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ANS Day 2021 Abstract Book

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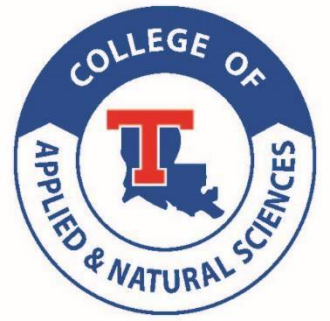

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College of Applied and Natural Sciences
ANS Day & ANS Research Symposium
Louisiana Tech University Student Center

April 15, 2021

8:00-8:10 Welcome

8:15-9:15 Breakout Rooms

Breakout Room 1A: Faculty Presentations

- Bulldog Clinic: Providing Real-World Experience to Healthcare and Child Development Undergraduates
  Keeley Machen & Dr. Julie Rutledge, Human Ecology
- Nutritional Environment Measures Survey Project
  Vicky Green, Human Ecology
- The Case for Precision Medicine
  Dr. Sherry Peveto & Dr. Rebecca Clark, Nursing
- Development of Nutrition Focused Physical Assessment Skills
  Dawn Erickson, Human Ecology
- Pint-Sized Impressions: Creation of a Pediatric Simulation Center
  Tanya Sims, Sarah McVay, and Dr. Patti McFadden, Nursing

Breakout Room 1B: Undergraduate Presentations

- Wastewater Detection of SARS-CoV-2.
  Laura Lee, Biological Sciences
  Advisor: Dr. Jamie Newman
- What Environmental Factors Affect Calling Activity of Frogs in Northern Louisiana?
  Peyton Franklin, Biological Sciences
  Advisor: Dr. Julia Earl
- DNA Sequences in the human beta-globin gene that are suitable for genome manipulation by DNA recombinases
  Gabriel Peterman, Morgan Setliff, and Yuri Voziyanov, Biological Sciences
  Advisor: Dr. Yuri Voziyanov

- Determining Patterns of Avian Herbivory Related to Loblolly and Longleaf Pine Seed Genetics
  Kelsey Shoemaker, Agricultural Sciences & Forestry
  Advisors: Dr. Paul Jackson & Dr. Heidi Adams
- ExoSense: a microprobe-based method for single-step isolation and genetic analysis of exosomes
  Clay Brasuell, Biological Sciences
  Advisor: Dr. Gergana Nestorova
- Determination of best methods of temporary identification of horses during disasters
  Brent Nugent and Tori Olivier, Agricultural Sciences & Forestry
  Advisor: Dr. Rebecca McConnico and Dr. Laura Gentry
- How Do Young Adults in the South Learn About Sexual Orientation?
  Haley Bryan, Hannah Cascio, Annie Cook, Annie Gremillion, David Rusk
  Advisor: Dr. Katie Barrow

9:15-9:30 Break

9:30-10:30 Breakout Rooms

Breakout Room 2A: Graduate Student Presentations

- The Role of Notch1 and Notch3 in Adult Stem Cell Osteogenesis
  John Bradley Cart, Biological Sciences (MSNT)
  Advisor: Dr. Jamie Newman
- Enhanced Germination of Heat Activated *Bacillus anthracis* Spores Persists Over a Five-week Period
  Andrew Roser, Biological Sciences (MSNT)
  Advisor: Dr. Rebecca Giorno
- MED12 involved in initiating adipogenesis in human adult stem cells
  Joseph Straub, Biological Sciences (MSNT)
  Advisor: Dr. Jamie Newman
- Photon versus proton neurotoxicity: impact on mitochondrial function and 8-OHdG base-excision repair mechanism in human astrocytes
  Hope Hutson, Biological Sciences (MSNT)
  Advisor: Dr. Gergana Nestorova
- The role of MED12 in adipogenesis of human adipose stem cells (hASCs)
  Onyekachi Idigo, Biological Sciences
  Advisor: Dr. Jamie Newman
- The Relationship between vitamin D intake, sun exposure, handgrip strength, and HG A1C levels in college students
  Janelle Melancon, Human Ecology
  Advisor: Dr. Simone Camel

- The Role of MED12 in Adipogenesis
  Caroline Rinderle, Biological Sciences
  Advisor: Dr. Jamie Newman
- Notch and Mediator work together to direct hASC self-renewal
  Jaylen Mumphrey & Taylor Teach, Biological Sciences
  Advisor: Dr. Jamie Newman

Breakout Room 2B: Undergraduate Presentations

- Notch Signaling Plays a Key Role in Regulating Adult Stem Cell Osteogenic Differentiation
  Summer Adams & Lucas Norris, Biological Sciences
  Advisor: Dr. Jamie Newman
- Factors Related to Quality and Yield Grading on Cattle in North Central Louisiana
  Molly Dickens, Agricultural Sciences & Forestry
  Advisor: Dr. Mark Murphey
- Analysis of North Central Louisiana Fed Cattle Traits and Production Practices
  Emily Milbourn, Agricultural Sciences & Forestry
  Advisor: Dr. Mark Murphey
- Factors Affecting Dressing Percentages of Cattle Harvested in North Central Louisiana
  Tyler Mayfield, Agricultural Sciences & Forestry
  Advisor: Dr. Mark Murphey
- Crabtivating Behavioral Analysis: the Impacts of Fipronil Pesticides on Blue Crab Behavior
  Annabeth Rawls, Biological Sciences
  Advisor: Dr. Jennifer Hill
- The Effect of Leaf Species on Insect Oviposition Preference and Colonization
  Brent Lawson, Biological Sciences
  Advisor: Dr. Julia Earl
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  Jamie Sparkman, Emily Meaney, School of Biological Sciences
  Advisor: Dr. Jamie Newman

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Bulldog Clinic: Providing Real-World Experience to Healthcare and Child Development Undergraduates

Keeley Machen[1], Julie Rutledge[2], Patti McFadden[3], Sarah McVay[3], Laura Chestnut[4], Shannon Tatum[4], Amy Yates[5], Katie Barrow[6]

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A key component of enhancing professional skills and understanding course materials in undergraduates is the ability to take course content and apply it in real-world experiences. This is particularly important for healthcare students who will be providing direct care to patients. Further, the healthcare environment can be threatening and overwhelming to children. The fear of visiting the doctor or hospital can decrease with developmentally appropriate preparation and education. The purpose of the Bulldog Clinic is to normalize the healthcare setting for children as they guide their bulldog (the patient) through the hospital experience while providing students with experience in teaching children about medical equipment/procedures they may experience in medical settings. Children become familiar with real medical equipment and learn coping techniques as they participate in the student-led medical stations. Human Development and Family Science (HDFS) and Division of Nursing students will implement knowledge into practice by engaging children in medical play. Several HDFS courses have included assignments in preparation for the Bulldog Clinic including Parenting (prepare materials for parents) and Hospitalized Children/Youth (design the clinic). The goal of these projects was to utilize the Bulldog Clinic to give students experience in translating course content into material for consumers (i.e., parents), preparation for community educational events, preparing materials for developmentally appropriate preparation and education for healthcare setting for children, and, most importantly, the opportunity to have real-world experience practicing the skills they are learning in healthcare and child development. The pilot run of the Bulldog Clinic is scheduled for Spring 2021.

Nutritional Environment Measures Survey Project

Vicky Green

Assistant Professor, School of Human Ecology, Louisiana Tech University

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Community nutrition is one of the growing areas of practice for nutrition and dietetics professionals. FNU 403: Community Nutrition helps to prepare our students for the real-world of this profession by teaching core concepts such as community needs assessments, asset mapping, and assessment evaluation. Community needs assessment is the process of evaluating the health and nutritional status of a community. Determining the community's health and nutrition needs and identifying places where those needs are not being met is the basis for planning interventions.

Our environment impacts our health outcomes. It is imperative that we understand the environment in which our clients live to make appropriate recommendations. One way to do this is surveying food and nutrition environment using the Nutrition Environment Measures Survey (NEMS). The NEMS tools are validated observational measures to assess the community and consumer nutrition environments in food outlets, specifically stores, corner stores and restaurants that focus on availability of healthful choices, prices and quality. Students will use the resources provided by this grant to conduct community assessments. Using critical thinking and problem solving skills students will develop plans of action and set priorities for intervention projects and educational outreach efforts of the class and department. Long-term goals of this project would include developing assessment data of Ruston/Lincoln parish for larger research and intervention projects.

FNU 403: Community Nutrition is a required course in the undergraduate nutrition and dietetics curriculum. It is scheduled to be offered in Winter quarter 2022 and this project will begin.

The Case for Precision Medicine

Sherry Peveto[1], Rebecca Clark[1], Don Johnston[2], Ashley Wiltcher[3]

[1]*Assistant Professor, Division of Nursing, Louisiana Tech University*
[2]*Northwestern State University*
[3]*University of Louisiana Monroe*

All of Us Research program sponsored by the National Institute of Health is designed to help build one of the most diverse health databases in history. The data will be used to learn more about how an individual's biology, lifestyle and environment can affect one's health in an effort to find ways to prevent and treat disease. The All of US presentation was executed on the La Tech campus and ULM campus via virtual and live format. Students, faculty, healthcare providers and area stakeholders were invited to attend. A pre and post survey on precision medicine was given to evaluate the knowledge base of participants. The goal of the program is to inform the public about precision medicine and recruit for participation in the national database of health information to assist researchers in developing therapies and clinical pathways that provide better outcomes for population health.

Development of Nutrition Focused Physical Assessment Skills

Dawn Erickson[1], Vicky Green[2]

[1]*Instructor, School of Human Ecology, Louisiana Tech University*
[2]*Assistant Professor, School of Biological Sciences, Louisiana Tech University*

Nutrition and Dietetics majors are required to meet the curriculum requirements of the accrediting body, the Accreditation Council for Education in Nutrition and Dietetics (ACEND). The course FNU 414: Nutrition Assessment meets the required ACEND student learning outcomes for evaluation of nutrition assessment to identify individuals at nutrition risk and use of the Nutrition Care Process to make decisions, identify nutrition-related problems and determine and evaluate nutrition interventions.

As part of the systematic assessment process, the Nutrition Focused Physical Exam (NFPE) is a physical exam performed by Registered Dietitian Nutritionists to assess nutritional status or evaluate patients for malnutrition. It is imperative that students gain these skills in our labs to be competent entry-level practitioners.

Funds awarded by the ANS Instructional grant for the development of nutrition focused physical assessment skills, provided materials that will aid in teaching nutrition students how to obtain various anthropometric measurements and complete NFPE assessments. In addition students will be able to use these skills along with the equipment, to enhance the department's outreach efforts in the community at health fairs and promotional events.

The items purchased with these funds represent some of the basic needs for a modern nutrition assessment lab. Items were selected and reviewed by the Nutrition and Dietetics faculty for basic function, practicality, accuracy and overall need for the nutrition assessment class and the program. Specific equipment purchased includes the pitting edema trainer, handheld body fat loss monitor, slide calipers, digital baby and toddler scale, and a baby measuring board.

Pint-Sized Impressions: Creation of a Pediatric Simulation Center

Tanya Sims[1], Sarah McVay[2], and Patti McFadden[2]

[1]*Professor, Division of Nursing, Louisiana Tech University*
[2]*Associate Professor, Division of Nursing, Louisiana Tech University*

Pediatrics is a specialized area of nursing that requires unique equipment, specific skill methodologies, intentional communication, and targeted assessment strategies. The Division of Nursing received an allocated area for a Pediatric Simulation Center that was enhanced with an Innovative Instruction Grant from the College of Applied & Natural Sciences in the fall of 2020. What began as an empty sterile space transformed into a pediatric simulation center, providing a more realistic clinical experience for nursing students enrolled in NURS 212, Child Health Maintenance. The goal for creation of the Pediatric Simulation Center is to provide students clinical experiences infused in a realistic pediatric environment to prepare them for future interactions with children with a greater sense of confidence.

The Simulation Center mimics a children's hospital environment through visually stimulating images that serve as both a distraction technique for pediatric assessment as well as a realistic child-friendly health care setting. Pediatric assessment equipment, a high-fidelity school–age pediatric mannequin and low fidelity newborn and toddler mannequins complete the setting. Funded storage facilitates functionality of equipment access during the simulation experience. This transformed setting fosters nursing student assimilation of clinical practice essential to accommodating a child's unique medical and emotional needs. The Pediatric Center promotes realistic clinical preparation for nursing students and will create avenues for future opportunities for collaboration and interdisciplinary partnerships.

Wastewater Detection of SARS-CoV-2

Laura Lee[1], Sree Venigalla[2], Haley Barnett[2], Paul Austin[2], John Matthews[3], Jamie Newman[4]

[1]*Undergraduate student, School of Biological Sciences, Louisiana Tech University*
[2]*Graduate student, Molecular Science and Nanotechnology, Louisiana Tech University*
[3]*Associate Professor, Trenchless Technology*
[4]*Associate Professor, School of Biological Sciences, Louisiana Tech University*

SARS-CoV-2 can be transmitted up to five days before a positive test or onset of symptoms. In addition, asymptomatic individuals that go untested can transmit SARS CoV-2, causing an inaccurate measure of positivity in the community. Already being used successfully in Spain, Italy, and Sub-Saharan Africa to analyze and mitigate spread of the virus, Wastewater-Based Epidemiology (WBE) allows for the detection of pathogens in samples collected from wastewater samples regardless of symptoms. WBE can give real-time insights into the prevalence of SARS-CoV-2 in a population, as it samples from an entire community and does not rely on individual testing. Testing and monitoring the city of Ruston's wastewater for SARS-CoV-2 RNA will provide a more accurate count of positive cases present across the population and possibly allow health care providers to mitigate the spread. Samples are pulled over a 24-hour period and examined using quantitative reverse transcriptase PCR (qRT-PCR) to detect viral genome units for genes that encode two nucleocapsid proteins in SARS-CoV-2, N1 and N2. We have observed increases in viral RNA at specific points throughout the pandemic, largely consistent with positive case statistics. We continue to monitor wastewater in the city of Ruston and at specific locations on campus to determine efficacy in individual testing, reporting, and determine if results may be used to predict future surges and work to effectively prevent the further spread of COVID-19. WBE could allow researchers to predict and prevent future viral outbreaks in order to avoid a pandemic in the future.

What Environmental Factors Affect Calling Activity of Frogs in Northern Louisiana?

Peyton Franklin[1], Julia E. Earl[2], Donald B. Shepard[2]

[1] *Undergraduate, School of Biology, Louisiana Tech University*
[2] *Assistant Professor, School of Biology, Louisiana Tech University*

Multiple variables influence amphibian activity, such as weather, time of year and day, sound, and light (artificial or natural). Previous studies have found that light can impact frog calling behavior, and species vary in their responses to light levels. Because call surveys are useful in determining whether a site is occupied by a species, it is important to determine what factors affect calling activity. In this study, we determined how light and the other previously mentioned variables affect calling activity of two species of frog (Spring Peepers and Cajun Chorus Frogs). We conducted nighttime frog call surveys between January and May 2019 in 14 different areas in northern Louisiana. We recorded data on vocalizing species, weather, noise, and light. We then created occupancy models for each species in R to determine which factors best predict frog calling activity. The null model was the best model for Spring Peepers; they call in almost all conditions. For Cajun Chorus Frogs, the noise model was the best model, but none of the parameters were significant. Although we predicted light would have a greater impact on frog calling activity than other variables, it was not an effective predictor of calling activity. For future investigations, we recommend focusing on the relationship between noise level and calling activity of Cajun Chorus Frogs. We plan to repeat these analyses for other frog species.

DNA Sequences in the human beta-gobin gene that are suitable for genome manipulation by DNA recombinas

Gabriel Peterman, Morgan Setliff[2], and Yuri Voziyanov[3]

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[3]*Professor, School of Biological Sciences, Louisiana Tech University*

Genome editing is a rapidly evolving field that benefits from the availability of different tools that can be used to manipulate genomes. The relative simplicity of modifying target specificity of site-specific nucleases, particularly in the CRISPR/Cas9 system, made these DNA manipulation enzymes the leaders of the genome editing field. However, the intrinsic properties of the nuclease systems, such as their significant off-target activity and the necessity to introduce double strand breaks, increase the probability of abnormal genome modifications and therefore dangerous side effects thus limiting the use of the nuclease systems to treat patients. To overcome these limitations, alternative genome editing approaches that rely on different DNA processing mechanisms are being actively explored.

Some of these approaches take advantage of the unique functional properties of the tyrosine DNA recombinases which are highly specific for their target sequences, versatile, and self-sufficient in performing DNA manipulation reactions as they do not require cellular enzymes to complete the reactions. Several members of the tyrosine recombinase family, such as recombinase Cre from bacteriophage P1, recombinase Flp from baker's yeast, and integrases from bacteriophages lambda and HK022, are actively used to manipulate genomes.

In the present work we analyzed several genomic sequences in the vicinity of the mutation that causes sickle cell anemia for their ability to get recombined by the bacteriophage lambda integrase. Out of six sequences tested, three sequences were recombination positive. Our results open an opportunity to develop safe genome editing approaches to replace the mutated genomic sequence with the normal one.

Determining Patterns of Avian Herbivory Related to Loblolly and Longleaf Pine Seed Genetics

Kelsey Shoemaker[1], Paul Jackson[2], Heidi Adams[2]

[1]*Undergraduate, School of Agriculture and Forestry, Louisiana Tech University*
[2]*Associate Professor, School of Agricultural Sciences and Forestry, Louisiana Tech University*

Results from a recent survey indicated avian herbivory as the leading cause of seed loss in tree seedling container nurseries in the southern United States. Economic losses resulting from seed consumption, lower seedling sales, and wasted growing medium may exceed $150,000 with a 1 percent seed loss. Despite its prevalence, patterns in avian herbivory are currently not well defined. Observations by nursery staff may indicate that birds tend to forage more heavily on seedlots of higher genetic quality produced through tree improvement initiatives. Thus, the objective of this research is to determine if different levels of seed genetics impact consumption preferences. Three loblolly pine (Pinus taeda L.) seedlots and two longleaf pine (Pinus palustris Mill.) seedlots will be tested. Loblolly pine treatments will consist of open-pollinated seedlots (high and low grades) and a mass controlled pollinated seedlot, while longleaf pine treatments will consist of improved (high quality) and unimproved (low quality) seedlots. Seeds will be sown in IPL Rigi-pots™ (trays of 45 cells) and arranged in a randomized complete block design at two sites near tree lines. Container cells will be evaluated for intact or consumed seeds for 10 days, and remote game cameras will be used to identify avian species responsible for disturbances. Determining patterns in seed loss will assist nursery mangers with seed selection and help mitigate economic losses from avian herbivory.

ExoSense: a microprobe-based method for single-step isolation and genetic analysis of exosomes

Clay Brasuell[1], Chukwumaobim Nwokwu[2], Saif Mohamad Ishraq Bari[2], Gergana G. Nestorova[3]

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[3]*Assistant Professor, School of Biological Sciences, Louisiana Tech University*

The goal of this study is to develop a new method for non-invasive and selective isolation of exosomes from cell media. Exosomes, a type of extracellular vesicles, contain proteins and RNA biomarkers for the diagnosis of diseases. The core of this technology is a stainless-steel microprobe (300μm × 30mm) functionalized with anti-CD63 antibodies that specifically capture pure exosomal subpopulations. This method provides several advantages over commercial exosome-purification technologies. These include increased selectivity, purification of an antigen-specific subpopulation of exosomes, and direct integration of the microprobe with genetic analysis instruments. Experiments were performed to assess the efficiency of the functionalization of the probe as well as the number of captured exosomes, exosomal protein, and RNAs per probe. Scanning electron imaging was used to visualize the polyelectrolyte coverage while fluorescent imaging was applied to determine the efficiency of the chemical bond of NH2-conjugated biotin to the COOH group of polyacrylic acid. The captured exosomes were quantified by measuring the activity of acetylcholinesterase (AChE). The BCA protein assay was utilized to quantify the amount of protein captured per microprobe while Agilent Bioanalyzer 2100 was used to assess the quantity and quality of the exosomal RNA. Our results indicate that the microprobe-based technology isolates CD63-positive exosomal subpopulation (23×106 exosomes/probe) from astrocytes derived cell media after 16 hours of incubation. The exosomal fraction is enriched in small RNAs. Future work will focus on the assessment of blocking reagents (BSA, PEG) to reduce the binding of the cell-media-derived protein to the surface of the probe.

Determination of best methods of temporary identification of horses during disasters

Brent Nugent[1], Tori Olivier[1], Krisxan Bell[1], Dr. Laura Gentry[2]

[1]*Undergraduate Student, School of Agricultural Sciences and Forestry, Louisiana Tech University*
[2]*Associate Professor, School of Agricultural Sciences and Forestry, Louisiana Tech University*

Natural disasters are becoming increasingly common and more erratic causing the safety of livestock to be at risk. When natural disasters occur animals can be displaced. Although horses can be microchipped, in a natural disaster setting it could be hard to scan and identify each individual horse. Therefore, it is important for owners to put a form of temporary identification on the horse that can be seen from a distance, will not get weathered quickly, and will also not fall off. With so many options for temporary identification it is critical to know which one would perform best in a natural disaster situation. In our research, sixteen methods of temporary identification were applied to twelve horses. The condition of each product was monitored for a total of five weeks to determine which one was best suited for disaster situations. The visibility, presence, and deterioration of each product was monitored and compiled for the first four days of the study and then every week for five weeks. Our results showed that cattle ear tags braided into the tail had the best visibility, least deterioration, and most presence among all temporary identification devices. This finding rejects the hypothesis that animal identification inscription placed directly on the animal's hair or skin will be readable for a longer duration than methods using a device. This study can help owners in choosing which temporary identification to use in a natural disaster situation.

How Do Young Adults in the South Learn About Sexual Orientation?

Haley Bryan[1], Hannah Cascio[1], Annie Cook[2], Annie Gremillion, David Rusk[3,] Katie Barrow[4]

[1]*Undergraduate Student, School of Human Ecology, Louisiana Tech University*
[2]*Undergraduate Student, Division of Nursing, Louisiana Tech University*
[3]*Graduate Student, College of Education. Louisiana Tech University*
[4]*Assistant Professor, School of Human Ecology, Louisiana Tech University*

This retrospective qualitative investigation seeks to understand how youth learn about sexual orientation from their families and communities. Utilizing a narrative approach, thirty-nine (n=39) young adults compiled a one-page, single-spaced narrative (approximately 650 words) in which they reflected on the messages they received about sexual orientation – and to a lesser extent, gender identity – throughout childhood, adolescence, and emerging adulthood. A multi-theoretical framework guided the development of this study and informed the data analysis, which was conducted through an intensive constant comparative process of open, axial, and selective coding techniques. Members of the research team separately reviewed each narrative before coming together to discuss codes and create a unified, yet flexible, coding scheme that revealed explicit and implicit messaging surrounding sexual orientation in micro and macro systems (e.g., families, schools, media). Findings suggest a common pattern of learning and unlearning through a myriad of individual, interpersonal, and educational experiences, causing youth to explore and critique information they were told about sexual orientation and gender identity. Additionally, the influence of ecosystems and life course factors revealed nuances in what youth were exposed to and how they questioned, challenged, and/or endorsed longstanding beliefs about the ways sexual orientation and gender identity are experienced.

The Role of Notch1 and Notch3 in Adult Stem Cell Osteogenesis

John Bradley Cart[1], Summer Adams[2], Lucas Norris[3], Dr. Jamie Newman[4]

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[3]*Undergraduate Student, School of Engineering and Science, Louisiana Tech University*
[4]*Associate Professor, School of Biological Sciences, Louisiana Tech University*

Human adipose-derived stem cells (hASCs) have significant therapeutic potential due to their ability to self-renew, differentiate down multiple lineages, and modulate the immune system. In addition to these many benefits, hASCs boast a minimally invasive harvesting procedure, making them a readily available cell source for stem cell research and tissue regeneration. Despite their broad use, very little is known about the mechanisms that control cell fate. We seek to further understand how hASCs can be used to clinically treat degenerative bone diseases by studying the mechanisms that regulate osteogenic differentiation.

One way to enhance our mechanistic understanding of differentiation is through the systematic examination of the signaling pathways. The Notch signaling pathway is a highly conserved, contact dependent, cell-to-cell signaling cascade known to regulate cell state and multipotent differentiation of hASCs. This pathway consists of four unique receptors and five unique ligands. Two receptors believed to play a significant role in regulating osteogenic differentiation are Notch1 and Notch3.

We are characterizing Notch1 and Notch3 expression during osteogenesis and evaluating the effect that siRNA-mediated knockdown of each receptor has on osteogenic differentiation. By studying changes in osteogenic marker expression following a reduction in Notch expression and activity, we will be able to determine how each receptor individually affects the osteogenic potential of hASCs and identify potential novel therapeutic targets to treat bone damage and loss.

Enhanced Germination of Heat Activated Bacillus anthracis Spores Persists Over a Five-week Period

Andrew Roser[1], Blake Roberson[2], Alex Plaisance[3], Rebecca Giorno[4]

[1]*Graduate Student, School of Biological Sciences, Louisiana Tech University*
[2]*Undergraduate Student, School of Engineering and Science, Louisiana Tech University*
[3]*Undergraduate Student, School of Biological Science, Louisiana Tech University*
[4]*Associate Professor, School of Biological Science, Louisiana Tech University*

Bacteria of the Bacillus genera can form dormant and resilient cells called spores in response to starvation. These dormant spores can be reactivated in the presence of nutrients by a process called germination. Historically, spores are exposed to sublethal heat treatments, known as heat activation, to increase the extent and rate of germination. Previous studies on Bacillus cereus T indicate that effects of heat activation are reversible within 72 hours. After this time, the spores must be reactivated. However, recent experiments by our lab suggest that this might not be the case for Bacillus anthracis spores. B. anthracis Sterne spores were prepared by exhaustion and extensively water washed. Each sporulation was split into three samples: no heat treatment (UH), heat activated day zero of experiment (HA), and heat activated same day of measurement relative to day 0 (Hn). Spores were heated at 65oC for 30 minutes, cooled on ice for 15 minutes, and warmed to room temperature. Germination was initiated with 1mM inosine paired with either 1mM L-alanine or 1mM L-serine in 20 mM Tris pH 7.5 and was measured by the loss of OD at 580nm on various days up to five weeks. As expected, heat activation had a positive impact on spore germination with either germinant pair. On day zero using L-alanine and inosine, UH spores had an OD loss of 33% while HA and H0 spores had an OD loss of 58% and 59%, respectively, after 60 minutes. On day 35, UH spores had only 38% OD loss compared to HA and H35 with 62% and 65%, respectively. A similar trend was observed with L-serine and inosine. Our data suggest that B. anthracis spores remain activated for at least 35 days after heating. This may have broader impacts on our understanding of heat activation among Bacillus species.

MED12 involved in initiating adipogenesis in human adult stem cells

Joseph Straub[1], Sree Venigalla[1], Onyekachi Idigo[1], Caroline Rinderle[1,] Jamie Newman[2]

[1]*Graduate Student, School of Biological Sciences, Louisiana Tech University*
[2]*Associate Professor, School of Biological Sciences, Louisiana Tech University*

The Mediator Complex is a critical transcriptional cofactor in the regulation of cell-type specific gene expression. Our research focuses on how Mediator influences the differentiation of human adipose-derived stem cells (hASCs). We are focused on MED12, a Mediator kinase domain subunit that appears to have a significant role in maintaining cell state. We hypothesize that the loss of MED12 disrupts adipogenic differentiation in hASCs. We have performed siRNA-mediated knockdowns of MED12 in hASCs prior to inducing adipogenesis and observed reduced adipogenesis as demonstrated by cell morphology, lipid vesicle staining, and PPARG expression. We also show evidence of a role for MED12 in initiating adipogenesis using delayed knockdown assays in which adipogenesis is allowed to progress before treatment with MED12 siRNA. MED12's influence on adipogenesis appears to decrease between 3- and 7-days post-induction. This research is important for elucidating the requirements for proper transcriptional regulation of clinically-relevant hASCs in order to aid in maximizing their application in the clinic and areas of regenerative medicine.

Photon versus proton neurotoxicity: impact on mitochondrial function and 8-OHdG base-excision repair mechanism in human astrocytes

Hope Hutson, Kaitlynn Willis[1], Chukwumaobim D. Nwokwu[2], Matthew Maynard, Gergana G. Nestorova[3]

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Proton and photon ionizing radiation exposure is commonly used in the treatment of various forms of cancer. Because radiation is used often as a form of medical therapy, it is important to investigate the neurotoxic effects associated with radiation exposure in order to reduce these effects in the design of future medical irradiation methods. An ELISA test was used to assess the excision rate of 8-Oxo-2'-deoxyguanosine (8-OHdG), a common biomarker of oxidative stress, from the astrocytes into the surrounding cell media. RT-qPCR analysis was used to measure the expression level of OGG1, a protein involved in DNA repair in the excision repair pathway. The radiation-induced neurotoxic effects on the mitochondria were analyzed using fluorescent imaging and PCR. MitoTracker™ Orange CM-H2TMRos and MitorTracker™ Green FM dyes were used to measure mitochondrial mass and oxidative activity. Image J software was used for data analysis. Mitochondrial copy number was measured using RT-qPCR analysis, and extracellular oxygen consumption rates were assessed using fluorescent measurement. The results indicate a decrease in OGG1 expression and a decreased excision rate of 8-OHdG. Mitochondrial mass was overall increased following radiation treatment, while both mitochondrial oxidative activity and extracellular oxidative consumption were reduced. Mitochondrial copy number increased, and the viability of the astrocytes following treatment was confirmed. It can be concluded that ionizing radiation exposure is associated with the impairment of cellular DNA repair and an overall decrease in mitochondrial function in human astrocytes. Photon radiation treatment is associated with an increased negative impact on cellular and mitochondrial activity.

The role of MED12 in adipogenesis of human adipose stem cells (hASCs)

Onyekachi Idigo[1], Sree Venigalla[1], Jamie Newman[2]

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The interest in adipogenesis stems from the high rate of obesity in the world and the motivation to better understand the process of cell fate in relation to human diseases. Mutations in MED12 lead to developmental disorders and certain malignancies. To date, specific roles of Mediator and MED12 in cell state regulation are unclear, nevertheless, they are critical for understanding stem cell regulation and enhancement of their clinical applications. This study investigates the role of MED12 in relation to the Mediator complex kinase domain to better understand transcriptional control of adipogenesis in hASCs. MED12 expression was diminished with MED12 specific siRNA and adipogenesis was induced/assessed at different time points (day 3,7 and 14) using phase imaging to detect lipid droplets with Oil red-O staining being used to further validate differentiation and visualize the cells. To validate and confirm the effects of the MED12 knockdown, qRT-PCR and western blot analysis was carried out. Results from this study show that in the absence of MED12, there is a significant decrease in the number of lipid vesicles compared to the negative control as observed via oil red-O staining and a decrease in the expression of adipogenic transcription factors such as PPARγ and C/EBPα via qRT-PCR and western blot analysis. Taken together, these data suggest a significant role for MED12 in regulating adipogenesis and will initiate new research into understanding the regulatory mechanisms of adipogenesis and offer insight into novel treatments for obesity and relevant human disease."

The Relationship Between Vitamin D Intake, Sun Exposure, Handgrip Strength and HG A1C Levels in College Students

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Vitamin D is known for its importance to bone health and calcium metabolism, but also plays a role in insulin resistance. Recent research has recognized its role in insulin secretion, inflammatory response, and adipose tissue changes as possible reasons for its association with insulin resistance and cardiovascular disease. The CDC (2019) reported that 20% of adolescents are now living with prediabetes. Most individuals with prediabetes progress to type 2 diabetes within 10 years. Because many studies have focused on adults of all ages, it is important to conduct research in young adults.

The purpose of this research is to explore the relationships among Vitamin D intake, sun exposure, handgrip strength, and Hemoglobin A1c levels in college-age adults. Handgrip strength is a biomarker of malnutrition and evidence suggests a correlation between Vitamin D and skeletal muscle function. Studies have linked Vitamin D to body weight, the development of metabolic syndrome, and prediabetes.

A convenience sample of students 18-28 years old (target sample size 120) with no history of metabolic syndrome, prediabetes, or diabetes are eligible to participate. Following consent, a random subject number along with a link will be provided to the questionnaire that includes demographic and sun exposure items, Vitamin D food frequency, height and weight, and family history of metabolic syndrome or diabetes. Finally, physical measurements and a self-administered Hemoglobin A1c Test will be completed.

Currently, the IRB has been approved; the materials have been purchased with the help of this grant. Data collection is now in progress.

The Role of MED12 in Adipogenesis

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In order for any function to occur within a cell, transcription factors must be able to interact with genes. When this occurs, genes are expressed, and ultimately, proteins are translated and perform the specific function that needs to be done within the cell. In order for this to occur, genes must interact with transcription machinery. The Mediator complex recruits transcription factors to genes in order to promote cell-type specific gene expression. The Mediator complex is a multi-protein complex consisting of four modules: head, middle, tail, and kinase. The kinase module is known to dissociate from the rest of the complex in order to function. MED12 of the kinase module has been shown to mediate CDK8 function by binding to Cyclin C, allowing for phosphorylation and propagation of signals. When this interaction is disrupted, downstream effects, like differentiation of stem cells, cannot occur. In the lab, we study human adipose-derived stem cells (hASCs) during adipogenesis in order to determine MED12's role in allowing CDK8 function in promoting cell-type specific gene expression. Through the use of siRNA-mediated knockdowns of MED12, it is evident that MED12 plays a role in the initiation of adipogenesis. qRT-PCR and staining confirm this assumption, as there is significantly less adipogenesis occurring in hASCs when MED12 is knocked down. This is further evidenced by reduced expression of early adipogenic markers, most notably, PPARγ. In studying MED12's role in adipogenesis of hASCs, we can possibly determine MED12's role in all cell type-specific gene expression.

Notch and Mediator work together to direct hASC self-renewal

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Stem cells are unique in that they possess totipotent, pluripotent, or multipotent differentiation capabilities and can also self-renew. Stem cells are in either a state of self-renewal or differentiation, but never both. If we are able to gain a full understanding of the underlying mechanisms that allow stem cells to remain self-renewing and multipotent, we will better be able to control the fate of cells, ultimately allowing stem cells to be used to their full capabilities in regenerative medicine. My research focuses on MED12 and its effects on Notch signaling. Here we describe the expression profile and activity of MED12, Notch1, and Notch3 in self-renewing human adipose stem cells and determine the impact that MED12 knockdown has on Notch1 and Notch3 expression and activity in self renewing hASC's. We hypothesized that MED12 has a critical role in regulating transcription, while Notch signaling has a role in directing cell fate commitment. We observed that the knockdown of MED12 in hASCs has no effect on the protein expression of Notch1. We also observed that the knockdown of Notch3 does reduce the amount of MED12 transcript expressed in hASCs. To date, our data suggests that MED12 has no effect on Notch1 expression but does affect Notch3 expression. Also, the knockdown of Notch3 directly effects MED12 transcript. This data indicates a unique role for MED12 and a relationship with Notch3 in regulating cell state, leading us one step closer to realizing the clinical potential of these cells and using them in novel cell-based and tissue engineering therapies.

Notch Signaling Plays a Key Role in Regulating Adult Stem Cell Osteogenic Differentiation

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Human adipose-derived stem cells (hASCs) are an easily accessible type of multipotent stem cell that boasts immense potential as a cell source for personalized regenerative medicine. Given their tremendous clinical potential, our research strives to better understand hASCs and their potential use in combating degenerative bone diseases such as osteoporosis and trauma related degradation. We are specifically interested in deciphering the role of the highly conserved Notch signaling pathway and how it might be manipulated to enhance bone differentiation and regeneration.

The Notch signaling pathway is a cell-to-cell contact dependent pathway that is involved in cellular homeostasis, stem cell differentiation, and cell fate determination. Notch1 and Notch3 are two receptors in the Notch signaling pathway that play a critical role in osteogenesis and self-renewal. To better understand the role of these two receptors, siRNA knockdowns are performed. Small interfering RNAs lead to the degradation of a significant amount of a targeted mRNA transcript, and in turn results in a significant decrease in protein expression. The literature indicates that a decrease in Notch1 expression leads to a decrease in osteogenic differentiation. Given data in the literature for other types of cells, we expect to confirm that the decrease in Notch1 leads to a decrease in hASC osteogenesis while the decrease in Notch3 may lead to enhanced differentiation. Identifying the role of each receptor will aid in identifying potential therapeutic targets for treating bone degeneration and loss in the future.

Factors Related to Quality and Yield Grading on Cattle in North Central Louisiana

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The purpose of this project is to determine traits that affect the overall quality and yield grade of beef carcasses harvested at the Meat Science Laboratory at the south campus of Louisiana Tech University. Data for quality and yield grade is collected after harvesting the cattle. The focus of this study is to perform an audit and analysis of post-harvest data. This project is an ongoing study in which undergraduate student researchers are trained in data collection and reporting prior to the beginning of the study. The study will analyze data collected from January 12th to March 16th, 2021, with data collected from 53 cattle. Post-harvest data is collected to assess the carcass's yield and quality grade. Grading is determined by utilizing criteria related to quality and yield used officially by the U.S.D.A. The criteria are back fat measured between the 12th and 13th rib, ribeye area measured between the 12th and 13th rib, and kidney-pelvic-heart fat (KPH).back fat is measured in tenths of inches around the outside of the exposed ribeye. Marbling is intramuscular fat; it is determined through the use of an official measurement guide ranging from devoid to moderately abundant. KPH is the internal fat accumulated around the kidney, pelvic, and heart regions. Marbling is used to grade the quality of the cattle, using a scale from devoid to moderately abundant. We have found that dressing percentages between 56% and 62% usually correlated to higher yield and quality grades in the cattle.

Analysis of North Central Louisiana Fed Cattle Traits and Production Practices

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The purpose of this project is to assess traits that affect the overall yield of beef carcasses harvested at the Meat Science Laboratory located on the south campus of Louisiana Tech University. Data is collected before, during, and after harvest. The focus of this study is an audit and analysis of pre-harvest data. This project is an ongoing study in which undergraduate student researchers are trained in data collection and reporting prior to the beginning of the study. The study will analyze data collected from January 12th to March 16th, 2021, with data collected from 53 cattle. Researchers communicate directly with producers to determine criteria regarding how the animal was raised, its diet, age, sex, and breed. Additional data is collected regarding how long the animal was removed from feed before harvest and live animal data. We measure hip height to determine frame size and collect live animal weight. We estimate body condition score (BCS) using a scale of 1-9. After harvest, the hot carcass weight is recorded. Hot weight is the carcass weight at the end of the harvesting process. The hot weight allows us to determine dressing percentage and the percentage of offal items lost during the harvest process. We will report how the pre-harvest traits and production practices affect the carcass dressing percentage. We have found that higher dressing percentages typically come from animals that are older, steers, fed grain, a BCS of 8-9, and had been removed from feed for more than 12 hours.

Factors Affecting Dressing Percentages of Cattle Harvested in North Central Louisiana

Molly Dickens[1], Emily P. Milbourn[1], Tyler S. Mayfield[1], Tori L. Olivier[1], Faith H. Scott[1], Callie M. Ezell[1], Spenser M. Stelly[2], Makenzi B. Williamson[1], Gordon Reger[3] , Mark Murphey[4]

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The project is designed to assess traits that affect the overall dressing percentage of beef cattle harvested at the Meat Science Laboratory located on the South campus at Louisiana Tech University. Data is collected before, during, and after harvest and utilized to perform an audit and analysis of cattle entering the food chain in North Central Louisiana. This project is one part of an ongoing study in which undergraduate student researchers are trained in data collecting and reporting prior to involvement in this study. The study will analyze data collected from January 12th to March 16th, 2021. Data was collected from 53 head of cattle presented for harvest at Louisiana Tech Meat Science Laboratory. Live animal data includes shrunk live weight, body condition score and hip height. Harvest data includes all offal items. Offal items include head, lower legs, liver, digestive tract, hide, tail, reproductive tract of bred females, and the pluck (heart, lungs, and trachea). During harvest, any physiological or pathological conditions are recorded. Each offal item is removed from the carcass, weighed individually and returned for inspection by State of Louisiana Meat Inspectors. Previous research has indicated that gut fill, body condition score and amount of muscling will have an impact on dressing percentage and total carcass value. It will be determined if individual offal items have a significant effect on dressing percentages. Of the 53 cattle harvested so far, the average dressing percentage is 52.79%, with a range from 41.85% to 67.11%.

Crabtivating Behavioral Analysis: the Impacts of Fipronil Pesticides on Blue Crab Behavior

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Pesticides are used in agriculture, urban, and forest pest management to control weeds and insects. Through nonpoint source pollution these pesticides are carried to into rivers, lakes, and coastal habitats where they can impede the abilities of animals to forage, avoid predators, and find mates. In coastal habitats, crustaceans, such as the blue crab, may be negatively impacted by pesticide exposure. Blue crabs are ecologically important predators and scavengers that help to maintain estuarine habitats through trophic cascades and also essential commercial fisheries species. Thus, impairments to blue crab movement or foraging could have significant economic and ecological impacts. Yet, there are a limited number of studies investigating if pesticides can impair crab movement and behavior. We exposed crabs to fipronil pesticide (0, 0.5, 1, 5 ug/L) to determine whether blue crabs recovered from pesticide exposure, we observed them for an additional eight days after exposure in which we measured behaviors such as their tank entry time, response to a dowel rod stimulus, and their time to stop moving after a disturbance. Crabs exposed to 5ug/L treatment had impaired balance which resulted in longer times to cease movement once entering the tanks and after disturbance. However, crabs that were exposed to lower concentrations exhibited results similar to the controls. Consequently, fipronil in higher concentrations is likely to impair crab foraging and other behaviors which could negatively impact blue crab populations resulting in economic losses in commercial fisheries as well as structure of ecological communities.

The Effect of Leaf Species on Insect Oviposition Preference and Colonization

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Some insects are known to be common disease vectors, which is an important public health issue. As such, diverse studies on the ecology of vectors are needed for effective management. Aedes albopictus (Asian tiger mosquito) is the 2nd most important vector of human diseases and a common carrier for dengue fever, yellow fever, and encephalitis viruses. It is commonly found in most areas of the central and eastern U.S., can have oviposition sites that occur close to human settlements (e.g., buckets, tires), and is an invasive species in the U.S. Our study aims to examine the influence of vegetation on insect oviposition in a residential neighborhood. This experiment used 18 buckets filled with water in Ruston, LA as available oviposition sites. Leaf treatments of loblolly pine, post oak, and southern magnolia were added to the buckets. Twice a week in May and June, we collected immature insects, which were preserved, counted and identified. Preliminary results using Poisson regression showed a significant difference among leaf treatments in Asian tiger mosquito and non-biting midge abundance. For general leaf treatment, southern magnolia leaves were preferred in non-biting midges and post oak leaves were preferred in Asian tiger mosquitoes with neither having a preference for loblolly Pine. These initial results could possibly guide landscaping projects to limit the prevalence of insect disease vectors such as Asian tiger mosquitoes.

The Influence of MED 12 Knockdown on Adipogenesis

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The ubiquity of obesity has increased exponentially, and the health burden of obesity-related diseases including type 2 diabetes, metabolic disorders, heart diseases, and some types of cancers is growing. Obesity is characterized by the excess accumulation of fat and adipose tissue and driven by adipogenesis, which is the process in which stem cells differentiate into adipocytes. We utilize human adipose derived stem cells (hASCs) isolated from adult fat tissue to study adipogenesis (the formation of fat tissue). This physiological potential, combined with non-invasive collection methods, make hASCs favorable in the search for new clinical stem cell treatments and for the study of cellular processes and differentiation. We are interested in understanding the function of MED12 in adipogenesis and determining its role in initiating cell type specific gene expression in hopes that this research can be used in treatments for obesity and related metabolic disorders. MED12 is a subunit of the Mediator complex kinase module that is critical in regulating cell-type specific gene expression. We have determined a decrease in MED12 leads to a decrease in adipogenesis as shown by the decrease in staining of lipid vesicles and the decrease in expression of adipogenic factors, CEPBα2, SREBP1c, and PPARɣ. This supports that MED12 does indeed play an important role in adipogenesis. We will continue to examine at what point during adipogenesis MED12 is most critical so that MED12 may be used as a therapeutic target to control adipogenesis and treat obesity in the future.