion and flexibility and emotion regulation. Results, implications, and limitations from the current study will be discussed.

120

Name: Wilmoth, Bayley

Major: Wildlife & Fisheries Science/Aquaculture & Fisheries Science

Faculty Advisor, Affiliation: Dr. Michael Colvin, Wildlife, Fisheries, and Aquaculture

Project Category: Biological Sciences and Engineering

Co-Author(s): Bayley M. Wilmoth, Michael E. Colvin, Nigel Temple, Eric Sparks

Evaluating Accuracy of Inexpensive Acoustic Water Level Sensors

Hydrological dynamics in streams and lake are important drivers of physical and biological processes of aquatic systems. Minimizing cost and person hours an important consideration for sensors used to collect time series of water level measurements. Recent developments in microcontroller technology and acoustic distance sensors allows researchers to cheaply build water level sensors, but the accuracy of water level measurements is uncertain. This study evaluated the accuracy of a prototype acoustic water level sensors (AWLS). We used an aquaculture tank to simulate the water level dynamics in an aquatic system and assess the accuracy of AWLS. Three AWLS were suspended above the tank. Two HOBO level loggers were placed in the tank with one logger outside the tank to adjust for atmospheric pressure. Water level was also measured manually. The tank was filled and drained repeatedly at different rates over three days to produce known water level dynamics. AWLS water level measurements were then visually and statistically compared to manual measurements and the HOBO level loggers. Water level measurements were not different among the measuring types. Battery life of the acoustic sensors was 5.5 days. AWLS were effective at measuring hydrological variation but field implementation needs longer battery life.

179

Name: Worch, Ethan

Major: Electrical Engineering

Faculty Advisor, Affiliation: Sathish Samiappan, Geosystems Research Institute

Project Category: Physical Sciences and Engineering

Co-Author(s): Meilun Zhou

Hyperspectral Band Selection Using Moth-Flame Metaheuristic Optimization

Metaheuristic optimization algorithms have been popular band selection methods in hyperspectral imaging (HSI) over the years due to their ability to find good solutions in reasonable time frames. Nature-inspired metaheuristics imitate processes in nature to determine solutions and should be investigated in detail stochastically. In this research, the authors propose to use moth-flame optimization (MFO), inspired by the flight of moths around artificial light sources for HSI band selection. The MFO algorithm explores a search space with moths as search agents that circle inwards logarithmically to a flame or artificial light. At every step, the best solution is updated until the exploration is complete. In this paper, a pilot study of MFO based band selection for Indian Pines HSI benchmark dataset is presented. The results of MFO are compared with particle swarm optimization (PSO). Preliminary results show that MFO is a promising strategy for HSI band selection when compared to PSO.

121

Name: Yingling, Ryan

Major: Biological Engineering

Faculty Advisor, Affiliation: Lauren Priddy Raj Prabhu, Agricultural and Biological Engineering

Project Category: Biological Sciences and Engineering

Co-Author(s): Kali M. Sebastian, Aref Yadollahi, Matthew Register

Other Competition(s): Thesis Research Competition (TRC)

Mechanical Deformation Characteristics of Porcine Brain Tissue Enduring Cyclic Compressive Loading

Millions of Americans suffer from traumatic brain injuries (TBIs) every year. In the last decade, repetitive TBIs have been linked to chronic traumatic encephalopathy (CTE), a neurodegenerative disease that affects populations exposed to iterative head impacts such as those that occur in American football and soccer. This study served to examine the mechanical and cellular response of porcine brain tissue to cyclic impacts, in order to better define the relationship between impact variables and brain tissue deformation. Tissue samples were exposed to a quasi-static, cyclic compressive testing procedure for which variables of strain rates ($6.25E^{-3}$, 0.025, 0.100, and 1.00 s^{-1}), strain levels (15, 30, and 40% compressions), and cycle numbers (25, 50, 100, 150, and 200 cycles) were varied. Values of peak stress, hysteresis energy, and change in hysteresis energy over cycle progression were compared within each testing parameter (i.e. strain rate, strain level, and cycle number). Additionally, the cellular response of each sample was examined by measuring alterations in the density and distribution of cell bodies in the tissue via area fraction and nearest neighbor distance calculations, respectively. The mechanical responses for each parameter demonstrated pronounced stress softening behavior. This study provided further evidence of the highly nonlinear, strain rate dependent characteristics of the viscoelastic brain tissue.

235

Name: Young, Amy

Major: Psychology

Faculty Advisor, Affiliation: Dr. Mary Dozier, Department of Psychology

Project Category: Social Sciences

Emotional Attachment to Objects in Older Adults with Hoarding Disorder

Since there has been limited research on geriatric hoarding disorder in rural areas, the purpose of this study is to assess the characteristics of hoarding disorder in older adults who reside in Northern Mississippi. In particular, we examined the emotions expressed by participants when sorting and discarding possessions. The study took place in participants' homes and consisted of self-report measures, a structured interview, and completion of a neuropsychological battery. The final part of the assessment was a behavioral sorting task where participants are asked to sort through personal items and asked to make a decision to either keep or discard each item. Participants were asked to rate their Subjective Units of Distress (SUDs) and were asked to state their emotional state prior to the sorting task, every 5 minutes throughout the test, and after completing the task. The average age of the 8 participants was 68 with an average of 14 years of education completed. There were 2 males and 6 females. Four participants did not complete the sorting task for a variety of reasons. For the 4 participants who did complete the task, an average of 52.75 items were sorted and an average of 24 items were discarded. Every participant chose to sort items in their living rooms. The average pre-task SUDs was 56 and the average post-task SUDs was 10. The average change in SUDs from pre-task to post-task was 40. The participants reported feeling "joy," "anticipation," and "hopeful" prior to the task. During the task, participants reported feeling "joy," "frustration," and "hope." After the task was finished, participants reported feeling "joy" and "hopeful." Overall, less than half of the items sorted were discarded and most participants felt positive emotions on the SUDs. This study supports prior research suggesting that not all hoarding is fear based.

021

Name: Yu, Yongxin

Major: Landscape Architecture

Faculty Advisor, Affiliation: Cory Gallo, Department of Landscape Architecture

Project Category: Arts and Humanities (Poster)

Co-Author(s): Peter Summerlin

The Amrabad Tiger Preserve: A conceptual model for protecting Bengal tigers and supporting indigenous cultures

At the turn of 20th century there were more than 100,000 Tigers in the world. Today only 3,890 still live in the wild. Home to 80% of the world's tigers, India has embarked on a conservation plan to create 50 tiger reserves as part of 'Project Tiger'. Since 1973, this program has created numerous preserves, including the 2,800 sq. km. Amrabad Tiger Reserve in the central eastern area of the country. However, the preserve has created a conflict between the indigenous people that have occupied the region for thousands of years and the government's goals of preserving tiger habitat. This study explores the specific habitat needs of wild, Bengal Tigers, the specific cultural needs of the indigenous peoples in the areas and developed an approach to identify the most suitable model for both preserving tiger habitat and preserving areas for indigenous peoples to thrive in the preserve.

The project includes background research on the physical attributes of the preserve, the specific habitat needs of tigers (including the habitat needs of their prey), and the cultural and food production needs of the indigenous peoples. Through a comparative analysis of the individual needs of each group, the project maps the habitat for tigers, and then overlays the best areas for human development. These two systems are weighed against each other to form three different planning approaches that could be successfully executed in the preserve.

180

Name: Zhou, Meilun

Major: Computer Engineering

Faculty Advisor, Affiliation: Sathish Samiappan, Geosystems Research Institute

Project Category: Physical Sciences and Engineering

Co-Author(s): Ethan Worch

Hyperspectral Image Classification Using Fisher's Linear Discriminant Analysis Feature Reduction with Gabor Filtering and CNN

Deep learning-based approaches for hyperspectral image (HSI) feature extraction and classification have gained popularity in recent years. Effective extraction of spectral and spatial information is desired for classifying HSI using a convolutional neural network (CNN) to avoid overfitting. Previous research suggests that Fisher's linear discriminant analysis (LDA) is a better alternative for HSI feature reduction compared to principal component analysis (PCA). In this work, an LDA approach is studied as a dimensionality reducer along with a Gabor filter for extracting spatial features and classification using CNN. The efficacy of the proposed approach is compared with a similar classification scheme with the PCA. Experimental results from two benchmark HSI datasets show the benefits of using LDA with notable improvements in class and overall accuracies.

*Home Institution other than Mississippi State University - Main Campus

Projects Not Submitted for Judging (Display Only)

Name: Shannon Warren

Major: Chemistry

Faculty Advisor: Todd Mlsna, Department of Chemistry

Co- Authors: Amali Herath, Chanaka M Navarathna,

Title: A versatile Fe-Ti oxide/biochar composite adsorbent for contaminant removal from water

Name: Alexia Parker

Major: Human Science/ Fashion Design and Merchandising

Faculty Advisor: JuYoung Lee, School of Human Science; Joe Wilmoth, School of Human Science

Co-Authors: Alena Calderon, Korey Charles, Madalyn Bails, Taylor Nix

Title: Knowledge of Fair Trade and College Consumer's Intent to Purchase

Name: Matelyn Jones

Major: Human Development Family Science

Faculty Advisor: Joe Wilmoth, School of Human Science; JuYoung Lee, School of Human Science

Co-Authors: Kelly Pigott, Malorie Payne, Chole Balducci, Kody Schexnayder

Title: On-Campus Involvement and GPA

Name: Nicole Rigsby

Major: Business Economics

Faculty Advisor: Melanie Loewing, Communication; Brian Shoup, Political Science & Public Administration

Title: Disaggregating Education and Political Behavior Outcomes: A Review of the Literature

Name: Madi Claire Windham

Major: Biochemistry

Faculty Advisor: Xueyan Shan,

Co-Authors: Felicia Parish, Akanksha Awasthi, W. Paul Williams, Gary L. Windham

Title: Verification of Maize Genes Associated with *Aspergillus flavus* Resistance and Aflatoxin Reduction



SUMMER 2020

**Undergraduate
Research Symposium**

Friday, July 31, 2020

Griffis Hall, Mississippi State University

**Abstract submissions will be accepted
starting May 2020.**

honors.msstate.edu/research/undergraduate-research-symposium/



MISSISSIPPI STATE UNIVERSITY™

JUDY AND BOBBY SHACKOULS HONORS COLLEGE

SUPPORT PROVIDED BY:



MISSISSIPPI STATE UNIVERSITY™
OFFICE OF THE PROVOST AND
EXECUTIVE VICE PRESIDENT



**MISSISSIPPI STATE
UNIVERSITY™**

OFFICE OF RESEARCH AND
ECONOMIC DEVELOPMENT



**MISSISSIPPI STATE
UNIVERSITY™**

COLLEGE OF ARTS & SCIENCES

THE HONOR  SOCIETY OF

PHI KAPPA PHI



**MISSISSIPPI STATE
UNIVERSITY™**

CENTER FOR
COMMUNITY-ENGAGED LEARNING



**MISSISSIPPI STATE
UNIVERSITY™**

THE GRADUATE SCHOOL



**MISSISSIPPI STATE
UNIVERSITY™**

DEPARTMENT OF FOOD SCIENCE,
NUTRITION AND HEALTH PROMOTION



MISSISSIPPI STATE UNIVERSITY™
NATIONAL STRATEGIC PLANNING
& ANALYSIS RESEARCH CENTER



**MISSISSIPPI STATE
UNIVERSITY™**

STUDENT ASSOCIATION